
The International
Long Term Ecological
Research Network
2000
ILTER

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2000

Perspectives

from Participating Networks

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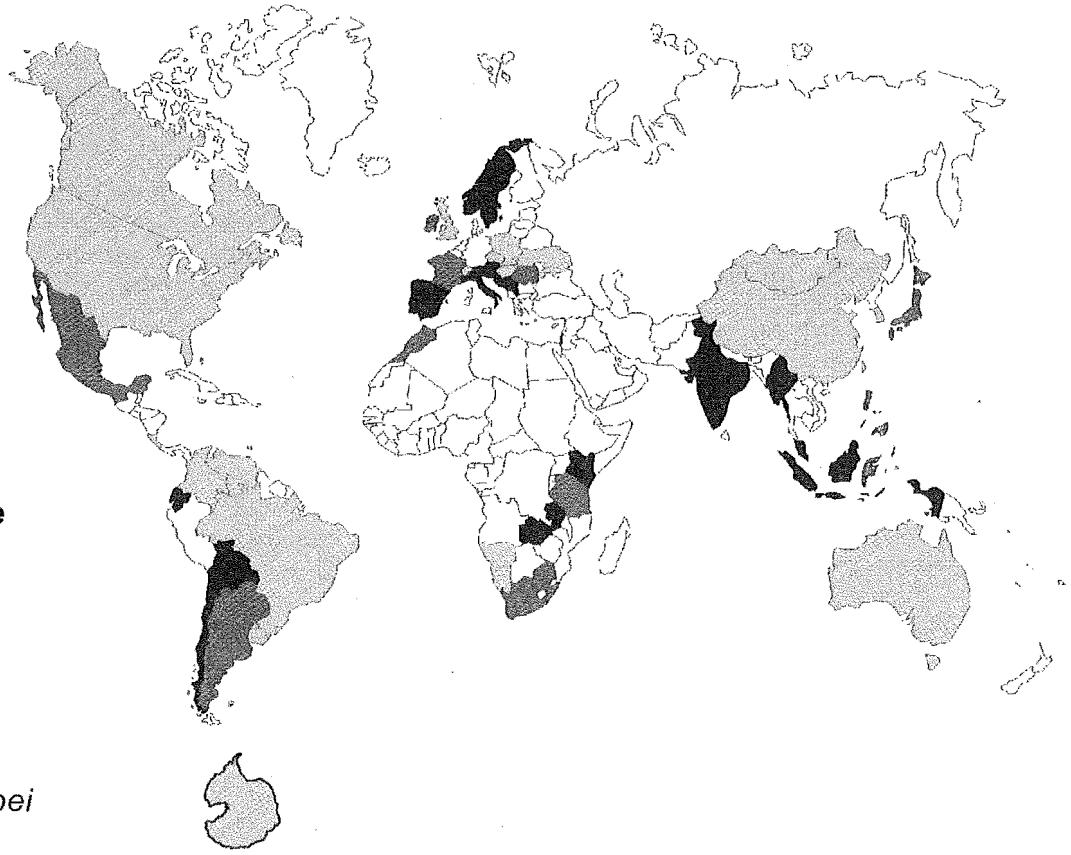


Members of the ILTER Network

- *Australia*
- *Brazil*
- *Canada*
- *China*
- *China—Taipei*
- *Costa Rica*
- *Colombia*
- *Czech Republic*
- *Hungary*
- *Israel*
- *Mongolia*
- *Namibia*
- *Poland*
- *Slovakia*
- *South Korea*
- *Switzerland*
- *Ukraine*
- *United Kingdom*
- *United States*
- *Uruguay*
- *Venezuela*

Countries in the process of developing national LTER Networks, awaiting formal recognition from thier governments

- *Argentina*
- *France*
- *Ireland*
- *Japan*
- *Mexico*
- *Morocco*
- *Paraguay*
- *Romania*
- *South Africa*
- *Tanzania*

Countries expressing interest in developing a national LTER Network sites

- *Austria*
- *Bolivia*
- *Chile*
- *Croatia*
- *Ecuador*
- *India*
- *Indonesia*
- *Italy*
- *Kenya*
- *Norway*
- *Portugal*
- *Spain*
- *Sweden*
- *Zambia*

Toward a Global Understanding

An Introduction to the International Long Term Ecological Research Network

James R. Gosz
Chair, ILTER Network
Principal Investigator, Sevilleta LTER, U.S.
University of New Mexico

Long-term data are now recognized as crucial to our understanding of environmental change and management. Historically, these studies have been difficult to maintain because of the dominance of short term funding programs, a misconception that long-term studies are merely monitoring, and emphasis on short-term experimentation or hypothesis testing of specific interactions or processes under the assumption of equilibrium conditions. The complexity of the environment and the dynamic nature of environmental conditions require additional research efforts that are not only long term, but address questions of scale dependency, complex assemblages of species and their interactions, and the role of humans in the environment. Long Term Ecological Research (LTER) sites offer this important complement to the more traditional types of ecological research. These sites also provide opportunities, contacts and infrastructure for multi- and interdisciplinary research as well as research across multiple sites (between networks), which is fundamental to understanding the environment. Such collaborations are essential for the development of sustainable management of our natural resources.

The need for collaborations among the numerous scientists and high-quality programs that are involved in understanding the various areas of our globe is an even stronger argument for the development of a worldwide network of LTER sites and programs. As a result of an international meeting in 1993 to focus exclusively on networking of long-term ecological research, an International LTER (ILTER) Network was formed with a mission to facilitate international cooperation among scientists engaged in long-term ecological research.

Thirty-nine scientists and administrators representing 16 countries participated and developed the initial recommendations for the network. These are repeated here to document the legacy of this activity as well as to evaluate progress for the ILTER Network.

1. Communication & Information Access for LTER Researchers Worldwide

- Determine the general connectivity status of LTER sites and scientists by country or region
- After completing a connectivity assessment, organize a clearinghouse system to facilitate technology and skills transfer between sites
- Create an information server on the global Internet to provide worldwide access to information and data relevant to international long-term ecological research
- Establish an international LTER (ILTER) server access mechanism (or mechanisms) for researchers in regions presently without access to the international Internet

2. Developing a Global Directory of LTER Research Sites

- Develop minimum site capabilities or standards for inclusion in an ILTER directory
- Identify existing and potential LTER sites worldwide
- Create both electronic and hard copy versions of an ILTER directory to be updated regularly
- Form a directory working group to help define tasks and secure funding for the creation of an ILTER directory

3. Developing LTER Programs Worldwide

- Encourage the pairing of mature and developing sites, which share similar ecological settings, and encourage cooperation between pairs of established sites within or between countries
- Produce an inventory of sources of financial support for ILTER activities and infrastructure at participating sites

4. Scaling, Sampling and Standardization: Some Design Issues

LTER sites should address the following questions:

- Will phenomena that occur over long time scales be adequately sampled over appropriate spatial scales?
- What is the spatial and temporal range over which site data can be legitimately extrapolated, and what methods(s) will be used?
- How much effort will be required for synthesis and intersite comparison, and has flexibility for subsequent adjustment of observations been incorporated into the design?
- Have the selected measurements been adequately tested, and have the required precision and frequency of observations been specified?
- Does the range of variables selected adequately reflect the full range of driving, state and response variables for the system under investigation?

5. Education, Public Relations and Relationships with Decision makers

- ILTER sites should be used as sources of information for formal higher education and interdisciplinary curricula development
- ILTER sites should be used as sources of information for elementary and secondary school curricula development
- ILTER sites and networks should provide clear and accurate information on LTER research to the general public and decision makers

The ILTER Network Committee has continued and broadened its activities through annual meetings. Following the initial conference in the United States in 1993, meetings have been held in the U.K. (1994), Hungary (1995), Panama/Costa Rica (1996), Taiwan (1997), Italy (1998), South Africa (1999) and the United States (2000). Plans are being made for meetings in the United Kingdom (2001) and Canada (2002). The committee has established the following mission statements, based primarily on the 1993 conference:

1. Promote and enhance the understanding of long-term ecological phenomena across national and regional boundaries;
2. Promote comparative analysis and synthesis across sites;
3. Facilitate interaction among participating scientists across disciplines and sites;
4. Promote comparability of observations and experiments, integration of research and monitoring, and encourage data exchange;
5. Enhance training and education in comparative long-term ecological research and its relevant technologies;
6. Contribute to the scientific basis for ecosystem management;
7. Facilitate international collaboration among comprehensive, site-based, long-term, ecological research programs; and
8. Facilitate development of such programs in regions where they currently do not exist.

The ILTER Network Committee identified a number of target regions to focus on during the first decade. Substantial progress has been made as

demonstrated in the current map of countries that have LTER Networks, those near to receiving formal recognition and establishment of their Networks and countries that have expressed an interest and are pursuing the development of a LTER Network (fig. 2). This list is very dynamic and is continually updated. It is presented here to demonstrate the remarkable progress made from the initial 3 countries in 1993 to the status of the Network by August 2000.

Each country must assess its own needs and resources if it wishes to involve itself in an ILTER program. Each will have a unique set of opportunities and limitations that are best evaluated by the scientists and policy makers of that country. The typical procedure for a country is for the scientists of that country, along with the funding agencies, to decide whether to endorse the premise that ecology and environmental management are significantly benefited by studies in long-term and broad spatial scales. A plan is then developed that establishes the context and mission for such studies, sites and programs identified that will contribute to this mission, and support is obtained from within that country or international organizations for implementation and continued maintenance. It is anticipated that each country's program will be part of a global network of scientists and of scientific information that will advance our understanding of not only local and regional, but also global issues and provide solutions to environmental problems at these scales. The map show in figure 2 demonstrates that many countries believe this an important undertaking.

A more recent development among a number of countries is the formation of Regional LTER Networks. Neighboring countries often have similar issues and have demonstrated increased opportunities for collaboration and increased support to other countries in the region that are attempting to develop their own LTER Network. To date, there are regional LTER Network efforts in the East Asian-Pacific Region, Latin America, Central and Eastern Europe, Middle East and North America.

LTER sites in the countries of the ILTER Network now can provide unparalleled opportunities for cross-site and comparative research efforts on many of the world's ecosystems at levels from genes to landscapes. These global LTER sites function as "research platforms" that led to interdisciplinary research, extrapolation to larger areas or regions, provide the scientific basis for management and policy decisions that incorporate social and economic issues, and attract scientists from other sites and networks, expanding the effective "network" of sites. The ILTER Network is now well positioned to interact with other international activities such as the International Geosphere Biosphere Program (IGBP) and the Global Terrestrial Observing System (GTOS). A major effort in GTOS is the participation of ILTER in the Global Terrestrial Network (GT Net) of sites. The Mission of GTOS is:

- To build databases and information systems that assist countries to address issues related to global and regional environmental change.
- To ensure that biophysical and socio-economic dimensions are addressed in an integrated manner.
- To present scientific information related to terrestrial ecosystems in ways that are relevant to policymakers and resonant with national priorities.

The challenges are to:

- Improve the flow of information between terrestrial scientists and policymakers.
- Present scientific information in ways that assist in policymaking (e.g. biodiversity, climate change, desertification, hazardous chemicals).
- Promote systematic, long-term observations in order to understand global and regional changes and provide countries with policy relevant information.

The priority issues for GTOS are:

- Changes in land quality;
- Availability of freshwater resources;
- Loss of biological diversity;
- Climate change; and
- Impact of pollutants and toxic chemicals.

A variety of GTOS demonstration projects will be undertaken to demonstrate the value of linking the current terrestrial observation networks. The first is a project on global net primary productivity (NPP), which is a key variable in climate change modeling. Global NPP values are obtained from the new MODIS sensor on the TERRA satellite. GTOS and ILTER sites contribute to validation of the imagery through site measurements of rainfall, temperature, soil water holding capacity and nitrogen content, land cover, and leaf area index. A second related project is the Terrestrial Carbon Observation (TCO) initiative. Sites will be involved in validating the carbon flows and biomass for satellite estimates. A third related project is the Global Observation of Forest Cover (GOFC) that will be expanded to all land cover observations. Projects such as these are dependent on the information from ILTER sites and will demonstrate the value of all ILTER research andinformation for global assessments.

During the past two years the GTOS project has made notable progress in improving our collective capacity to make global observations of changes in the Earth's natural systems. Recent progress toward developing a Global System of Terrestrial Observation Networks (GT-Net) addresses important issues related to global and regional environmental change. At present more than 15 national and international networks are members of GT-Net, addressing topics ranging from glaciers and permafrost to drylands and mountaintops.

However, even if we continue at the present rate, at the end of this decade we will still be far from having in place the systems for collecting the minimum information required for this ambitious project. We will still be far from understanding how key changes in the Earth's systems may affect the well-being of all humans. IN some cases, uncertainty abou thow certain global processes work call for more scientific research. But in many instances we simply are not collecting even the most basic terrestrial information. The situation in many developing countries is extremely poor and yet many global studies require data and information from these regions.

The Global Terrestrial Observing System is just a small part of efforts to make systematic global observations. But it is one of only a few for which the mandate is global in scope, specifically built around operational international partnerships such as the ILTER Network, and is aimed at addressing issues related to sustainable development.

It is not a simple task to convince countries to shift away from ad hoc approaches to terrestrial observations toward systematic investment in building capacity to generate data, information and knowledge as is required for a global system such as GTOS. However, I do see gradual improvements in some cases. We will count on your support and collaborative efforts over the coming years to keep up the momentum of these important programs. Thank you, Jim Gosz

An Overview of the East Asia-Pacific Regional LTER Network

Hen-biau King
Chair The East Asia-Pacific Regional LTER Coordinating Committee
Taiwan Forestry Research Institute

In 1993 an All Scientists Meeting was held at Estes Park, Colorado in the United States and was hosted by the U.S. Long Term Ecological Research (LTER) Network. The meeting focused on establishing linkages with existing and developing long term research programs around the world. An International LTER (ILTER) network was then proposed. An International LTER Coordinating Committee was also established to achieve wider regional representation. The First ILTER Annual meeting was held in Rothamstad, United Kingdom in August 1994 and an ILTER Coordinating Committee was concurrently formed. A series of follow-up action plans has occurred ever since.

In realizing the importance, necessity and benefits of a multi-disciplinary, integrated and long term research network in ecology at the regional scale, an East Asia-Pacific Regional LTER Coordinating Committee was established in 1995. The committee currently consists of 12 members, each representing one to several LTER sites across the region with wide ranges of climatic regimes and geographic features, vegetation types, and others such as cultures, etc. There are six formal LTER Networks with 42 LTER sites in the East Asia-Pacific region.

The Australia LTER Network has four LTER sites that have wide ranges of climatic regimes and diverse biomes. They range from rainforest with 3600mm annual rainfall to open forest with 700mm of annual rainfall.

The Chinese Ecosystem Research Network (CERN) was launched in 1988. It serves as a base for the LTER and monitoring activities. Twenty-nine stations were selected with 16 agriculture, 7 forestry, 2 grassland, 1 lake and 1 estuarine ecosystems. The CERN was designed to integrate the stations by adopting common core research areas, standardizing methods, data management, and monitoring, etc. Its major programs are "Mechanisms of Formation and Sustainability of Ecosystem Productivity", "Water Cycle and Geographic Pattern Studies of Agricultural Ecosystems in Northern China" and "Interaction between Agroecosystems and Global Change."

A Working Group on LTER in the Ecological Society of Japan was established in 1998. Discussions were held to promote Japanese LTER and international correspondence. The Ministry of Education, Science, Sports and Culture (MESSC) of Japan has planned to establish an institute for global environmental studies, which includes field stations for LTER and networking. Japanese ecologists are actively participating in regional as well as international LTER Network activities. They hosted the Second East Asia-Pacific Regional LTER Meeting in 1997. Junior scientists from Japan, Korea and Taiwan have joined the US-East Asian Reciprocal Visiting Programs.

In June 1998, the Mongolian Academy of Sciences and the National University of Mongolia sponsored an LTER workshop. The Mongolian LTER program was then formally established. Lake Hovsgol in Hovsgol National Park was selected as the first LTER site in the summer of 1999. A water quality monitoring program and a database management system for data were established. Russian land-cover resource maps (1947) were digitized. A GIS for Hovsgol National Park was developed. Land cover changes are being studied. In 2000 the Mongolia LTER hopes to begin a forest and lake monitoring program that will study the impacts of deforestation, grazing, and climate changes on the biodiversity of the watershed and lake.

After several years of discussing, reviewing and conducting LTER workshops and hosting international and regional LTER meetings, the Korea LTER (KLTER) Network was established with 3 LTER sites in 1999. These sites include an old growth forest that is over 500 years old. One of the many contributions KLTER made to regional LTER Network development was to host the Third East Asia-Pacific Regional LTER Meeting in 1999.

The Philippines has one candidate candidate LTER site (Mt. Kitanglad Range National Park) which was established in 1997. The program focuses on inventory of flora and fauna for biodiversity, monitoring and managing watersheds, and conserving upland resources. There are three sites, namely Irawan, Bicol, and Manila Bay, to be evaluated for possible future LTER sites.

The Taiwan Ecological Research Network (TERN) was established in 1992 with one LTER site. It has grown into 5 LTER sites. These sites were new sites and were specifically established for the LTER. The National Park Division of Taiwan is current developing six additional LTER sites, one for each national park. TERN hosted the First Regional LTER Meeting in 1995 and the 1997 international LTER meeting. The TERN scientists have actively conducted collaborative research projects with US LTER scientists and the sites have hosted overseas students for their ecological studies.

Others countries, namely Indonesia, Malaysia, Singapore and Thailand, have expressed intense interest in developing national networks of LTER sites. These countries have not yet formally established LTER networks, but they do conduct ecological research at permanent plots and have established new plots for long term research. For example, Indonesian ecologists have continuously carried out periodical inventory of trees and undergrowth species in existing permanent plots. They also established new permanent plots at 1997 forest fire burn sites to study the effects of fires on long term ecological processes. These four countries have representatives actively participating in the International and the East Asia-Pacific regional LTER activities.

The major and regular activities of the East Asia-Pacific Regional LTER Coordinating committee include calling for biannual committee meetings; holding scientific conferences, symposia, workshops, and conducting reciprocal visiting programs and most importantly, coordinating collaborative LTER research projects across the region. A total of three biannual regional LTER meetings were held since the establishment of the regional LTER committee in 1995. They were in Taipei (1995), Tsukuba (1997) and Seoul (1999) and the fourth will be held in Mongolia in 2001. Many other relevant LTER symposia were held in this region including International LTER Meetings (at Taipei in 1997), international workshops (for example, Information Management at Beijing in 1995, Networking at Taipei in 1995, LTER and Biodiversity Conservation at Seoul in 1998, and the LTER Conference at Ulaanbataar

in 1998 etc.). Numerous domestic LTER meetings also have been held in most countries in the region since 1995.

A regional collaborative research project, Comparison of Litter Decomposition among LTER Sites across the Region, was proposed and endorsed during the Third East Asia-Pacific Regional Meeting, Seoul during October 1999 and the detailed proposal and protocol are under preparation by the Regional Coordinating Committee. The project is scheduled to commence in the summer of 2001.

Future activities that have been recommended by the East Asia-Pacific Regional LTER committee are:

1. Co-organizing biannual LTER Coordinating Committee Meetings;
2. Promoting LTER program in countries that have no formal LTER sites yet but are interested in developing such programs;
3. Initiating and conducting more collaborative research projects across the regional LTER sites;
4. Producing a regional directory of long term ecological research sites;
5. Sharing the values and results of long term ecological research with resource managers and policy makers;
6. Incorporating results and findings from long term ecological research into curricula at all levels of educational organizations; and
7. Adopting programs and action plans made by the International LTER Coordinating Committee, particularly important plans for participating in the NPP demonstration project of the Global Terrestrial Observing System (GTOS).

Reviewing the progress that the regional LTER networks have made, it is reassuring that the Long Term Ecological Research programs have been accepted by science communities and funding agencies within the East Asia-Pacific region.

The East Asia-Pacific Region already has and will have impacts on global scale processes. For example, a few decades ago, the contribution of this region to global nutrient fluxes was small relative to other areas of the world. Now they have become, in some cases, major components of the global cycle. The East Asia-Pacific Regional LTER networks should thus establish linkages with other regional LTER networks and global programs that focus on ecological research and monitoring. The East Asia-Pacific region is a "big player" in global modeling of any large-scale issues. The need for data, particularly long term data, is critical. The knowledge of the patterns of population, development, biodiversity, etc. in Asia is very important in dealing with global effects of pollution, climate change, deforestation, land use and many other issues.

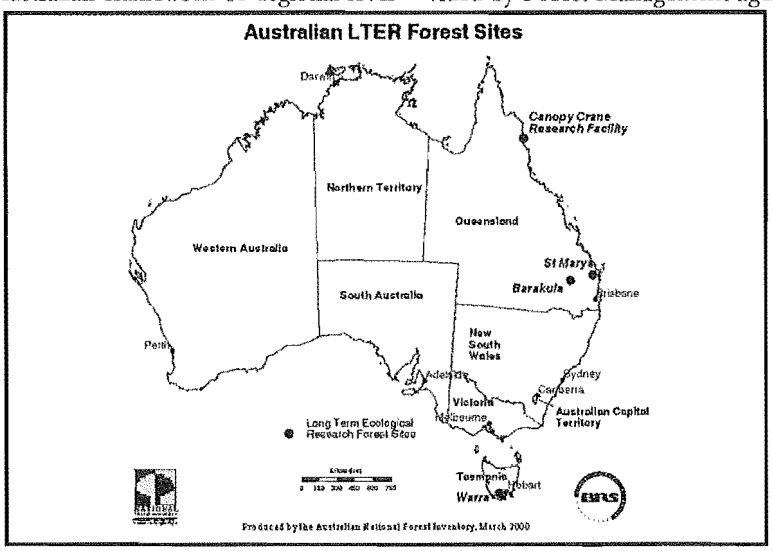
Australia's Long Term Ecological Research Forest Sites

J. Bradley[1], C. Howell[1], M. Brown[2] and P. Norman[4]
[1]National Forest Inventory
[2]Forestry Tasmania
[4]Queensland Dept of Natural Resources

Australia has a history of long-term ecosystem research and monitoring. Whilst the concept of a co-ordinated national network of long-term ecological research sites has been discussed for some time it has only recently made tangible progress. Australia's National Forest Inventory (NFI) in the Bureau of Rural Sciences, Canberra, has been the catalyst by taking up the role of coordinating the collation of information on Australia's Long Term Ecological Research sites and hosting the Australian LTER website.

At this stage, the Australian network is largely restricted to forest sites, although it is expected that this will diversify as Australian interest in LTER sites continues to grow as a consequence of increasing interest in the development and testing of sustainability indicators.

Interest in sustainability indicators has, in part, emerged as a result of the August 1998 release of an Australian framework of regional level criteria and indicators of sustainable forest management. This framework was developed and based on the internationally agreed national level Montreal Process criteria and indicators.



Australia's Forests

Australia is located southeast of Asia and is the only country in the world to occupy a single continent. The Australian continent covers 7,682,300 sq km and has a diverse and unique ecology. It is populated by 19 million people making Australia the most sparsely populated continent after Antartica.

Australia has 155.8 million hectares of forest, covering almost 20 per cent of the total land area. Australia's native forests account for approximately 154 million hectares of the total forest area, and plantations 1.3 million hectares. The native forests cover a wide range of topoclimatic zones, ranging from dry arid to wet tropical to cool temperate, and coastal to alpine environments. The geographic extent of Australia's native forests is controlled largely by rainfall and temperature, with fire playing a major role in their ecology. Many forest species are dependent on fire to create conditions for regeneration.

Of the 910 plant communities recognised in Australia, 457 are considered as forest communities and are grouped into the following broad native forest types: eucalypt; acacia; melaleuca; rainforest; casuarina; mangrove; callitris; and 'other'. The biodiversity of these forests is known to be high, even though many areas are yet to be documented. There are over 1200 vertebrate fauna species and 13 600 higher plant species known from forest areas of the continent.

Under Australia's federal system of government, primary constitutional responsibility for land management rests with State and Territory Governments. The Commonwealth Government is responsible for coordinating national approaches to both environmental and industry development issues. Forested land tenure in Australia can be broadly classified into five tenure classes: conservation reserves (11 per cent of total forest); multiple-use (9 per cent); leasehold land (43 per cent); other crown land (10 per cent); and private forests (27 per cent).

Site Level Information

Information on one site in Tasmania (Warra), and three sites in Queensland (Barakula, St Mary and the Canopy Crane Research Site) have been included on the ALTERs website to date.Another 12 sites have been identified for inclusion as Australian LTER sites when information becomes available. Information on existing sites has been provided by Forest Management agencies of the respective States using a standard set of data, the format of which was developed, in consultation with them, and based largely on that used by the LTER networks of other countries.

Warra, Tasmania

The Warra site, located in Tasmania, has been established to facilitate the understanding of ecological processes of Tasmania's wet (E. obliqua) forests. These forests are part of the southern cool temperate wet forest biome. Programs at the Warra site foster multi-disciplinary research within a long-term framework. The site contains both working forests and conservation reserves. Appropriate management prescriptions and practices prevail in different parts of the site.

The main objectives of the site are:

-To understand fundamental ecological processes in E. obliqua wet forests.

-To assess and monitor biodiversity and geodiversity.

-To determine the long term effects of different forest management regimes on natural diversity and ecological processes and thus assess their sustainability.

-Where necessary, to develop alternative management regimes.

-To provide an integrated multidisciplinary focus which complements research programs elsewhere in Tasmania.

-To link Tasmanian forest research with national and international programs having a long term ecological focus.

Barakula, Queensland

This site is a working forest, managed for logging (mainly cypress pine at present but also for hardwood), and grazing. There are six Scientific Areas (or proposed areas) within the site managed for the conserva-

Mosses and rainforest species understories develop in wet eucalypt forest in southern Tasmania when not subjected to fire. Photo: Leigh Edwards, Forestry Tasmania.

tion of examples of rare ecosystems. A large number of permanent forest growth plots and research experiments exist in the area.

Current research activities in the Barakula LTER are aimed at:

* understanding fundamental ecological processes in Callitris and dry mixed eucalypt open-forests and woodlands;
* developing tools and techniques to assess and monitor biodiversity, productivity, and other forest values;
* determining the long term effects of different forest management regimes (including fire and grazing) on ecological processes, biodiversity, and forest productivity and thus assess the sustainability of such regimes;
* providing base-line information on trends in forest condition as a contribution to Queensland's commitment to report on Montreal Process criteria and indicators of sustainable forest management;
* providing a focus for integrated multi-disciplinary research which complements research programs elsewhere in the state;
* linking Queensland forest research with national and international programs having a long term ecological focus.

St Mary, Queensland

The St Mary's site is largely multiple-use forest including a number of permanent forest growth plots and long-term research experiments.

Current research activities at the St Mary LTER are aimed at:

* understanding fundamental ecological processes in dry mixed eucalypt open-forests and woodlands;
* developing tools and techniques to assess and monitor biodiversity, productivity, and other forest values;
* determining the long term effects of different forest management regimes (including fire and grazing) on ecological processes, biodiversity, and forest productivity and thus assess the sustainability of such regimes;
* providing base-line information on trends in forest condition as a contribution to Queensland's commitment to report on Montreal Process criteria and indicators of sustainable forest management;

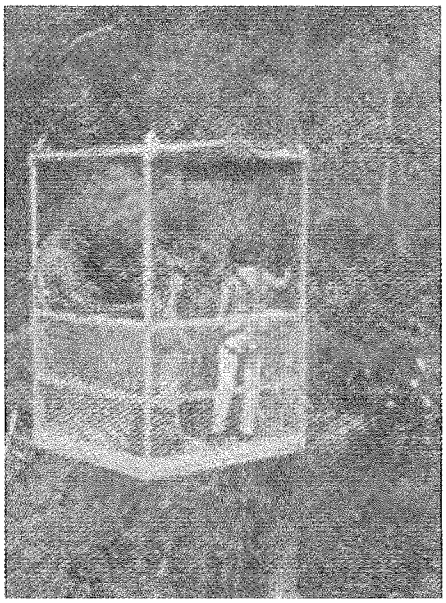
Woodland at St Mary's Site, QLD. Photo: Department of Natural Resource, Queensland

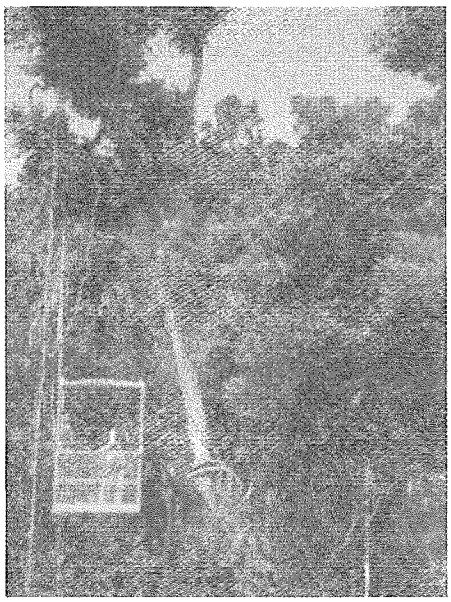
* providing a focus for integrated multi-disciplinary research which complements research programs elsewhere in the state;
* linking Queensland forest research with national and international programs having a long term ecological focus.

The Canopy Crane Research Facility, Queensland

This site was established in 1998 as a rainforest research facility based around a 50 m tower crane placed in the rainforest. The crane provides enhanced access to the rainforest canopy for researchers.

The central aim in establishing the site was to facilitate rainforest canopy research.





Workers at the Canopy Crane Research Facility site in Queensland

Network web site URL: http://www.brs.gov.au/nfi/forestinfo/ltrsites/index.html
National Network Chairperson and e-mail address:
Mick Brown
Mick.brown@forestrytas.com.au

Year Network joined ILTER network: 2000

Australia: Table of Site Information

Site name	Date	Principal biomes	Research themes	Type and lengths of data sets
Warra, Tasmania	1998	Temperate broad leaf forest (mainly Eucalyptus obliqua forest) with some areas of moorland, alpine, temperate rainforest, riparian conifer forest and scrubs.	Aquatic, Biodiversity, Soils, Hydrology, Modelling and Remote Sensing	1.Spatial Data Sets: The following GIS layers have been collected at a 1:25,000 scale: Forest type maps (vegetation structure) derived from aerial photography. * Geology * Vegetation fire history * Modelled climate surfaces (ESOCLIM) * Satellite images * Aerial videography * Environmental stratifications 2. Non-Spatial Data Sets: * Hydrology and climate There are weirs constructed (or modified) and instrumented on Warra Creek, Swanson Creek and King Creek. Sampling commenced in 1998. There is an operational weather station on Manuka Road and 17 fortnightly river sampling sites on Manuka, Warra and South Weld Roads. A second weather station is to be established at the top of the catchment. * Forest productivity Continuous forest inventory plots (CFI) have been established in the area since the late 1960s - early 1970s. These are measured at establishment, at 5 years, 10 years and then 10 yearly. * Biodiversity Species lists (and locations) are available for vascular plants, vertebrate fauna and some non-vascular plants and invertebrate groups. A stratified system of baseline long term vegetation monitoring plots is being established at Warra to complement the CFI plots.
Barakula, Queensland	1936	Mixed eucalyptus open-forest and woodland and cypress pine open-forest and woodland. The principal overstory species include *Callitris glaucophylla*, *Corymbia citriodora*, *Eucalyptus crebra*, *Allocasuarina luehmannii*, *Angophora leiocarpa*, *Eucalyptus fibrosa* subsp *nubila*, *E. tenuipes*, *Corymbia bloxsomei* and *C. polycarpa*.	Biodiversity, Silviculture, Forest Growth & Yield	1. Spatial Data Sets: The following GIS layers have been collected: * Regional Ecosystem types (pre-European and present) at 1:100 000; * Vegetation overstorey floristic composition at 1:50 000; * Geology at 1:1 000 000; * Soils at 1:2 000 000; * Landsat imagery at 25m grid cell; * Modelled climate surfaces (ESOCLIM) at 250m grid cell; * Logging history (virgin/logged) at 1:25 000 to 1:100 000; * Recent fire history at 1:50 000; * Environmental stratification at 250m grid cell. 2. Non-Spatial Data Sets: * Growth and Yield Detailed yield plots (permanent); Southern Brigalow Bioregion (SBB) forest condition and inventory project non-permanent plots; DPIF non-permanent plots. * Biodiversity SBB forest condition non-permanent plots; Species lists for vascular plants and vertebrate fauna; Some invertebrate information. * Other Ecosystem health (grazing) sites; European cultural heritage sites (incomplete).

Affiliation/ownership	Site manager	address	Area extent in hectares	Location	Travel distance and direction to nearest town
Forestry Tasmania	Mick Brown	Forestry Tasmania 79 Melville Street Hobart Tasmania 7000 Phone: +61 3 6233 8202 Fax: +61 3 6233 8292 Email: Mick.brown@forestrytas.com.au http://www.warra.com	15,900 ha	146°40'E, 40°04'S	1 .5 hours drive from Hobart
Queensland Department of Natural Resources and Queensland Department of Primary Industries	Phil Norman	FERA, Queensland Dept of Natural Resources 80 Meiers Road Indooroopilly Qld 4068 Telephone: +61 7 3896 9830 Fax: +61 7 3896 9858 EMail: Phil.Norman@dnr.qld.gov.au	285,145ha	150.65, 26.34	The edge of the site is a half hour drive from Chinchilla

Australia: Table of Site Information

Site name	Date	Principal biomes	Research themes	Type and lengths of data sets
St Mary, Queensland	1951	Mixed eucalypt open-forest and woodland. The principal species include Corymbia citriodora, Eucalyptus acmenoides, Corymbia intermedia, Eucalyptus fibrosa subsp'fibrosa, E. siderophloia and Corymbia trachyphloia	Biodiversity, Forest growth and yield, Silviculture, Other - The Development and Implementation of Landscape Metrics; Production of Forest type and structure maps from high resolution digital imagery and comparison with API maps and field data for monitoring sites in eastern Australia.	1. Spatial Data Sets: The following GIS layers have been collected: * API polygons assessed for old growth characters (crown cover projection, proportion of senescing, mature and regrowth trees and disturbance) at 1:25 000; * Vegetation type and regional ecosystems at 1:100000; * Geology at 1:100 000; * Soils at 1:2 000 000; * Recent fire history at 1:25 000; * Logging history (virgin/logged) at 1:25 000; * Modelled climate surface (ESOCLIM) at 100m grid cell; * Digital Elevation Model at 50m grid cell; * Environmental stratification; * Landsat imagery at 25m grid cell; * Digital video, laser profiling and high resolution digital imagery over some areas. 2. Non-Spatial Data Sets: * Biodiversity Arboreal marsupial habitat quality and population density Epiphagic ant population monitoring Diurnal bird populations Species lists for vascular plants and vertebrate fauna * Forest productivity Detailed yield plots (permanent) DPIF non-permanent plots
Australian Canopy Crane Research Facility, Queensland	1998	Tropical Lowland Rainforest	Hydrology and climate Forest Productivity Biodiversity	1. Spatial Data * Mapping of the site (point coverage at 1:5000 is in progress) 2. Non-Spatial Data Sets: * Hydrology and climate No hydrological data has been collected to date; Meteorological instruments have been installed on the crane tower and in a clearing adjacent to the rainforest. Vertical micro-meteorological instrumentation is attached to the crane tower at heights of 50m, 30m and 10m. This instrumentation takes half-hourly readings of the following meteorological parameters at the 3 heights: -photosynthetically active radiation; -air temperature; and - relative humidity. - Wind velocity and direction will also be measured at a height of 50m.The automatic weather station located in the clearing measures wind velocity and direction, rainfall, air temperature, soil temperature at 10cm, soil moisture at 10cm, relative humidity, solar radiation, and leaf wetness. * Forest productivity Forest productivity is not measured at present. * Biodiversity All trees greater than 10cm DBH within the arc of the crane have been tagged and identified; Liverworts and mosses have been sampled and are at present being identified; and Arthropods on the site are being collected and identified on an ongoing basis.

Affiliation/ownership	Site manager	address	Area extent in hectares	Location	Travel distance and direction to nearest town
Queensland Department of Natural Resources and Queensland Department of Primary Industries (Queensland Forest Research Institute).	Phil Norman	FERA, Queensland Dept of Natural Resources 80 Meiers Road Indooroopilly Qld 4068 Telephone: +61 7 3896 9830 Fax: +61 7 3896 9858 E-Mail: Phil.Norman@dnr.qld.gov.au http://www.forests.qld.gov.au/forests/fera/FMPMaryborough.htm	11,161ha	152°46E, -25°68S	The site is a half hour drive from Maryborough
The Australian Canopy Crane Company Pty Ltd.	Nigel Stork	Australian Canopy Crane Company Rainforest CRC James Cook University Smithfield Qld 4878 Phone: +61 7 4042 1243 Mobile: 0419 774 784 Fax: +61 7 4042 1246 Nigel.Stork@jcu.edu.au http://www.tsd.jcu.edu.au/netshare/rainforestCRC/crane.htm	1 Hectare (within arc of canopy crane) + 20 ha of surrounding tropical lowland rainforest	145°27'E, 16°06'S	The journey from Cairns to the site takes approximately 2.5 hours.

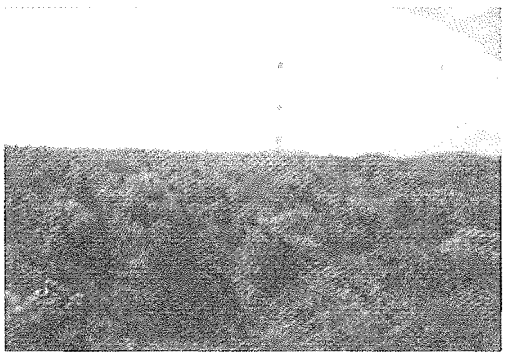
Chinese Ecosystem Research Network (CERN)

Zhao Shidong and Wang Qunli
Chinese Academy of Sciences

Network history

Under the support of the Chinese Academy of Sciences (CAS) and the World Bank, the Chinese Ecosystem Research Network (CERN) was established in 1988.

Since the founding of the Chinese Academy of Sciences in the early 1950's over a hundred field stations has been gradually set up across the country, covering various ecological zones. The initiatives of these stations were to improve productivity of agriculture, forestry, animal husbandry and fishery, and to observe and study specific natural phenomena, such as glaciology, frozen earth, mud- rock flows, landslides, etc. Over forty years, these stations have played significant roles in helping with the reasonable utilization of local natural resources and solving local environmental problems, as well as in terms of the advancement of ecological research.



The observation tower of Changhaishan Forest Ecosystem Research Station (Photo: ZHAO Shidong).

Since the 1980's, due to the origination and development of Earth System Science, particularly the implementation of the IGBP and the increased pressure caused by the growing shortage of resources and environmental degradation, the Chinese Academy of Sciences has taken several steps to establish and strengthen the Chinese Ecosystem Research Network. First it chose 29 from the all field stations, covering the important ecosystems in China of agriculture, forest, grassland, lake and bay. Among these stations, there are 16 for agriculture, 7 for forest, 2 for grassland, 2 for lake and 2 for bay ecosystems. In order to improve data management and synthetic research, the five disciplinary Sub-Centers (hydrology, soil, atmosphere, biology and aquatic ecosystem) and one Synthesis Center were established too. More than 1000 scientists and technicians from 21 institutes of CAS have been involved in the activities of CERN. Through the developments in the past ten years, CERN has become a very important basis for ecological research in China and an element of the global ecological networks.

In the beginning of this project, the essential task was to complete an overall design. During the five years from 1988 to 1992, detailed investigations were made of the newest developments and trends of ecosystem research in the world. In particular, scientific personnel from the concerned institutes of CAS examined the various demands that modern ecosystem research sets forward for the networking of ecosystem research. Efforts were made to learn about the design and operation of both existing networks and those being established around the world for ecological observation and research, such as the program of the Long-Term Ecological Research (LTER) Network in the United States.

Based on detailed investigations and extensive discussions, and with consideration of the specific features of the Chinese situation, the overall design of the project was finally worked out in 1992. This design is fully reflected in the project proposal submitted to the World Bank in the beginning of 1993.

Compared with other networks in the world, the design of CERN contains the following features:

1) As a general principal of the design, the "Top-down" approach was taken, which means that all of the units of the network should follow unified principles, and the major activities, including research and moni-

China: Table of LTER Site Information

Site Name	Date	Principal biomes	Research themes	Types and lengths of data sets
Yingtan Red Soil Research Station	1985	Subtropical evergreen forest ecosystems mainly consist of Pinus massoniana , Castanopsis sclerophylla, Schima superba, Rhododendron simsii, Quercus fabri, Gardenia jasminoides, Imperata cylindrica, and agricultural ecosystems like rice and other subtropical crops.	Red Soil ecological studies; Comprehensive experimentation on structure, function and dynamics of the ecosystems in the region.	Data sets on the soil and vegetation monitoring and research, since 1985.
Yucheng Comprehensive Experimental Station	May 1979	Winter Wheat, Corn, Cotton, and Soybean.	Water circulation, water and energy balance, mass transfer, agricultural ecosystem management, and regional agricultural sustainable development.	Meteorological data 1979-now Ground water level data 1984-now Water surface evaporation data 1984-now Data of evapotranspiration from farmland (by large weighing lysimeter) 1987-now Soil nutrients mainly NPK contents on soils 1990-now Soil moisture data 1984-now

toring, would be supported by centralized funds.

2) As a whole, the network emphasizes network integrity, core objectives, and direct service to the sustainable utilization of natural resources and to environmental protection.

3) In terms of monitoring and observation, it enforces the unification and standardization of methodologies and even instruments.

4) When considering data collection, it focuses on the standardization of the data formats, data quality control, data sharing, data synthesis and analysis.

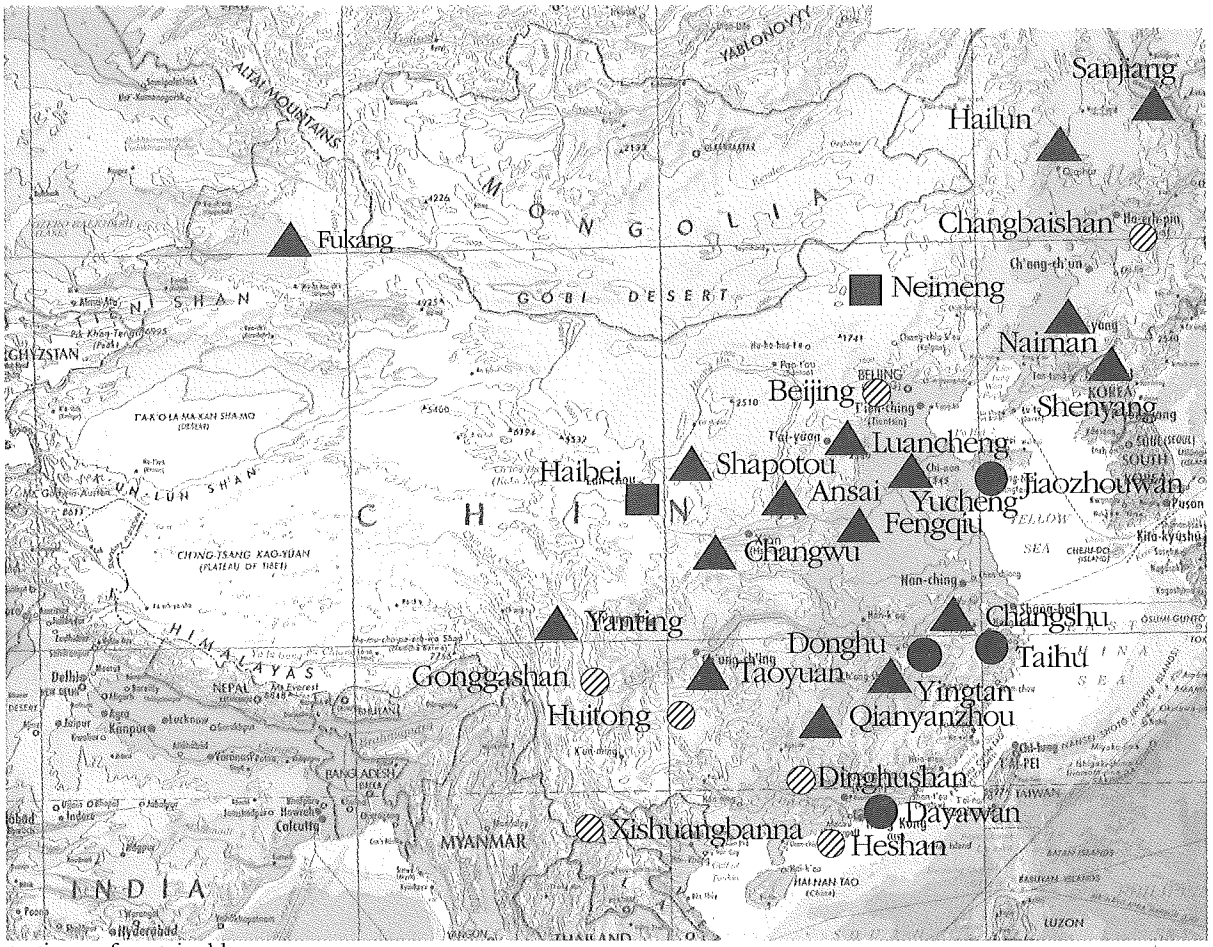
5) Regarding research methodology, it encourages cross-site and multidisciplinary approaches to research, including the involvement of social sciences, and the networking of research, based on the unified objectives and methodology.

6) Considering the serious problem and challenge of ecosystem management in China, demonstrations of sustainable ecosystem management are one of the highest priority tasks for all of the stations.

In the past several years, through several evaluations carried out by experts, this design was proved to be both advanced and feasible. It has laid a solid scientific foundation and structure for the realization of the overall objectives of CERN and of the various tasks concerned.

The Chinese Ecosystem Research Network

▲ Agro-ecological Station
● Hydro-ecological Station
■ Grass-ecological Station
⊘ Forest-ecological Station



The long term goal of the network is to understand the status of the various major ecosystems and environment by largely relying on the ground network monitoring and observation with modern methodologies, such as remote sensing, Geographic Information System (GIS) and mathematical models, thus contributing to the improvement of our living environment, the sustainable utilization of natural resources and

Affiliation/ownership	Site manager	Address	Areal extent in hectares	Location	Travel distance and direction
Institute of Soil Science, Chines Academy of Sciences.	Prof. He Yuanqiu He	Liujiazhan, Yujiang County Jiangxi Province P.R.CHINA, 335211 Or: Institute of Soil Science, Chinese Academy of Sciences. 71 East beijing Street P.O. Box 821, Nanjing, 210008 P.R.CHINA Tel: 86-0701-5321051 or 86-025-3369284 Fax: 86-0701-5321051 or 86-025-3353590 E-mail: yqhe@ns.issas.ac.cn or bsun@issas.ac.cn	1 km^2.	116°5′ 30″E, 28°5′ 30″N	13 km away from Yintan City.
Institute of Geography, Chinese Academy of Sciences.	Prof. Ouyang Zhu (director of the station) Prof. Xie Xianqun (deputy director of the station) Prof. Yu Qiang (deputy director of the station)	Institute of Geography, CAS Building 917 No.3 Datun Rd. Anwai Beijing 100101 PRC E-mail address: Yes@dls.iog.ac.cn	15 ha	36°57′N, 116°38′E	6km south-west of Yucheng City

China: Table of LTER Site Information

Site Name	Date	Principal biomes	Research themes	Types and lengths of data sets
Ansai Research Station of Soil and Water Conservation, Chinese Academy of Sciences (CAS)	1973	Principal biomes are millet, maize, broom corn millet, soybean, buckwheat, potato	The structure, function and controlling technologies of system in small watershed; Regulation of soil erosion; Water and nutrient balance and management; Vegetation rehabilitation theory and practice; Watershed management and ecosystem restoration in the Loess Plateau.	Social and economic data, since 1973; Meteorological data, since 1973; Long-term fertilization experiment, since 1983; Experiments of soil moisture dynamics and water productivity in grassland and woodland, since 1973; Experiments of soil erosion on different slope gradient, length and sharpness, since 1978; Experiments of deposition of soil & water conservation measure, since 1987; Short-term experiments on agriculture, forest and orchard ecosystems in various years since 1973; Land use and ecosystem change in small watershed under management practices, since 1936.
Beijing Forest Ecosystem Research Station, Chinese Academy of Sciences	1990	Warm temperate deciduous broad-leaved forest.	Structure, function and dynamics of forest ecosystem; conservation, restoration and sustainable utilization of biodiversity in destroyed forests; Global change.	Microclimate in deciduous broad-leaved forest, since 1992; General climate data of station, since 1992; Plant list in the studied area in the station, between 1991—1995; Solar radiation observing data in deciduous broad-leaved forest, between 1991—1993; Nutrient elemental contents of key plants , between 1992—1995.
Beijing Forest Ecosystem Research Station, Chinese Academy of Sciences	1990.	Warm temperate deciduous broad-leaved forest.	Structure, function and dynamics of forest ecosystem; conservation, restoration and sustainable utilization of biodiversity in destroyed forests; Global change.	Microclimate in deciduous broad-leaved forest, since 1992; General climate data of station, since 1992; Plant list in the studied area in the station, between 1991—1995; Solar radiation observing data in deciduous broad-leaved forest, between 1991—1993; Nutrient elemental contents of key plants , between 1992—1995.
Changshu Agricultural Ecological Experimental Station	1987	Rice, wheat, rape and cotton.	Sustainable agriculture Eco-environmental Science Greenhouse agriculture.	Spatial data on soils of the studied area in 1985; Socio-economic data of the studied area since 1970; Meteorological data since 1949.
Changwu Agro-ecological Experiment Station on Loess Plateau	1984	Winter Wheat\Corn	Establishing a ecosystem with higher profits in both agricultural ecology and economy.	Social and economic data, since 1984; Meteorological data, since 1984; Research data: Potential crop yield in dryland experiments in 1985-1995; Long-term rotation and fertilization experiment, since 1984; Long-term fertilizer fixed experiments, since 1984. Many short-term experiments on agriculture, forestry, orchard and soil erosion were conducted in various years since 1984.

the general advancement of ecosystem research.

Its concrete objectives are as follows:

1) To conduct long-term monitoring programs on the country's ecosystems in agriculture, forestry, grassland, lake and bay, and the environmental factors, like water, soil and air.

2). To conduct thorough and in-depth investigations of the structure, function and dynamics of the ecosystems, and the approaches and methods for sustainable utilization of these systems.

3). To provide the optimal managerial models to the people of local communities for the sustainable utilization of the local natural resources and the improvement of the local living environment.

4). To provide the scientific foundations needed by the decision-makers at various administrative levels concerned with the utilization of natural resources and environment.

Affiliation/ownership	Site manager	Address	Areal extent in hectares	Location	Travel distance and direction
Institute of Soil and Water Conservation, CAS and Ministry of Water Resources	Dr. Guobin Liu	No. 26 Xinong Road Yangling, Shaanxi Province P. R. China, 712100 Fax: +86 29-7012210 Tel: + 86 29-7012907 E-mail: gbliu@ms.iswc.ac.cn	The long-term field experimental installations are built in 75ha. The station also has an experiment and demonstration watershed with area of 827ha.	Located in the typical loess hill-gullied region of Loess Plateau (E 109^0 19' 23", N36°51' 30")	The station was located in Ansai county, 350km far away from Xi'an City
Institute of Botany, CAS	Prof. Ma Keping	Nanxincun 20 Xiangshan Haidian Distr. 100093 Email:angwg@public2.east.cn.net	16600 ha.	39^0 58'N, 115^0 26'E	114.5 km west from Beijing.
Institute of Botany, CAS	Prof. Ma Keping	Nanxincun 20 Xiangshan Haidian Distr. 100093 Email:sangwg@public2.east.cn.net	16600 ha.	39^0 58'N, 115^0 26'E	114.5 km west from Beijing.
Institute of Soil Science, CAS	Dr. Wang Dejian Wang,	Institute of Soil Science, Chinese Academy of Sciences. 71 East Beijing Street P.O.Box 821 , Nanjing 210008 P.R.China Email: Djwang@issas.ac.cn WWW.CS.CERN.AC.CN	3 hectares	123^0 38' E, 31° 33'N	45 km North from Suzhou City
Institute of Soil and Water Conservation, Chinese Academy of Sciences, and Ministry of Water Resource	Prof. Hao Mingde	No. 26 Xinong Road, Yangling, Shaanxi 712100, PRC	8.3 km^2	107°40'30''E, 35°12'N.	200km north of Xi'an.

5) To contribute to the solution of global ecological and environmental issues through active participation in international ecological research projects.

Among the tasks mentioned above the essential one is to study the ecosystem.

2. Network management

The leading organization and the principal financial sponsor of CERN is the Chinese Academy of Sciences (CAS). 21 institutes of CAS dealing with geo-science and bio-science are involved in CERN.

The Leading Group, the Scientific Committee and the Scientific Advisory Committee take the responsibilities for CERN management.

The Chairperson of the Leading Group and the Scientific Committee is the Vice-President of CAS, Academician Chen Yiyu. The Chairperson of the Scientific Advisory Committee is Academician Sun Honglie.

China: Table of LTER Site Information

Site Name	Date	Principal biomes	Research themes	Types and lengths of data sets
Daya Bay Marine Biology Research Station	1984	Subtropical marine ecosystems	Marine ecology of Daya Bay ecosystems Structures and functions of marine cosystem Impacts of human activities on environment Energy flow and nutrients cycling Experimental biology and pathology of economically important species Genetics of fishery species Techniques for shellfish hatching-breeding Harmful algae bloomEcological capacity to prevent the pollution.	Routine survey data, including physico-chemical parameters of the seawater and the composition and biomass of the biota (phytoplankton, zooplankton, pisces, benthos) at twelve stations within Daya Bay since 1982. Meteorological data since1997
Dinghushan Ecosystem Research Station	1978	Lower Subtropical Evergreen Broad-leaved Forest	Biomass and Productivity Nutrient Cycling Hydrological Cycling Ecophysiological Process Conservation Strategies	Meteorological data, since 1975. Data seta on structure, function and dynamics of vegetation and environment obtained from the monitoring and research projects operated in different years since 1978.
Donghu Experimental Station of Lake Ecosystems	(not as network member) 1956	Lake Donghu is a shallow freshwater lake in the middle reaches of the Yangtze River. It has a total surface area of 27.8 km^2 m, a mean water depth of 2.2 m, and a drainage basin covering an area of 187 km^2. The station is situated on the southwestern bank of the lake. The Yangtze River is the longest river in Asia, ranking the fourth in the world after the Amazon River, Congo River and the Ganges in terms of flowing capacity. It totals about 1000 billion cubic meters in annual run-off volume, accounting for 42% of the national freshwater volume emptied into the sea each year. The Yangtze valley lies between 25-35 North Latitude. Its mainstream and low-lying tributaries in its middle and lower reaches house a complicated and labyrinthine fluvio-locustrine ecosystem, criss-crossed by countless streamlet, inlets, marshlands, shallow lakes and ponds, known as one of five lake groups on the Asian continent. The food-inundated alluvial deposits and plains are a treasurehouse of aquatic resources including a priceless waterlife trove. Its aquatic product accounts for two thirds of the national freshwater fishery output, being a main contributor to the national economy. In addition, the world-renowned Three Gorges Program now in construction is located in the area. The Hubei Province itself is a vast locustrine system popularly known as a "land of one thousand lakes" since time immemorial. The system has a nearly round shape, about 10000 square kilometers in total area, with the Donghu Station roughly standing at the center of the circle. Only in the outskirts of Wuhan City, there are more than 100 lakes each larger than 1 km^2 in water surface. The local climate is dominated by subtropical monsoon, noted for it humidity and warmth. During the 1960s, the Donghu Lake was divided into five subsystems varied in the degree of eutrophication, native fish species, plankton taxa as well as their biomass or other ecological parameters. All these provide good conditions for probing the structure, functioning, material-and-energy equilibrium, evolution and sustainable development of the limnetic facies.	a). The cycling and dynamics of major nutrients such as N, P, C, including their input, output and circulatory patterns in the lake. b). The structure of the food web in the lake and the impacts of filer-feeding fishes and eutrophication on the lake ecosystem. c). The functioning of aquatic vegetation in the lake ecosystem and the ecological method to restore macrophyte community. d). Long-term impacts of human encroachment on changes of a waterbody, generative mechanism of eutrophication and its control.	TDN – 1978 -1997 NH_4 – N,NO_3 – N,NO_2 -N - 1978,1997 TDP, PO_4 –P – 1962, 1965, 1978, 1997 SiO2 – 1962, 1965, 1978, 1997 Species composition of phytoplankton –1956, 1958, 1962, 1965, 1978 Density and biomass of phytoplankton – 1962, 1965, 1978, Species composition of zooplankton – 1956, 1958, 1965, 1965, 1978 Production of zooplankton – 1979, 1982 Production of phytoplankton – 1962, 1965, 1978 Biomass of zoobenthos –1978 Macrophytes – 1962, 1963,1972-1982, 1988 Fish production -1951

Prof. Zhao Shidong is one of the Vice-Chairpersons of the Scientific Committee as well as the Secretary General of CERN, with responsibility for the routine work of managing CERN.

3. Special activities

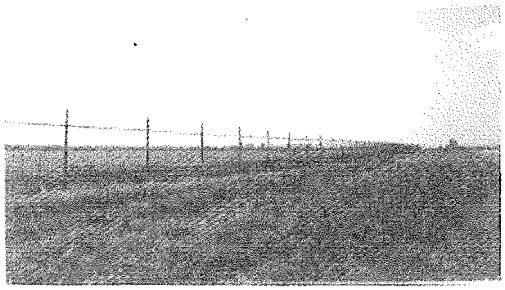
All of the Stations, Sub-centers and the Synthesis Research Center of CERN have developed strong links with universities, local people and the public media. They have played important roles in education and outreach directed at improving the living environment and sustainable management of ecosystems, by means of offering training courses, distributing papers and showing the managerial demonstration sites.

Affiliation/ownership	Site manager	Address	Areal extent in hectares	Location	Travel distance and direction
South China Sea Institute of Oceanology, CAS	Prof. Wang Zhao-Ding Email: wangzd@21cn.com	Daya Bay Marine Biology Research Station Dongshan, Nanao, Longgang District, Shenzhen, P.R. China 518121 Email: szmbrs@public.szptt.net.cn URL: http://www.mbrs.ac.cn or http://www.dyw.cern.ac.cn	38,000 square meters of terrestrial area and 6,000 square meters of a water area.	22° 33′ 17″ N, 114° 31′ 12″ E	About 60km east to the Shenzhen City
South China Institute of Botany, Chinese Academy of Sciences	Prof. Huang Zhongliang	gyzhou@scib.ac.cn	Dinghushan Biosphere Reserve	23°09′21″-23°11′30″N , 112°30′39″-112°3′41″E	80 km west to Guangzhou metropolitan city, and 15 km east to Zhaoqing city
Institute of Hydrobiology, CAS		Donghu Experimental Station of Lake Ecosystems, Institute of Hydrobiology, CAS Wuhan 430072, P.R.China E-mail: Xieping@ihb.ac.cn Xieping@public.wh.hb.cn	27800 hm2	114 °23' E 30°33' N	Donghu Lake is located in the eastern suburb of the metropolitan city of Wuhan, capital of Hubei Province in central China.

China: Table of LTER Site Information

Site Name	Date	Principal biomes	Research themes	Types and lengths of data sets
Fengqiu Agro-ecological Experiment Station	June, 1987	The cultivated crops of the area include wheat, corn, peanut, rape and cotton.	Farmland ecological subsystem; Subsystem of soil water, nutrients and salt regulation, and circulation; Multi-layered farming subsystem; Agro-forestry subsystem; Biotic matter cycling subsystem; Aquatic ecology subsystem; Agro-ecological environment information system;	Data sets on observation, survey, analysis and statistics (climate, water, soil and vegetation), since 1965.
Fukang Desert Ecosystem Observation and Experimental Station	March 1987	Alpine glaciers, mountain forests, sub-alpine meadow, low elevation steppe, desert, arid wildness and oases.	Structure, function and dynamics of the natural and cultivated ecosystems.	Meteorological data set, since 1987; Long-term nutrition cycling data set, since 1987; Grass-field rotation experiment data set, since 1994.
Gongga Alpine Ecosystem Observation and Experiment Station	Dec.1987	Mountainous ecosystems from the subtropical evergreen forest at the lower elevation to the alpine and glacier at the higher elevation. The forest populations mainly consists of Abies (*A. fabris*), Picea (*P. balfouriana*), Pine (*P. densata*), Betula (*B. utilis*), *Rhododendron* and so on.	Forest ecology Forest hydrology Glacial dynamics Mountain environment change.	Data on meteorology, hydrology, biomass of trees, glacier and chemical analysis for water and soil, since 1988.
Haibei Research Station of Alpine Meadow Ecosystem	April 1976	Alpine meadow and alpine shrub	Structure, function, dynamics and management of the Alpine Meadow ecosystem. Impacts of global warming on vegetation	Climate data, since 1976; Pedological data, since 1976.
Hailun Agricultural Ecological Experimental Station	June, 1978	Corn, soybean and sorghum	Moisture and nutrient in arable black soil Ecological system productivity,	Monitoring and research data sets, since 1978.
Heshan Hilly Land Interdisciplinary Experimental Station	1994	Artificial pure forests and artificial mixed forest (major species are Acacia and Pine trees, and the native tree species)	Restoration Ecology Agroforestry Ecosystem Management, Long-term Ecological Research	Data sets on plant, animal, soil, soil microbe, hydrology, geography, meteorology, eco-physiology, forest stand productivity etc. The lengths of data sets are quite different among the types.
Hitong Experimental Station for Forest Ecology	October 1960.	Sub-tropical ever-green broad-leaved forests	Structure, function, dynamics and sustainable management of Chinese fir (Cunninghamia lanceolata (Lamb.) Hook.) plantation and evergreen broad-leaved forests.	Data sets on structure, function, dynamics and sustainable management of Chinese fir (Cunninghamia lanceolata (Lamb.) Hook.) plantation forests, since 1960.
Inner Mongolia Grassland Ecosystem Research Station	March 1979.	Temperate typical steppe.	Structure and function of ecosystem, sustainable development of animal husbandry.	Meteorological data set, since 1982; Typical steppe monitoring data set, since 1980.

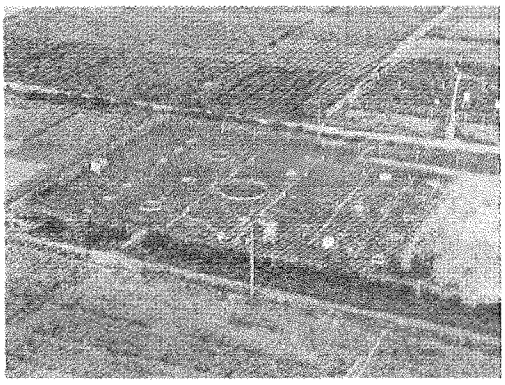
Affiliation/ownership	Site manager	Address	Areal extent in hectares	Location	Travel distance and direction
Institute of Soil Science, CAS	Jiabao Zhang	Institute of Soil Science, CAS 71 East Beijing Road, P. O. Box 821, Nanjing 210008, P.R.China E-mail: jbzhang@ns.issas.ac.cn URL: http://www.fq.cern.ac.cn	17ha	114°24′E, 35°00′N	50 km South from Kaifeng City across Kaifeng Bridge/The station is located in Fengqiu County, north bank of Huanghe River.
Xinjiang Institute for Ecology and Geography Research, CAS	Ji Fang,	No 40-3 of southern Beijing road Urumqi 830011, Xinjiang, China. E-mail: FKS@MS.XJB.AC.CN Tel: 86-0991-3824292, 3837396, 3837357, 0994-3241210, 3241659. Fax:86-0991-3835459, 0994-3241658.	70 ha	44°17′44″N, 87°55′67″E.	40 km from Ulumuqi
Institute of Mountain Hazards and Environment, CAS	Dr. Cheng Genwei	Institute of Mountain Hazards & Env., Huaxiba, Chengdu, Sichuan, P.R.China, 610041 Fax: 086-28-5222258 E-mail: ggs@mail.sc.cninfo.net	8.5 km^2	101°59′55″E, 29°34′34″N	About 56 km in the southwest of Luding county, Sichuan province.
Northwest Plateau Institute of Biology, CAS.	Prof. Xinquan Zhao	59 Xiguan Dajie, Xining Qinghai 810008 P.R.China	38800 ha	37 29'-37 45'N, 101 12'-101 23'E	160 km northwest from Xining.
Heilongjiang Institute of Agricultural Modernization, CAS	Xiaozeng Han xzhan@mail.hrb.hl.cnin.fo.net	138 Haping Road Harbin, 150040 P.R.China Hiamcas@mail.hrb.hl.cninfo.net URL: 202.118.251.251	23 ha	47°26′N , 126°38′E	7km from Hailun city.
S. China Institute of Botany, CAS and Local government of Heshan City	Prof. Dr. Peng Shaolin	Heshan Station South China Institute of Botany Chinese Academy of Sciences Guangzhou 510650, P.R.China Tel: 0086 20 87639381 Fax: 0086 20 87701031 E-mail: heshanstation@scib.ac.cn http://www.cern.ac.cn.members.# Field Stations	140ha.	112°53′15″- 112°54′00″E, 22°40′07″-22°41′07″N	The Heshan Station is located in 100km southeast of Guangzhou, the capital city of Province Guangdong, or 14 km southeast of Heshan City.
Shenyang Institute of Applied Ecology, CAS	Dr. Liping liao E-mail: lpliao@iae.syb.ac.cn	Institute of Applied Ecology Chinese Academy of Sciences Shenyang 110015 P.O.Box 417 P.R.China Email: lpliao@iae.syb.ac.cn http://www.ht.cern.ac.cn	100 ha	26 47' 23''N, 109 35' 25''E	16 km to the town of Huitong County
Institute of Botany, CAS	Dr. Bai Yongfei	Xiangshan Nanxincun 20 Beijing 100093 P.R.China Tel:(010)62591431 Fax:(010)62613547 http://www.nmg.cern.ac.cn	160 ha	43 38'N, 116 42'E	700km north of Beijing.



The experimental plots of Inner Mongolia Grassland Ecosystem Research Station (Photo: ZHAO Shidong).

China: Table of LTER Site Information

Site Name	Date	Principal biomes	Research themes	Types and lengths of data sets
Jiaozhou Bay Marine Ecosystem Research Station.	1978.	Temperate marine bay ecosystem in the west coast of the Northern Pacific Ocean.	(1)Long term monitering the state of Jiaozhou Bay Ecosystem (2)Study on basic ecological Processes, Nutrient dynamics, Formation mechanism of productivity, Sustainable development of marine ecosystem. (3) Study on ecology of microbial living organisms in the sea (4) Study on the dynamics of DMS in the sea (5) Ecological study on archaea, extracellular enzyme in the sea water (6) Ecological modeling (7) Ecological effects and optimum managerial experiments of mariculture in the China Sea.	Types and lengths of data sets Salinity data set: 1962-1963, 1981-1986, 1991-1999 Meteorological and radiation data, since 1978 Data on physical properties of water, since 1962 Data on chemical substances of water, since 1962 Data on primary production for phytoplankton, between1991-1995
Luancheng Agro-ecosystem experimental station, CAS	1981	Wheat, corn, fruit tree, vegetable	Nutrient cycles SPAC Crop breeds Sustainable agriculture	Meteorological data, since 1981 Research data, since 1981
Naiman Research Station of Desertification	1985	Grassland (Leymus) with opening forest (Ulmus).	Restoration and rehabilitation of degrading semi-arid. ecosystem	Research and monitoring data, since 1985
Qianyanzhou Experimental Station for Comprehensive Development of Natural Resources in Red Earth Hilly Area.	Oct. 1983	Artificial forest, paddy field.	Modes of integrated development and their technological system in red earth hilly area.	Environmental effects in the process of development and utilization in red earth hilly area. Ecosystem restoration and agricultural sustainable development in the subtropical region. Management of agricultural resources and rural economical development. Study on theory and method of resources science. Spatial data and attribute data on structure, function, dynamics and social-economics, since 1983
Sanjiang Ecological Experiment Station of Mire-Wetland	1989.	Mire-wetland consists of Carex pseudocuraica, C.lasiocarpa, Glyceria spicilosa, Salix brachypoda, S. myrtilloides, Deyeuxia anguslifolia and Betula fruicosa, Quercus monglica etc.	Mire-Wetland and farmland ecosystem derived from Mire-Wetland reclamation.	Meteorological data, since1989 Hydrological data , since 1990



The experimental plots of Yucheng Comprehensive Experimental Station. Photo: ZHAO Shidong.

Affiliation/ownership	Site manager	Address	Areal extent in hectares	Location	Travel distance and direction
Institute of Oceanology, CAS	Dr, Prof. Jiao Nianzhi.	7 Nanhai Road Qingdao, 266071 P.R.China E-mail: Jiao@ms.qdio.ac.cn http: //www.jzw.cern.ac.cn	39 000 ha (390 km^2).	The station is located on the bank Jiaozhou Bay (36°03′12″N, 120°20′30″E). The place of Jiaozhou Bay is 35°58′48″N;,36°11′42″ N, 120°09′24″E;,120°20′3 0″E	The station is set up in the City of Qingdao and at the southern bank of the mouth of Jiaozhou Bay.
Shijiazhuang Institute of Agriculture Modernization, CAS	Dr. Hu Chunsheng	Shijiazhuang Huaizhong Road 286, Shijiazhuang institute of agriculture modernization, CAS Shijiazhuang 050021, P.R.China E-mail: cshu@public.sj.he.cn cernlca@public.sj.he.cn URL: http://www.sjziam.ac.cn	28 ha	37°50′N, 114°40′E	28 km east-southern far from Shijiazhuang city
Cold and Arid Regions Environmental and Engineering Research Institute, CAS	Prof. Zhao Halin	260 Donggang west road Lanzhou 730000 P.R.China Tel: (0931) 9975129 Fax: (0931)8821894 Email: resdiv@ns.lzb.ac.cn	8 ha	42 55′35″N, 120 42′55″E	The station located in 675 km in northeast of Beijing
Commission for Integrated Survey of Natural Resources, CAS	Prof. LI Jiayong	Qianyanzhou Experimental Station P.O. Box 9717, Beijing 100101 P.R.China Fax: (8610)64914230 E-mail:jyli@cianar.ac.cn OR Qianyanzhou Experimental StationTaihe County, 343725 Jiangxi Province, China Fax: (8610)0796 5572260 e-mail: qyzes@public1.japtt.jx.cn	204ha	$26^0$44′N, $115^0$04′E	48km south-east of Taihe County
Changchun Insitute of Geography, CAS	Prof. Wang Ruishan	16 Gongnong Road Changchun 130021 P.R.China Tel: (0431)5674704 Fax: (0431)5652931 Email:gqyang@mail.ccig.ac.cn	67000 ha	133 30′34″E, 47 35′11″N	30km east to Qianjin town

China: Table of LTER Site Information

Site Name	Date	Principal biomes	Research themes	Types and lengths of data sets
Shapotou Desert Experiment and Research Station	1956	The transitional vegetation between desert and steppe, dominated by the semi-shrubs, shrubs and herbs	Water requirement of sand-fixing plant species and water balance of sandy land vegetation; Drought resistance and water relationship of desert plants; Vegetation dynamics on sand dunes; Soil nutrition dynamics on sand and nutrient cycles on oasis farmland; Micro-geomorphology, aeolian sedimentation and mechanism of sand current; Micro-meteorology and turbulence in the interface layer between atmosphere and vegetation and sand dune surface; Transformation and utilization of sandy land. Theories and techniques of sand blocking and stabilizing.	Meteorological data, since 1956 Various data sets on vegetation and environment accumulated by research activities conducted in different years since 1956.
Shenyang Ecological Experimental Station, Chinese Academy of Sciences.	1987	Corn, Rice and Soybean	Agro-ecology Pollution ecology Microbial ecology Environmental changes	Several research and monitoring data sets, since 1987.
Taihu Laboratory for Lake Ecosystem Research	1989	Lake water ecosystem biomes	Water quality and water ecosystem structure Lake ecosystem energy conversion, nutrient cycling Interface actions between water and air, water and sediments Lake eutrophication and ecological experiments with different organisms Lake ecosystem management and modelling Physico-biological engineering	Data on water quality, water level and water current, since 1989. Meteorological and radiation data, since 1989.
Taoyuan Station of Agro-ecosystem Research	June 1979	The original vegetation is subtropical evergreen forest consisting of the following forms and species: Form. Castanopsis Farsesii; Form. Castanopsis Tibetana; Form. Cyclobalanopsis Slauca; Form. Cyclobalanopsis Gracilis; Form. Castanopsis eyrei; Form. Lithocarpus Glabros & Castanopsis Sclerophylla; Form. Quercus glandulifera Var. Breviretiolata & Cycloblanopsis Mnltinervia; Form. Castanea Henryi; Form. Pinus Massoniana; Compl form frutex & herb-Pinus massoniana; Form. Cunninghamia Lanceolata; Form. Plyllostachys Pabescens; Form. Phyllostachys Nidularia; Form. Corylus sinensis & Weigela japonica Var. Sinica; Form. Miscanthus Sinensis; Form. Camellia Oleosa; Form. Sapium Selbiferum; The current vegetation is cultivated one consisting of the following crops in many places: rice, corn, cotton, ramie, tea and orange.	Structure, function, succession and management of agro-ecosystem in subtropical red earth hilly area. Principle and technology for sustainable utilization of natural resources. Comprehensive development of agriculture, forestry, livestock, fishery in red earth hilly area. Matter and energy cycling and utilizing characteristics in farming systems.	Meteorological and microclimatic data, since 1979 Biological data on rice, since 1979 Land cover dynamic data, since 1978 Agro-economic data of the studied area, since 1978 Soil fertility data, since 1978 Land productivity data, 1978 Solar radiation data, since 1998
Xishuangbanna Tropical Rainforest Ecosystem Research Station	July 18, 1959	Tropical rainforest	Structure, function and dynamics of tropical rainforest Restoration of tropical rain forest Man-made tropical ecosystem	64 data sets on meteorology, hydrology, pedology and biology, since 1959. But some of the data sets are not complete and continuous.
Yanting Agro-Ecological Station of Purple Soil	May, 1973	Rice, maize, wheat, cotton and sweet potato	Purple soil (Regosols); soil formation; soil fertility; soil ecology; structure, function and succession of agro-ecosystem; soil and water conservation; agro-forestry; landscape ecology; ecological restoration.	Climate 1980—now Soil 1984—now Water 1984—now Biology 1984—now Land use 1983--now

Affiliation/ownership	Site manager	Address	Areal extent in hectares	Location	Travel distance and direction
Institute of Desert Research (IDR) and Cold & Arid Regions Environment and Engineering Research Institute (CAREERI), Chinese Academy of Sciences (CAS)	Prof. Li Xinrong (Ph.D.)	Address of the Station: Shapotou Experiment Station of Desert Research, Zhongwei County 751700, Ningxia Hui Autonomous Region, P. R. China Tel: 0086-953-7982072 E-mail: lbz@public.yc.nx.cn Address of the Institute The Instituteo f Desert Research (IDR), Cold and Arid Regions Environment and Engineering Research Institute (CAREERI), Chinese Academy of Sciences, CAS 260 Donggang West Road, Lanzhou 730000, P.R.China Tel: 0086-931-8847614 Fax: 0086-931-8883209/8889950	133.3 ha	104°57'E, 37°27'N	20km away from the west of Zhongwei County, Ningxia Hui Autonomous Region.
Shenyang Institute of Applied Ecology, CAS	Director: Yu Wantai	72 Wen Hua Road Shenhe District Institute of Applied Ecology Chinese Academy of Sciences P.O. Box 417 Shenyang, 110015 P.R. China E-mail: syz@iae.syb.ac.cn Web URL: http://www.sy.cern.ac.cn	15ha	41°32'N, 123°23'E	35km south of Shenyang City.
Nanjing Institute of Geography & Limnology, CAS	Prof. Weimin Chen	Taihu Laboratory for Lake Ecosystem Research 73 East Beijing Road, Nanjing 210008, China e-mail: Chenwm@niglas.ac.cn Web URL: www.@th.cern.ac.cn	2338 km2	31,25'12", 120, 13',02"E	20 km in the south of Wuxi or 100 km in the west of Shanghai
Changsha Institute of Agricultural Modernization, CAS		Taoyuan Station, Changsha Institute of Agricultural Modenization, CAS, Changsha city, Hunan province, 410125 China, PR. E-mail: krwang@ms.csiam.ac.cn URL: http://www.csiam.ac.cn/	12.2 hm^2	28°55'N, 111°30'E Elevation: 89 m to 124 m.	The station is located in the capital town of Taoyuan county which lies to the north-west part of Hunan province, and is about 200 km faway from Changsha, the capital city of Hunan province
Xishuangbanna Tropical Botanical Garden, CAS	Prof. Tang Jianwei	Menglun town Mengla county Yunnan Province, P.R. China 666303 E-mail:stznet@public.km.vn.cn http:/ www.XTBG.ac.cn	30800 ha	101°16'53" E, 21°54' 41"N	Southeast 70 km from Jinghong city
Chengdu Mountain Hazards Research Institute, Chinese Academy of Sciences	Prof. Zhu Bo	P.O.Box 417, Chengdu institute of mountain hazards and environment, CAS. The 9th section of Renmin Nan road, Chengdu, Sichuan 610041 P.R.China Official e-mail: ytg@mail.sc.cninfo.net	18 km^2	31°16'29"N, 105°27'26"E	It is located in the middle of Sichuan basin, 250 km from Chengdu, and 13km from Yanting

Korea
Long Term Ecological Research

Eun-Shik Kim
Department of Forest Resources
Kookmin University

Network history

Over the last 40 years, Korea's landscapes have been dramatically changed by intensive efforts toward afforestation while people convert from firewood to fossil fuel sources. Land area has been largely revegetated and the condition of vegetation is improving over time. Meanwhile, Korea has experienced degradation of the natural environment caused by intensive developmental activities and subsequent pollution. These activities include industrialization, urbanization, the construction of roads and golf courses, fossil fuel consumption, discharge of wastes to water systems, mineral extraction, land-clearing, and water control.

As evidence of environmental degradation emerges slowly over decades, most of the people do not sense the symptoms with any precision. Hence extensive collection and careful analyses of relevant data over long time periods are required for better understanding and management of biotic components and the environment of Korea. Although some scientists have realized the importance of studying long-term phenomena in ecology, major advancement in long-term ecological research has not yet been made in Korea.

The Korea LTER Network

A. Kwangnung Experimental Forest

B. Mt. Kyebangsan Forest

C. Mt. Keumsan Forest

Recently the Korea Forest Research Institute (KFRI) included Long Term Ecological Research (LTER) as a major project in forestry research, and three sites were officially designated for long-term ecological research and biodiversity conservation and monitoring. The first LTER site in Korea is Kwangnung Experimental Forest, which represents the oldest natural forest in Korea. Some parts of the forest have been protected for more than 500 years. The other two are the forests of Mt. Kyebangsan and Mt. Keumsan. Although LTER is in its early stages in Korea, promotion and encouragement of ecologists activities will help to ensure the sound development of the Korean LTER program in the future. The objective of most of the research is to investigate the dynamics of structure and function of ecosystems related to the changes of environment, which is ultimately related to monitoring biodiversity and global change.

As the three official sites (Kwangnung Experimental Forest, Mt. Kyebangsan Forest, and Mt. Keumsan Forest) are managed by the same members of research team of the Korea Forest Research Institute, the cross-site research is guaranteed. All the sites have common themes or core research topics, which must be investigated and compared to each other. The core areas include primary production, population dynamics, nutrient cycling, impacts of environmental stress and disturbances, and environmental changes. As the National Arboretum and the Forest Museum are located at the Kwangnung Experimental Forest, it became a popular place for public education on nature and ecology in Korea.

In addition to the three official sites, eight other sites are proposed as potential sites, whose names are Lake Soyangho, Mt. Jumbongsan, Mt. Hallasan, Mt. Chirisan, Mt. Soraksan, Mt. Namsan, Nakdonggang River and Demilitarized Zone (DMZ) in Korea. Outcomes of LTER activity become useful tools for detecting environmental changes such as regional pollution and global warming and managing natural resources such as forests, lakes, and rivers.

Network management, chairperson (or co-chairs) and principal financial sponsors

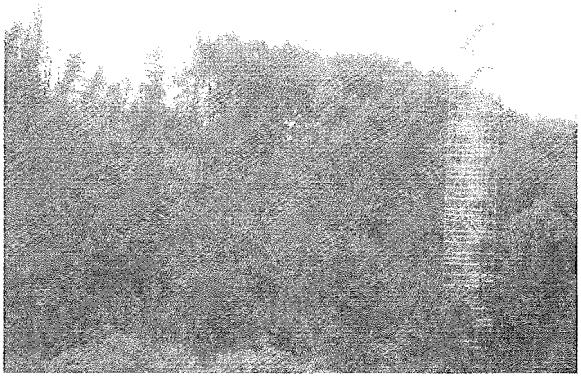
As the Korea LTER program is in early stage of development, much effort has been made to establish the LTER program and coordinate

Korea: Table of Site Information

Site name	Date	Principal biomes	Research themes	Types and lengths of data sets
Kwangnung Experimental Forest	1913	temperate mixed hardwood forest	forest stand dynamics; water cycling; nutrient cycling; change of biodiversity; microclimate; flux of energy, water vapour and CO_2; air pollution	Hydrological data for twenty years; ground survey on biodiversity from 1994
Mt. Kyebangsan Forest	1991	temperate mixed hardwood forest	forest stand dynamics; air pollution; decomposition of litter; water quality monitoring; change of biodiversity; climate change and monitoring	Ground survey on biodiversity in 1995
Mt. Keumsan Forest	1983	temperate mixed hardwood forest	forest stand dynamics; air pollution; decomposition of litter; water quality monitoring; change of biodiversity	Ground survey on biodiversity in 1994

research in official and potential sites in Korea. Meanwhile, in order to facilitate communication, coordination, and cooperation among the scientists in ecology and related disciplines, the Korea LTER Committee (KLC) was established in 1997.

The Korea LTER Committee plays a major role in improving LTER program and activities in Korea. The committee consists of five members and meets quarterly to discuss major activities of research and implement. The chairperson of the Committee is Eun-Shik Kim, Department of Forest Resources, Kookmin University, Korea. At this moment, the Korea Science and Engineering Foundation (KOSEF) plays an important role as a sponsoring agency for hosting international conferences and supporting joint research, exchange programs, and domestic LTER activities in Korea. In addition, the Forest Research Institute of Korea continues to set the basic framework for the development of LTER activities in Korea. The Committee found it needed to invite several financial sponsors to activate the LTER program in Korea, however.



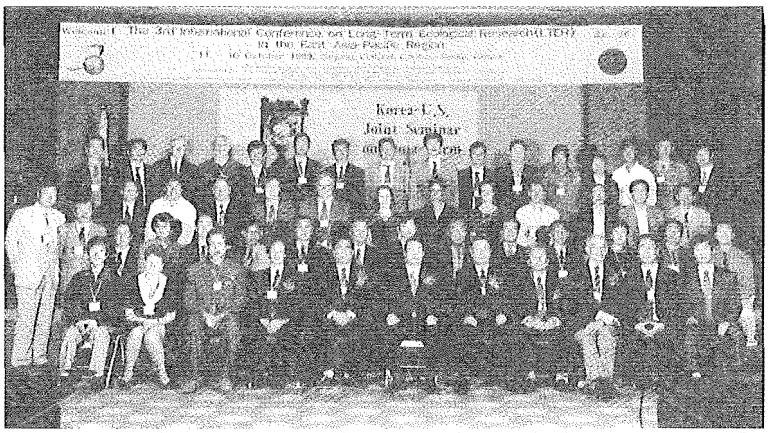
Monitoring tower construction in Kwangnung Experimental Forest

Partnerships (institutions, organizations)

The Korea LTER Committee actively pursues cooperative partnerships with the Korea Forest Research Institute and the Korea Science and Engineering Foundation along with the National Park Authority (NPA), local governments, and universities. These partnerships facilitate communication and cooperation among the scientists, managers, and policy makers in ecology and related disciplines.

Special activities (education, public outreach)

Collaboration with national networks in the region is made through a biennial Regional Conference. Collaboration among the global networks is facilitated via the internet, whose address is http://klter.Kookmin.ac.kr.



Participants in the 3rd International LTER Conference in the East Asia-Pacific Region in Seoul, Korea, 1999

Stemflow collection at a stand of fir forest in the Kwangnung Experimental Forest

The Korea LTER Committee hosted an International Workshop on LTER in the East Asia-Pacific Region in 1998 and the 3rd International Conference on LTER in the East Asia-Pacific Region, jointly with the Ecological Society of Korea, in 1999. These events were organized by Kookmin University and the Korea Forest Research Institute. Before the Conference, a bilateral Korea-U.S. Joint Seminar to identify and address key questions on up-to-date LTER issues in regional as well as global scale was held as a satellite meeting supported by both the Korea Science and Engineering Foundation and the U.S. National Science Foundation (US NSF), which will facilitate future cooperative research among the scientists of the countries and provide a firm stepping stone for the development of the national LTER network in Korea.

Three Korean sites are included in the GTNET-NPP Demo Project of the Global Terrestrial Observing System (GTOS), coordinated by the Network Office of US Long Term Ecological Research Network.

Allfiliation/ownership	Site manager	Address	Area extent in hectares	Location	Travel distance to nearest town
The Korea Forest Research Institute/national forest	Dr. Jeong Soo Oh, Director General, Department of Forest Environment, Korea Forest Research Institute		500 ha	37?45'N, 127?11'E	35km northeast of central Seoul, Korea
The Korea Forest Research Institute/national forest	Dr. Jeong Soo Oh, Director General, Department of Forest Environment, Korea Forest Research Institute	The Korea Forest Research Institute, 207, Chongnyangni 2-dong, Tongdaemun-gu, Seoul 130-012, Korea; JHS033@foa.go.kr	440 ha	37?44'N, 128?29'E	75km northeast of Wonju City, Kangwon Do Province, Korea
The Korea Forest Research Institute/national forest	Dr. Jeong Soo Oh, Director General, Department of Forest Environment, Korea Forest Research Institute	The Korea Forest Research Institute, 207, Chongnyangni 2-dong, Tongdaemun-gu, Seoul 130-012, Korea; JHS033@foa.go.kr	300 ha	34?45'N, 127?59'E	75km south of Chinju City, Kyongsang Namdo Province, Korea

Mongolia
Long Term Ecological Research

J. Tsogtbaatar[1] and C. E. Goulden[2]
[1]Mongolian Academy of Sciences
[2]Institute for Mongolian Biodiversity & Ecological Studies, Academy of Natural Sciences

Network History: The Government of Mongolia approved establishment of the Mongolian Long Term Ecological Research (MLTER) Network in December 1997.

Management: The Mongolian LTER Steering Committee, was organized in 1998, Dr. J. Tsogtbaatar of the Mongolian Academy of Sciences (geoeco@magicnet.mn) is the Director of MLTER. Dr. C. Goulden (goulden@acnatsci.org) is the International Coordinator.

Partnerships: MLTER is under the direction of the Mongolian Academy of Sciences with institutional support from the National University of Mongolia, The Ministry of Nature and the Environment of Mongolia, and The Academy of Natural Sciences of Philadelphia (USA).

Hovsgol National Park in northern Mongolia was designated the first MLTER network site in 1998, and was accepted as an East Asian ILTER site in 1998. Other potential sites are presently being considered and will include steppe grassland and desert sites. Monitoring and research programs have already started at Lake Hovsgol and are in the process of being designed at the other locations.

Goals: The primary goals of the Mongolian LTER Network are to study human impacts on Mongolia's environment with a focus on short-term impacts of nomadic pasture use and forest loss due to cutting or fires on terrestrial and aquatic ecosystems. Climate change impacts are also a major component of the MLTER program.

Some conclusions and observations resulting from these studies to date include:

1. The Siberian larch (Larix siberica) dominates the forest, composing more than 90% of the trees.
2. The lake is surrounded by continuous permafrost.
3. HNP has many rare and endemic taxa. The level of endemism in the Lake is ca. 10% of the taxa of several phyla, but most taxonomic groups are poorly studied.
4. Endemic taxa compose most of the animal biomass of the Lake
5. Based upon phytoplankton biomass and primary production measurements, Hovsgol is an ultra-oligotrophic lake.
6. Because of the very low productivity, larch leaf detritus may be a primary source of food for aquatic invertebrates. Detritus can be carried deep into the lake by thermal density currents that mix the water in the spring from the shoreline areas.
7. The tributary streams have many endemic species of insects and are important spawning sites for the lake's fishes.

Long-term monitoring programs at the Hovsgol LTER site

Meteorological and hydrological data are collected daily at the south and north ends of the Lake. The National Park has a chemistry laboratory and has monitored water chemistry of the Lake. In 1999 new equipment was purchased for analysis of water samples, and an improved water quality monitoring program was developed, which included study of the major tributary streams entering the Lake. Several long-term data sets will soon be available or are being obtained for the region and the Lake. Land cover maps from LandSat 4 satellite imagery are available, and new LandSat 7 imagery is now being used to develop more detailed land-cover maps for the region.

Impacts: Short-Term Impacts of Grazing and Fires

Grazing. The Hovsgol watershed primarily consists of taiga forest, but there are steppe grasslands bordering high alpine tundra in the west, and steppe on south-facing slopes of mountains. These areas have been grazed for centuries. Stream valleys are generally a combination of steppe vegetation and wetlands. Recently, the number of livestock in the valleys has increased because the loss of trade with Russia has limited the ability of the herdsman to sell their animals. This indirectly affects tributary streams of the Lake due to increased herd sizes. When grazing livestock move into grasslands they dramatically alter stream conditions. The erosion of stream banks is beginning to occur as grazing sheep, yaks, cows and goats move across streams more intensively.

Forest Fires. Natural fires now cause only an estimated 10% of the fires in Mongolia and Siberia; 90% of fires are due to carelessness or are deliberately set. Frequent forest fires change the course of plant succession in different ways, depending on topography, soil texture and moisture. Small

Mongolia: Table of Site Information

Site name	Date	Principal biomes	Research themes	Types and lengths of data sets
Hovsgol National Park LTER	Monitoring and research began in 1970.	Taiga, Steppe, Streams, Lake and wetlands.	Plant and animal biodiversity, landscape, ecosystem, pasture use, limnology.	Meteorological Continuous 1963-Present Hydrological Continuous 1967 - Present Permafrost Discontinuous 1980-90s Land cover Discontinuous 1940s/90s Biological (Lake) Discontinuous 1970-90s

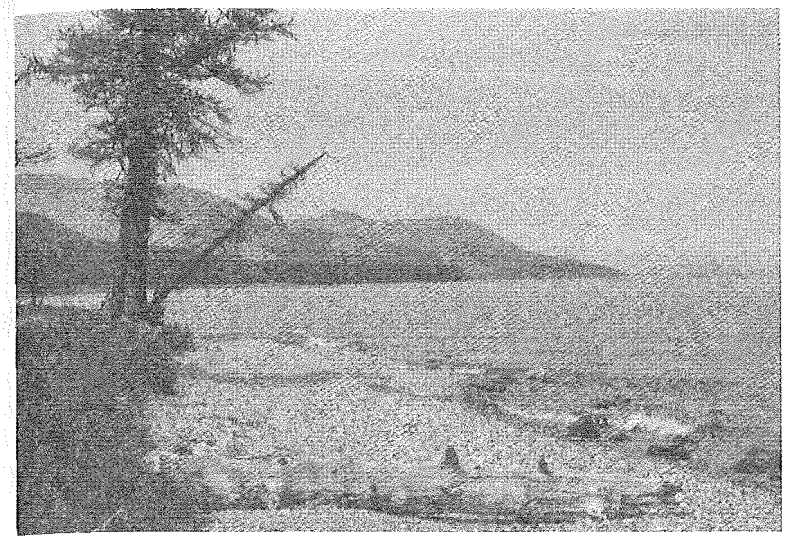


Figure 2. Lake shore and larch forest of Hovsgol LTER (Photo by C. E. Goulden).

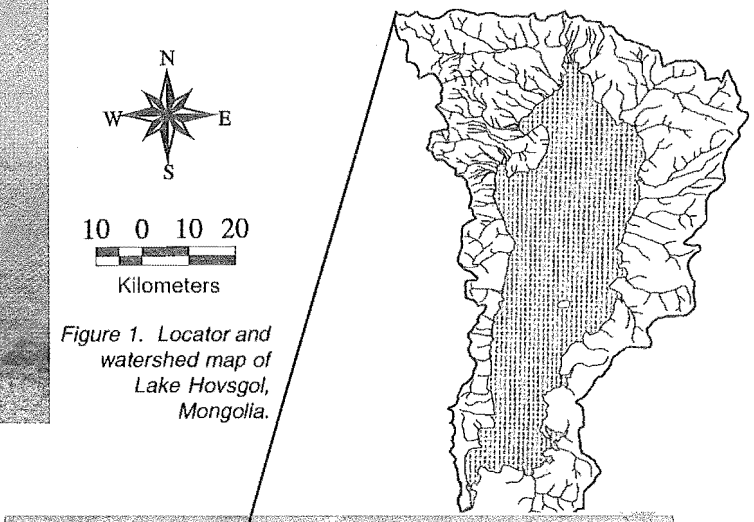


Figure 1. Locator and watershed map of Lake Hovsgol, Mongolia.

trees less than 10 cm diameter and trees with high resin content are killed by even moderate fires.

Impacts: Long-Term Climate Change, Forest and Permafrost

Hovsgol LTER is strategically located for monitoring climate change. It lies just north of the transition between steppe forest zone and the taiga or boreal forest. Average annual air temperatures at the southern end of the Lake have increased by 1.44° C since 1963, as estimated by time-series analysis. Forest loss in northern Mongolia is widespread. The taiga forest as a whole is under similar threat; this is a serious global issue, the Siberian forest represents 20% of the forestry resources of the World. It is a major carbon "sink" for the whole Northern Hemisphere. Managing this phenomenon is crucial because the forest grows on permafrost soils that are being degraded by climate warming. Permafrost soils are high in humus content; loss of permafrost and warming of soils increases the rate of decomposition of humus, increasing the rate of release of carbon dioxide and methane, further increasing greenhouse gas levels in the atmosphere.

At Hatgal, preliminary studies indicate that the active zone depth has increased by 0.2-0.3 m, and permafrost temperature has increased by 0.1 to 0.2° C in the last 20 years (Tumurbaatar 1999).

The Mongolian Academy is planning to begin monitoring forest and steppe habitats, permafrost, soil conditions, and vegetation at the Lake beginning in 2000-2001. Nine watersheds with different human impacts will be selected as study sites in the summer of 2000-01, and monitoring and experimental studies will begin in 2001.

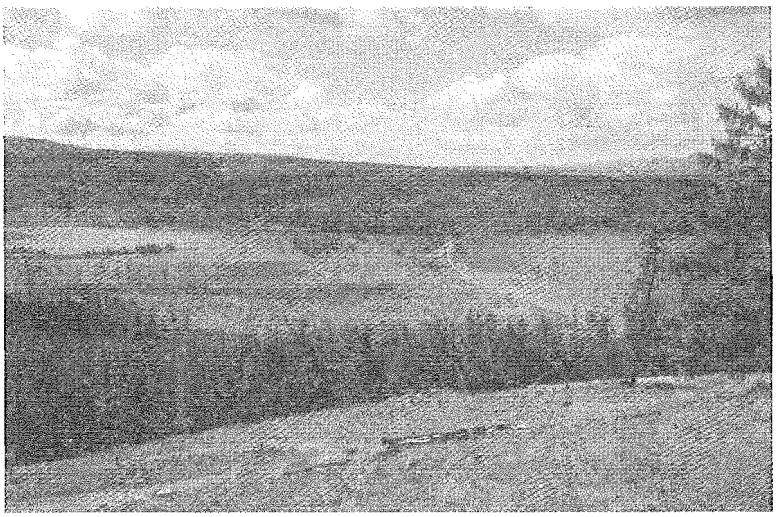


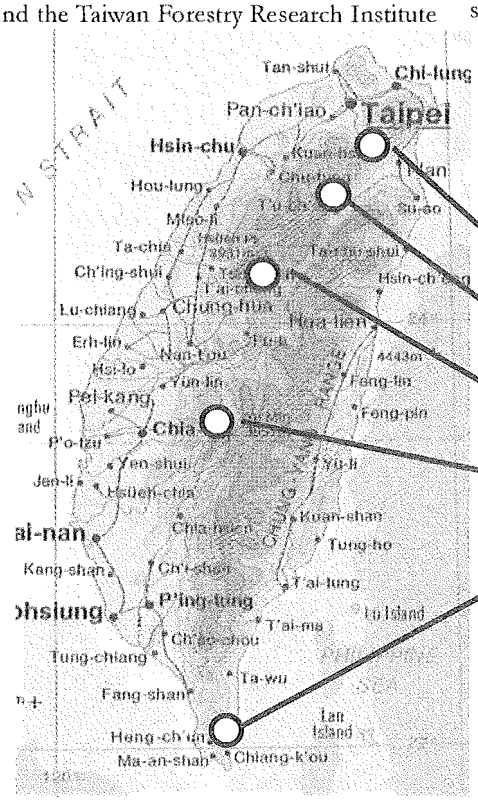
Figure 3. Embayment and tributary stream showing larch forest on north-facing slope and steppe grassland in valley, Borsog Gol, Lake Hovsgol, Mongolia (Photo by C. E. Goulden).

Affiliation/ownership	Site manager	Address	Area extent in hectares	Location	Travel distance and direction to nearest town
Hovsgol National Park is under the Ministry of Nature and the Environment	Clyde E. Goulden Academy of Natural Sciences Philadelphia, PA 19103	Hovsgol National Park, Hatgal, Hovsgol Aimag, Mongolia	900,000 hectares	(50°26'N, 100°09'E)	Located three hours by jeep north of Moron, Hovsgol Aimag, Mongolia.

TERN
Taiwan Long-term Ecological Research Network

Yue-joe Hsia[1] and Hen-biau King[2]
1. Institute of Nature Resources, National Dong-hwa University, Hualien, Taiwan
2. Taiwan Forestry Research Institute, Taipei, Taiwan

The Taiwan Long-term Ecological Research Network (TERN) was established in 1992 with main sponsorship from the Taiwan National Science Council (NSC) and cooperation with universities and the Taiwan Forestry Research Institute (TFRI). The network was launched with just one site, the Fu-shan long-term ecological study sites. Initially, the TFRI proposed to open its experimental site to all scientists interested in ecosystem studies when the Fu-shan Experimental Forest was established in 1990. The program was promoted as a LTER site with support from scientists from several universities and the NSC funded the Fu-shan LTER site in 1992. As the program met with great enthusiasm from ecologists in Taiwan, the NSC subsequently extended the TERN program to its current four sites (Fu-shan Forest, Guan-dau-shi Forest, Nan-jen-shan Forest/Lake, and Ta-ta-chia Forest). In additional to those NSC funded sites, the Yuan-yang Lake site has been funded by the Institute of Botany, Academia Sinica 1992.



The TERN sites were chosen based on representative forest ecosystem, facilities, and compliance of land management agencies. The principal objective of the TERN program is to understand long-term ecological phenomena and processes within Taiwan's dominant ecosystems. TERN's major concern is to gather baseline data on the productivity, diversity, structure, and function/process of Taiwan's major ecological systems. The program focuses on the long-term impacts of major disturbances (such as natural erosion, typhoon, monsoon, pollution and land use, etc.) at the research sites. The results of the long-term studies aid in understanding Taiwan's ecosystems, and the subsequent construction of ecological models may eventually be used to predict and ameliorate environmental disturbances at local, regional, and global levels. This information will also provide the insight necessary for sustainable ecosystem management and sound policy development. More objectives that are specific include:

* Understanding processes and mechanisms of ecosystem dynamics;
* Studying the major natural and human disturbances which affect ecosystem dynamics and ecosystem responses;
* Identifying ecological processes to address environmental changes;
* Providing science-based information to decision makers in formulating environmental policy;
* Training young scientists in ecology and using the long-term sites as resources for education;
* Incorporating research results into ecology curriculums at all levels of education, particularly in the field of subtropical forest ecology;
* Sharing research ideas and base-line data with scientists from other ecological sites through meetings and international networking; and
* Promoting collaborative research projects with scientists from other

Site name	Date	Principal biomes	Research Themes	Types and lengths of data sets
Fu-shan Forest site (FSF	1990	Subtropical mixed evergreen hardwood forest	Nutrient budget, hydrological processes, plant-animal interaction, forest regeneration mechanisms	Climate record (8 years), rainfall and stream discharge (6 years), phenology (4 years), rainfall, throughfall, and stream water chemistry data (6 years), vegetation components (2 permanent plots), fauna
Guan-dau-shi Forest TERN site (GDS)	1949	Subtropical mixed evergreen hardwood forest and China fir plantation	Nutrient budget, hydrological processes, plant-animal interaction, forest regeneration mechanisms, fire ecology	Rainfall and stream discharge (4 years), phenology (3years), rainfall, throughfall, and stream water chemistry data (4 years), fauna
Nan-jen-shan Forest/Lake TERN Site (NJS)	1992	Subtropical monsoon forest	Vegetation dynamics, nutrient cycling, plant-animal interaction, chronic wind disturbance, freshwater wetland trophic structure	Climatic data (4 years), vegetation components (4 permanent plots), fauna, soil chemistry
Ta-ta-chia Forest TERN Site (TCC)	1995	Alpine and sub-alpine evergreen coniferous forests	Ecosystem phenomena and processes; dynamics of animal communities; soil nutrient movement; human impacts (recreational activities); stand dynamics modeling	Climatic records (4 years), phonological data (4 years), basic soil data, vegetation inventory data, fauna inventory data
Yuan-Yang Lake Site (YYL)	1993	Montane evergreen coniferous forests	Nutrient cycling, productivity estimation, vegetation dynamics, lake acidification, soil structure.	Climatic data (4 years), rainfall, throughfall, and lake water chemistry (4 years), primary productivity (5 years), vegetation structure and inventory data, basic soil data.

Montane evergreen coniferous forest (Ta-ta-chia forest site)

ecological sites, particularly sites with similar ecological settings.

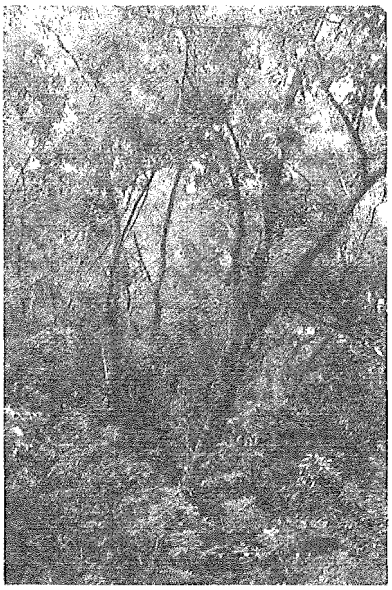
Initially, the TERN was loosely formed through funding of individual research projects at each site. The research projects were mainly inventory type research in the first phase of TERN. Consensus on core research areas is gradually being built through discussion among multi-disciplinary scientists. Major effort has been put in establishment of data sharing and networking among the five sites. After a discussion in the first all-scientists' meeting of TERN held in January of 2000, research focused on nutrient budgets, plant-animal interactions, and net primary production will be emphasized on all five sites. To facilitate standardized experimental methodology, research projects on cross-sites comparison of ecosystem processes and functions will be encouraged.

The promotion of the LTER concept to some governmental organizations, media, and public through various means has been very successful. For instance, the TERN program was introduced to the public through many news media (such as magazines, newspapers, television and radio broadcasting programs). With the adoption of the concept of establishing long-term baseline databases for management decision-makings, by the National Park Department of the Construction and Planning Administration, the Ministry of Interior, additional LTER sites will be established in the National Park system. Currently, a coastal coral reef site at Keng-ting National Park and a river gorge site at the Taroko National Park are being planned.

Nan-jen-shan forest/lake site

Participation in International LTER research activities is one of the objectives of TERN. For example, a small group of TERN scientists visited four forest CERN sites (Dinghushan, Heshan, Huitong and Xishuangbana) in May 1997. A tentative agreement was made to conduct further collaborative research projects and hold workshops. In May 1998, the US National Science Foundation hosted a group of Taiwan's administrators and scientists visiting the H.J. Andrews forest LTER sites. In June 1998, fourteen scientists and students from US LTER sites had the opportunity to visit two TERN sites (Fu-shan sub-tropical and Nan-jen-shan tropical forests) and related research facilities. This trip reciprocated a visit in 1997 when eight students and junior scientists from TERN sites visited H.J. Andrews LTER site in the US. Another group of TERN students again visited the H.J. Andrews LTER site in the spring of the 2000. A workshop on the "Typhoon and Hurricane disturbances on forest Dynamics" was held in September 1999 between representatives of US Luquillo LTER site and TERN sites.

Subtropical mixed evergreen hardwood forest (Guan-dau-shi forest site)



Monsoon impacted forest (Nan-jen-shan forest/lake site)

Affiliation/ownership	Site manager	Address	Area extent in hectares	Location	Travel Distance and Directeion to Nearest Town
Taiwan Forestry Research Institute	Dr. Kuo-Chuan Lin	kuolin@serv.tfri.gov.tw http://wagner.zo.ntu.edu.tw/fushan	1100 ha	24° 46'N, 121°43'E	60 km SE of Taipei
National Chung-hsing University/Experimental Forest, National Chung-hsing University	Dr. Bor-Hung Sheu	bhsheu@mail.nchu.edu.tw http://140.120.93.10/lter	220 ha	24°04' N, 121°01'E	80 km E of Taichung
Keng-ting National Park	Dr. Ping-Chun Ho	pchou@mail.ncku.edu.tw http://lter.npust.edu.tw/	5587 ha with core area ca. 430 ha	22°03'N, 120°51'E	80 km S of Kaoshung
National Taiwan University/ Experimental Forest, National Taiwan University	Dr. Biing, T. Guan	btguan@ccms.ntu.edu.tw *http://www.ms.cc.ntu.edu.tw/~exfo/tatachia/index.htm*	6000 ha	23°28' N, 120°52'E	90 km SW of Taichung
Institute of Botany, Academia Sinica /Forest Development Administration, Vocational Assistance Commission for Retired Servicemen	Dr. J.-T. Wu	jtwu@gate.sinica.edu.tw *http://ibas.botany.sinica.edu.tw/tern*	400 ha	23°28' N, 120°52'E	90 km SW of Taipei

An Overview of the Central and Eastern European Regional LTER Network

Edit Kovacs Lang
Chair The Eastern European Regional LTER Coordinating Committee
Institute of Ecology and Botany
Hungarian Academy of Sciences

In this region Long Term Ecological Research is a highly welcomed and supported idea among ecologists for three reasons:

- for existing traditions and results mainly in long term biodiversity studies;
- for the necessity of joint efforts in averting and preventing regional environmental damages; and
- for the recognition of the importance of ecosystem and landscape dynamics which take place on longer time scales and help in connecting the past, present and future states of the systems, making prediction possible.

The countries with established and recognized national LTER networks are the Czech Republic (1996), Hungary (1995), Poland (1998), Ukraine (1999), and Slovakia (2000) while in Romania the development of such a network is in progress.

These countries represent the temperate zone of Europe between 43-55°N latitude and 12-40°E longitude, with highly variable landscape and climate of transitional character. The main constituent geographical landscape units are the Polish Lowland, the East - European Lowland, the Bohemian and Moravian Basins surrounded by mountain massifs, the Carpathian Mountain Range System with the Carpathian Basin, the Romanian Lowland and the Northern Coastal Region of the Black Sea.

The geomorphology of the territory shows considerable variability with changing altitutes from 0 to 2655 m above sea level (Tatry). Most of the major rivers such as the Danube, Dnieper, Tisza, Dniester, Vah, Olt and Mures belong to the Black Sea catchment region, while the Vistula and Odra flow to the Eastern Sea and the Elbe with the Vltava belong to the Northern Sea catchment area.

Central Europe is situated in the cool temperate zone, but the climate is greatly variable and changeable due to the mixing of the atlantic, continental and submediterranean influences. Increasing continentality towards the East can be detected. The zonal biomes are temperate deciduous forests, temperate deciduous/conifer mixed forests, forest-steppe and steppe. In the mountain ranges beech forests, beech-conifer mixed forests, subalpine and alpine vegetation predominate, while the rivers are usually bordered by alluvial gallery forests, swamps and meadows. The main groups of the characteristic soils are the podzols, brown and grey forests soils, chernoziems and the intrazonal hydromorphic and lithomorphic types.

The average population density in this part of Europe varies between 86 (Ukraine) and 122/km^2 (Czech Republic). The share of agricultural lands can reach 70-80% of the territories of the countries.

The main environmental threats are eutrophication and acidification due to air and water pollution; toxicity; land use changes, climate change, and, as a consequence, loss of biodiversity.

Although several parts of the region are heavily damaged or degraded, the countries of Central and Eastern Europe still have rather rich flora and fauna in a wide range of ecosystems. Long-term data collection has traditions; meteorological records in most cases go back to the previous century, similarly many data come from geological, soil, floristic, faunistic and vegetation surveys and mapping. International scientific programs such as IBP and MAB gave a big impetus to site-based integrated research and monitoring mainly on biological productivity, ecosystem functioning and human impacts.

The LTER sites, their main characteristics can be seen in table 1. and map 1.

The research themes:

- in aquatic systems: hydrobiology (plankton, macrophytes, benthos, fish stock, microbial loop), biodiversity, water and sediment quality, nutrient loading from the catchment, functioning and sustainable management of estuarine, wetland, fish pond and reservoir ecosystems, eutrophication and acidification impact and recovery;
- in the terrestrial systems: biodiversity, primary and secondary productivity, nutrient cycling, responses of populations and communities to disturbances (pollution, grazing, climate change, acid rain, land use changes), ecosystem management and restoration; vegetation dynamics (succession, re-establishment); bird migration.

Research activity is organized and done under extremely bad financial conditions by the enthusiastic and optimistic members of scientific institutions: institutes of national academies, universities; ministerial or state institutes and services such as natural history museums, state forestry institutes, services and directorates; national meteorological and hydrological services, and directorates of national parks.

The participation of universities creates possibilities for involvement of students in the research. In most sites undergraduate and graduate students work on their diplomas and PhD theses.

There is a great amount of data accumulated, in most cases not computerized and properly managed, therefore hardly accessible. The region needs training and development in information technology.

LTER scientists and sites of the region participate in regional, European and global scale collaborations as follows:

- EU project on mountain lakes includes Czech, Slovak, Romanian and Polish LTER scientist partners, (and also Bulgarian).
- Evaluation of ozone air pollution and its phytotoxic potential in the Carpathian forests (1997-1999), and
- Effects of forest health on biodiversity with emphasis on air pollution in the Carpathian Mountains (1997-2000) projects with USA, Czech Polish, Slovakian, Romanian and Ukrainian participants.
- US - Hungarian LTER grassland cooperation (1996-1999) focused on biodiversity changes along climatic gradients.
- ILTER participation in the GTOS/NPP Project. LTER sites of Czech Republic, Hungary, Slovakia, Romania and Ukraine contribute to the European component of the project to demonstrate functional links between in situ and earth observation data by upscaling field measure ments in heterogeneous landscapes using satellite imagery.
- LTER scientists from the region organized workshops at the 2000 All Scientists Meeting in the United States (Trophic interactions in aquatic ecosystems; Biodiversity, disturbances and climate variability in arid and semiarid grasslands)

International meetings connected with regional LTER activity:

- 1995 Budapest, Hungary, ILTER Business meeting and workshop in EURECO (European Congress of Ecology)

♦1998 Madralin near Warsaw, Poland, ILTER Regional Workshop "Long Term Ecological Research: Examples, Methods, Perspectives for Central Europe"

♦1999 Budapest, Hungary, ILTER Regional Workshop "Cooperation in Long Term Ecological Research in Central and Eastern Europe"

♦2000 Nitra, Slovakia, ILTER Regional Workshop "Long Term Ecological Research: Current state and Perspectives in Central and Eastern Europe".

The proceedings of the 1998 and 1999 Regional workshops contain results of the first collaborative efforts, and are available on the International LTER Web site (www.ilternet.edu).

LTER Sites in Central and Eastern Europe

POLAND (PL)
1. Bialowieza Primeval Forest
2. Great Masurian Lakes
3. Jorka River Catchment
4. Zegrzynski Dam Reservoir
5. Kampinos National Park
6. Tatra Mountains
7. Bieszczady Mountains

CZECH REPUBLIC (CZ)
8. Krkonoše National Park
9. Vltava River Reservoirs
10. Krivoklatsko Biosphere Reserve
11. Šumava National Park
12. Trebon Basin Protected Landscape Area and Biosphere Reserve
13. Palava Protected Landscape Area and Biosphere Reserve
14. Bile Karpaty Protected Landscape Area and Biosphere Reserve

SLOVAK REPUBLIC (SK)
15. Bab forest
16. Polana Biosphere Reserve
17. Kovacova forest
18. Biely Vah forest

HUNGARY (H)
19. Lake Balaton
20. KISKUN sand forest steppe
21. Sikfokút oak forest

ROMANIA (RO)
(*candidate sites*)
22. Pietrosu Mare mountain system Biosphere Reserve
23. Retezat mountain system Biosphere Reserve
24. Small Island of Braila wetlands
25. Danube Delta Biosphere Reserve

UKRAINE (UA)
26. Beskidy Mountain System
27. Chornohora Mountain System

Long Term Ecological Research in the Czech Republic

Eva Jelinkova[1], Viera Straskrabova[2]
[1]National MAB Committee CR, 2Hydrobiological Institute CAS

Network History

Ecological research as well as nature protection have a long-standing tradition in the CR. Long-term data on biotic and abiotic parameters were gathered both by research institutions and universities dealing with specific topics, and by governmental and regional organizations during their routine monitoring. However, most of these data were neither freely available nor computerized. These data were in scattered locations and, especially the information from routine monitoring, had not been fully utilized in ecosystems evaluation.

Scientists from the US LTER program (led by Dr. James R. Gosz) together with the Czech National Committee for Man and the Biosphere Program (MAB) (led by Prof. J. Jenik) promoted the establishment of a Czech LTER, organizing a network based on existing sites with a long-standing history of research, and with institutions capable of continuing the investigations. The CZ-LTER Committee and network of sites was established by the Czech National MAB Committee in 1996. It consists of 7 sites (6 of them are UNESCO Biosphere Reserves (BR)).

Network Management

The Czech network is managed by the CZ-LTER Committee and the Czech National MAB Committee. Chair of the CZ-LTER: Viera Straskrabova, Hydrobiological Institute, Czech Academy of Sciences (CAS), Na sadkach 7, CZ 37005 Ceske Budejovice, Tel +420 38 7775819, fax +420 38 5300248, <verastr@hbu.cas.cz>. Secretary: Eva Jelinkova, CZ-MAB Secretariat, CAS, Narodni 3, 117 20 Prague 1, Tel +420 2 21403420, fax +420 2 24240531, <mab@kav.cas.cz>. There are no financial sponsors of the CZ-LTER network. Some monitoring activities in UNESCO Biosphere Reserves (6 sites) are supported by the Ministry of Environment of CR, other activities are financed from various projects (1 - 3 years duration), which are awarded by the Grant Agency of CR, Grant Agency of CAS, and others (Ministry of Environment CR, Ministry of Education CR).

Partnerships

Institutions responsible at particular sites are Hydrobiological Institute CAS (1 site), National Park Administrations (2 sites) and the Administration of Protected Landscape Areas (4 sites). Those institutions themselves are partly involved in the research at the respective sites and, besides, they cooperate in various research projects with the Institutes of CAS, mainly Institute of Botany, Institute of Entomology, Institute of Landscape Ecology and Institute of Soil Biology, and also with the universities, primarily with the faculties of sciences of Charles University, Prague, the University of South Bohemia, Ceske Budejovice, the Masaryk University, Brno, and the Mendel Agricultural University, Brno, and with other institutions such as Czech Geological Survey, Czech Agency of Nature Conservation.

Special activities

All CZ-LTER sites are important as teaching grounds for university students in ecological disciplines. Many scientists engaged in LTER are university professors, and students participate in inventories, monitoring, surveys and in solving specific research problems (often also supported by short-term grants of Ministry of Education CR) elaborating their BC, MS and PhD theses.

In all the Biosphere Reserves, dissemination of ecological knowledge and education of the public in environmental issues connected with nature protection and long-term changes of ecosystems is one of the obligatory activities.

Water in the Sumava National Park and Biosphere Reserve, Czech Republic (Photo S. Kucera)

Site-level information on research, cross-site and international collaboration and infrastructure

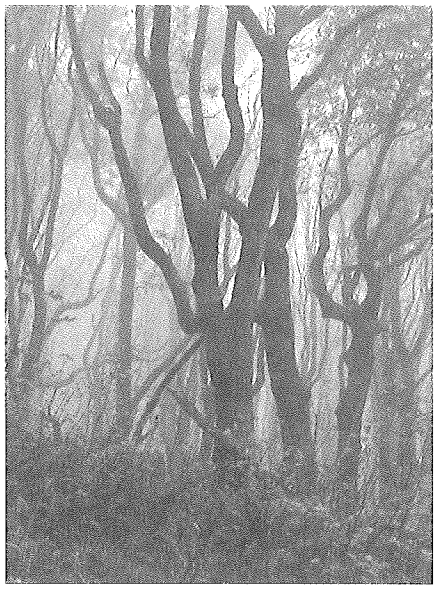
The CZ-LTER sites include: 1) Reservoir series in the upper and middle Vltava River watershed, 2) National Parks (NP) and UNESCO / MAB Biosphere Reserves (BRs) Krkonose and Sumava, 3) Protected Landscape Areas (PLAs) and BRs Krivoklatsko, Trebonsko, Palava and Bile Karpaty.

The geographic location of the Czech Republic (CR) between the Hercynian Platform, Alpine Carpathian System and Fenno-Sarmathian Platform has produced a high diversity of ecosystems, both their abiotic (geology, microclimate) and biotic components. Moravia in the eastern part of the country is an important divide between the Bohemian Massif to the west and Western Carpathians to the east. Moravia opens southwards to the Panonian lowlands thus providing an important migration route. The intensification of industrial and agricultural activities in densely populated middle Europe has resulted in rapid ecosystem changes due to eutrophication and acidification. Since the 1990s, both industry and agriculture have been reduced because of political and subsequent economic changes. Reduced emissions of S and N oxides and decreased fertilizer doses, together with relatively large areas of abandoned agricultural land

(meadows and fields) are recent factors causing ecosystem changes.

The present effort at CZ-LTER sites focuses on: 1) inventorying, computerizing and evaluating existing data at individual sites, 2) monitoring existing experimental plots, 3) identifying research problems specific to each site and 4) mutual cooperation. It is recognized that public relations efforts are important to demonstrate the usefulness of LTER to policy and decision-makers in the CR and to ensure continued funding. A joint project - "Evaluation and prognosis of ecosystem changes based on analysis of long-term data series" - for all the sites for a period of three years (1998 - 2000) was funded by the Grant Agency of CR (reg. No. 206/1998/0727) and is on- going . In meeting the goals of the project, available long-term data series have been used to: a) assess the extent and causes of deterioration of the ecosystem functions, b) identify any impacting of recent environmental changes connected with the political and economic transition in Central Europe and (c) establish a prognosis of the future development of these ecosystems. Methods include: assessment of the present status, elaboration of historical and contemporary data and their incorporation into the electronic network. Biomes evaluated across the sites are as follows: aquatic ecosystems (reservoirs, lakes, streams, brooks), at three sites —REV, KRI, SUM; wetlands (ponds, mires, peat bogs), at four sites—KRK, SUM, TRE, PAL; grasslands (mountain and alluvial meadows, steppes), at five sites—KRK, KRI, SUM, PAL, BIK); and forests (mountain, flood plain, dry), at five sites—KRK, SUM, KRI, PAL, BIK. Main human impacts to be considered include nutrient loading (fertilization, emissions, eutrophication), S and N oxide emissions (trans-boundary pollution and acidification), land-use and management changes, resultant micro- and meso-climate changes, and biodiversity changes.

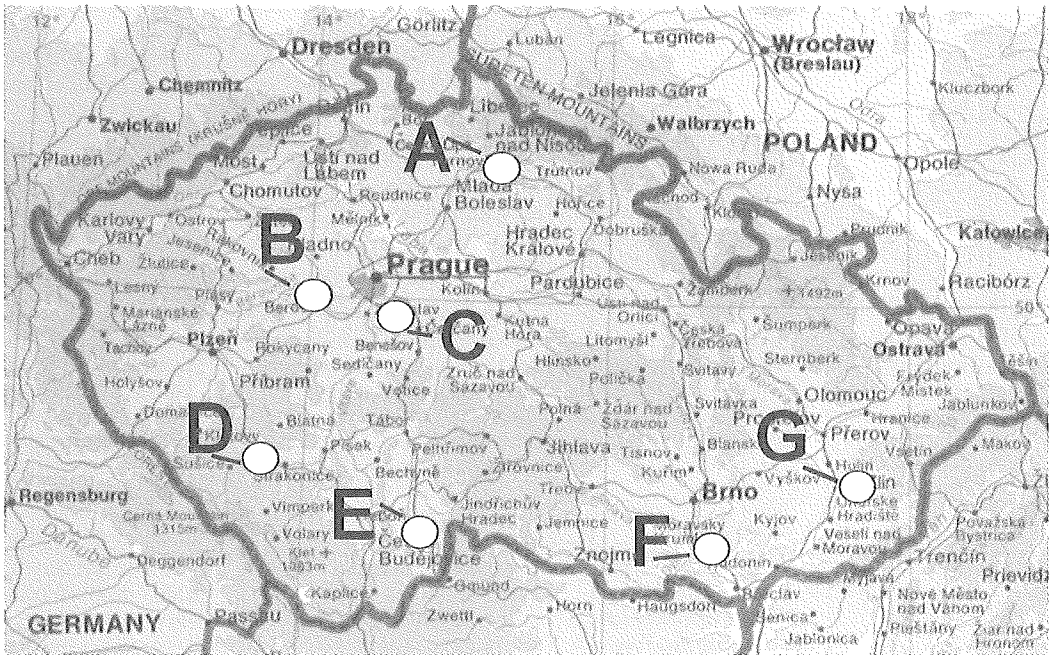
Each site has international connections and non-formalized collaboration. Collaboration on environmental problems common for middle and Eastern European postcommunist countries is coordinated with the LTER networks and individual institutions of Slovakia, Poland, Hungary and Romania in the CEE-LTER regional group. In the 5th framework of European Commission Research and Development Program, Czech, Slovak, Polish, Slovenian, Romanian and Bulgarian researchers cooperate in a project on long term changes in oligotrophic and acidified mountain lakes (EMERGE No. EVK1-CT-1999-00032). Two other proposals were prepared and submitted to the EC 5th framework RTD Program: one on terrestrial NPP with the participation of Hungarian and Czech LTER sites, and one on reservoirs with the participation of Czech, Polish and Romanian sites.



The Javorinskz Primeval Forest in the Bile Karpatz PLA and BR, Czech Republic (Photo B. Prokupek)

The BR sites of the CZ-LTER are connected with the Worldwide Network of Biosphere Reserves. The CZ-LTER network also joined No_limits network and GTOS network.

All sites are connected to the Internet and have World Wide Web sites. Series of various long-term data (several decades) are available at all the sites. Each site elaborates its databases separately. The state of databases varies, depending on the topics and history of the particular research, and has been improving. Each institution responsible for a particular site has laboratory facilities for their basic monitoring and has one or more field facilities (stations) and a limited capacity of lodging.



Long Term Ecological Research Sites in the CZ-LTER Network

A Krkonoše

B Krivoklatsko

C Reservoirs in the Vltava River Watershed

D Šumava

E Trebon Basin

F Pálava

G Bílé Karpaty

Czech: Table of LTER Site Information

Site Name	Date	Principal Biomes	Research themes	Types and lengths of data sets
Krkonoše National Park (NP) and Biosphere Reserve (BR) (part of the bilateral Czech-Polish BR) /Giant Mountains, NE Bohemia, KRK	1960	Complex mountain system; arctic-alpine tundra, subarctic mires, alpine meadows, glacial corries (cirques), mountain spruce forests, mixed beech-spruce forests, peatbogs, spruce plantations, flower-rich secondary mountain meadows.	Anemo-orographic systems; response of biota to air pollution; tundra habitats; snow and avalanche activity; palynology; ecological classification of plant and animal communities; restoration and management of forests and montane meadows.	First scientific expedition 1786; intensive inventories, monitoring, research since 1960s; Ramsar Site - subarctic mires, CORINE Biotope - arctic-alpine tundra; GEF Biodiversity Project 1994-97. Permanent plots: vascular plants since 1967, nonvascular plants since 1981; invertebrates since 1982, vertebrates since 1983, hydrology since 1904, soil, geology, climate since 1932. Geographic Information System (ARC/INFO - more than 300 layers).
Reservoirs in Vltava River watershed, central and S Bohemia, REV	1958	Upper and middle reaches of river, main-stem reservoirs, mostly canyon-shaped and elongated, with steep banks, with longitudinal heterogeneity: Lacustrine part and transition zone between river and reservoir.	Eutrophication and nutrient loading; internal loading by phosphorus from sediments; biotic interactions in pelagic assemblages; bio-manipulation/control of fish-stock; seasonal and inter-annual dynamics of plankton; effect of flushing rate variations on limnology and water quality.	Large reservoirs in cascade (Slapy, Lipno and Orlik) dammed in 1954, 1959 and 1960; smaller drinking water reservoir Rimov in 1979. Regular monitoring: Slapy Reservoir since 1958 (field station since 1960), Rimov Reservoir since 1979 (field station since 1997); chemistry, bacteria, phytoplankton, fish, zooplankton, temperature, oxygen, pH; precipitation chemistry.
Krivoklátsko (PLA and BR), central Bohemia, KRI	1974, BR since 1977, PLA since 1978.	Temperate broad-leaf forest/ highly diversified pattern of forest communities; broad-leaf and mixed coniferous forests, riparian stands, rock formations, top balds, meadows, agricultural land, spruce monocultures.	Synecological monitoring; climax forest ecosystems; impact of grazing; flora mapping; limnology of reservoir and small streams; conservation of biodiversity; anthropogenic impact on ecosystem change.	Long-term records on forestry and game; zoological and botanical inventories since the beginning of the 20th century (mosses, *Lepidoptera*); microclimate and fauna of stone debris since 1993; permanent monitoring plots for meteorological variables since 1974; soil, flora and fauna since 1993; hydrology, hydrobiology and chemistry since 1990, air quality; Important Bird Area since 1993; geological map; map of potential natural vegetation.
Trebon Basin (PLA and BR), southern Bohemia, TRE	1945, BR since 1977, PLA since 1979.	Temperate broad-leaf forests, fir-oak and pine woods, wetlands/ fishpond littoral zones, peat bogs, marshes, floodplain forests, old man-made fishponds, sandbanks, sand dunes.	Climatology and wetland ecology; hydrobiology (fishponds, rivers); nutrient cycling; emission damages, ecosystem conservation; ornithology; effect of fish-farming on waterfowl opulation fluctuations.	2 Ramsar Sites (1990, 1993); BirdLife International Area; temperatures since 1876, hydrology since 1945, bird census since 1960, microclimatology, water chemistry, fishponds over 20 years, soil mapping, geological maps; mammals, insects; forestry plots since 1938; air emission.
Sumava (BR, PLA and NP)/ Bohemian Forest, southern Bohemia, SUM	Boubinsky prales as nature reserve since 1858, PLA since 1963, BR since 1990, NP since 1991.	Complex mountain systems/ beech forests, mixed mountain forests, mountain spruce taiga forests, grasslands, wetlands, peatlands, glacial cirques and lakes	Transboundary flora of the Bohemian Forest; acidified lakes hydrobiology and hydrochemistry, stratigraphy of sediments; bioindication of mire disturbance; forest decline and re-establishment; gene conservation of endangered populations of forest tree species; reintroduction of vertebrates (lynx, Ural owl and capercaillie).	The primeval mountain mixed forest of Boubinsky prales (primeval forest) established as a Nature Reserve in 1858; GEF Biodiversity Project 1994-96; scientific studies since 1920s, intensified research since 1990; monitoring plots of vascular plants, vertebrate and invertebrate fauna, hydrology, climate; GIS and specialized databases.
Pálava (BR and PLA)/ southern Moravia, PAL	1950, PLA since 1978, BR since 1986.	Temperate broad-leaf forests, Pannonian vegetation harbouring species of sub-Mediterranean and Pontic-south Siberian origin/ forest, steppe-forest, steppe-rock communities, flood-plain forests, inundated meadows, halophilous vegetation, agricultural land, viticulture	Terrestrial invertebrates; floodplain forest ecology and management; ecological optimization of landscape management; biological control of pests in vineyards; halophilous plant ecosystems.	Ramsar site; GEF Biodiversity Project 1994-96; extensive prodromus on terrestrial invertebrates; databases on monitoring vegetation since 1985, vertebrate (since 1950) and invertebrate fauna, hydrology, soil and climate.
Bile Karpaty (BR and PLA)/ eastern Moravia, BIK	1978, PLA since 1980, BR since 1996.	Temperate broad-leaf forest/ oak and beechwoods, orchid meadows with solitary oaks, springs, brooks, orchards, arable land, vineyards	Grassland ecosystems dynamics; impact of grazing; conservation of biological diversity; restoration of species-rich meadows; invertebrate inventories; identification of local fruit-tree varieties.	Meteorological data; grassland vegetation monitored since 1989 - biomass and primary production, phytocoenological data; permanent plots in a virgin forest, changes in the tree layer and undergrowth monitored since 1978, data on local fruit-tree varieties.

Affiliation/ownership	Site manager	Address	Area extent in hectares	Location	Travel distance and direction to Prague
Krkonoše National Park Administration	Jiri Flousek	Krkonose National Park Administration , Vrchlabi, CZ 54311 Tel +420-438-456111 Fax +420-438-422095 Email posta@kmap.cas.cz http://www.kmap.cz	54800 ha	50°40'N, 15°38'E , elevation 480-1602m	100 km south-west
Hydrobiological Institute, Czech Academy of Sciences	Viera Straskrabová	Hydrobiological Institute CAS, Na sadkach 7 Ceske Budejovice, CZ 37005 tel. +420 38 7775819 fax +420 38 5300248, verastr@hbu.cas.cz, http://www.hbu.cz	150 km of river impounded	49°30'N, 14°30'E , elevation 270-500m	40 - 160 km north
Krivoklátsko Protected Landscape Area Administration	Petr Hula	Krivoklatsko PLA Administration Zbecno 5, CZ 27024 tel +420 313 554834 fax +420 313 554810, chko-kri@orfinet.cz krivoklatsko@chko.cz http://www.krivoklatsko.chko.cz	62792 ha	50°00'N, 13°52'E , elevation 223-616m.	30 km east
Trebon Basin Protected Landscape Area Administration	Miroslav Hátle	Trebon Basin PLA Administration, Valy 121 Trebon, CZ 379 01 Tel +420 333 721248 fax +420 333 721400, chkot@envi.cz http://www.butbn.cas.cz/lter http://chkot.envi..cz	70000 ha	49°00'N, 14°50'E , elevation 407-613m	160 km north
Sumava National Park Administration	Jiri Manek	Sumava NP Administration maje 260 Vimperk, CZ 38501 Tel +420 339 450 111 fax +420 339413 019 manekj@npsumava http://www.npsumava.cz	167000 ha	49°01'N, longitude13°45'E , elevation 470-1378 m	175 km north
Pálava Protected Landscape Area Administration	Josef Chytil	Palava PLA Administration Namesti 32 Mikulov, CZ 69201 Tel/fax +420 625 511130 jchytil@palava.cz http://www.ihost.cz/chko	8330 ha	48°50'N, longitude16°40'E , elevation 163-550 m	220 km north-west
Bile Karpaty Protected Landscape Area Administration	Jan W. Jongepier	Bile Karpaty PLA Administration Bartolomejske n. 47 Veseli n. Moravou, CZ 69801, Tel/fax +420 631 3225 csop@es-servis.cz http://www.lter.cz	71500 ha	49°00'N, longitude17°52'E , elevation 180-970 m.	320 km north-west.

Long Term Ecological Research in Hungary

Edit Kovács-Láng[1], Sándor Herodek[2] and János A. Tóth[3]
[1]Institute of Ecology and Botany of HAS
[2]Balaton Limnological Research Institute of HAS
[3]Ecology Department of KLTE University

Long-term ecological research motivated either by environmental problems or by scientific purposes has traditions in Hungary. Eutrophication of Lake Balaton, the maintenance of proper water quality of the River Danube, the need for insect pest prediction in agriculture and forestry have initiated mainly long-term biodiversity studies. The international scientific programmes such as IBP and MAB stimulated the productivity and ecosystem studies since the 1970s.

The demand for developing a nation-wide network to integrate the results of formerly separated long-term studies arose in the 1990s. The major impetus came from the cooperation with US LTER scientists after participating the US All Scientists Meeting in 1993 and later in the context of the project supported by NSF and HAS (Hungarian Academy of Sciences), "Development of Hungarian-American collaborative research efforts: Biodiversity and Long-Term Ecosystem Research" (1994). In 1995 Hungary officially joined the ILTER Network, which held its business meeting in Budapest that year.

In Hungary there are three research sites which are representative for the zonal biomes of the country, and that have significant scientific background from previous research activity. The scientists at these sites want to fulfil the requirements of the standards for Long Term Ecological Research sites, and to take part in regional and global networking activites. The three sites are: Lake Balaton LTER; the Síkfokut oak forest LTER site; and the Kiskunság forest-steppe LTER site. The scientific programs at these site are focused on learning the lorg-term dynamics of the space and time patterns of the vegetation, following the effects of global change on structure and dynamics of ecosystems, and discovering the regulatory mechanisms and the role of biodiversity in ecosystem functions.

Lake Balaton LTER site

Lake Balaton was formed mainly by tectonic forces about 10,000 years ago. Prior to the opening of Sió-canal in 1863, its water level was 3 m higher and its surface was about one and half times larger than that of the present. With its surface area of 593 km2, Lake Balaton is the largest lake in Central Europe, but its mean depth is only 3.2 m.

The main inflow, the Zala River, empties into the southwestern end of the lake, while the Sió-canal drains the water from the eastern basin into the River Danube.

The lake is covered by ice in winter. In summer the average water temperature is 23° C. The strong waves swirl up much sediments, rendering the transparency low.

The major ions of the water are $Ca^{2}+$, $Mg^{2}+$ and $HCO^{3}-$. The pH is 8.4, rising to higher values during intensive primary production. Oxygen deficiency is formed only temporarily in the western part of the lake in calm summer periods with algal blooms.

The distribution of macrophytes is restricted by strong waves to a relatively narrow belt. Only 3 percent of the lake surface is covered by reeds, and even less by submerged macrophytes. The major primary producers are phytoplankton. Zooplankton is not abundant. Zoobenthos represents an important food for the fish. The annual commercial fish

Hungary: Table of Site Information

Site Name/Location	Date	Principal biome Main communities	Research themes	Types and length of datasets
Lake Balaton LTER site	Established as research site in 1927	Temperate shallow lake	Phyto- and zooplankton dynamics, aquatic invertebrates pollution and eutrophication processes, fishstock dynamics, biological effects of heavy metals and organic pollutants	meteorological and hydrological data since 1900, water chemistry at 12 stations since 1975, phytoplankton and zooplankton since 1965 for the whole lake, fish yields since 1905, benthic and littoral invertebrates since 1975, macrophytes since 1975
Kiskun LTER site, Orgovány	1994	Sand forest steppe, sand grasslands, oak woodland, Juniper-poplar woodland, agricultural land	Landscape and land use history, biodiversity, spatial pattern of vegetation, plant-animal interactions, plant biomass and productivity, ecophysiology, secondary succession, effects of disturbances, restoration experiments, insect population dynamics, agroecosystems.	meteorological and groundwater data since 1950 historical vegetation maps from 1783-84, (1:100 000); 1883-84, (1:25000); 1980-90 years, (1:25 000) FLORA Database for the vascular flora of 2400 taxa, 1995; CoenoDAT Database of phytosociological data, 230 000 records, 1996 phytomass production of grasslands since 1969, (not continuous) ecophysiological characteristics of sand grassland species since 1985; data on insect dynamics from light traps since 1962; data on insect dynamics in apple orchards since 1985; data on plant-herbivore interactions since 1991
Sikfkút LTER site	1972	Temperate deciduous oak forest, dominated by Quercus petraea and Quercus cerris	Phyto- and zoostructure, primary production, dendrochronology, soil bacteria and fungi, litter decomposition, nutrient cycling, effects of tropospheric ozone, UV-B, drought, causes of the sessile oak decline, change of forest climate.	Continuous data since 1972 for tree, shrub and herb layer dynamics, meteorological observations (air temperature, precipitation, etc.) Non-continuous data for primary production, heterotrophic organisms, zoostructure, zoomass, secondary production, litter production and decomposition, number of soil bacteria and fungi.

catch is 1200 tons.

The southern shore of the lake consists of sandy beach, while on the northern shore there are mountains of volcanic origin with old ruins on their tops and vineyards on their slopes. The picturesque landscape and the water ideal for swimming and other water sports attract 2 million tourists annually.

The sewage discharge from rapidly developing towns in the watershed, the growing use of fertilizers in agriculture and large animal farms increased the nutrient loading to the lake in the last few decades. A rapid eutrophication became apparent by increased production and biomass of phytoplankton. Blooms of blue-green algae are frequent in the most polluted western part of the lake.

A eutrophication control program has been formulated, based on intensive scientific research. Most of the municipal sewage is now diverted from recreational areas. Phosphorus removal was introduced at other sewage treatment plants. A reservoir was constructed to retain the nutrients carried by the Zala River. Pollution due to liquid manure was reduced. A soil protection program is in progress.

Research history: The first large scale research program (1891-1918) resulted in a series of monographs on the geology, geography, meteorology, hydrology, zoology and botany of Lake Balaton and its surroundings. In 1927 the Balaton Limnological Research Institute of the Hungarian Academy of Sciences was established on the shore of the Lake. The present staff consists of 28 scientists.

The main fields of research are: eutrophication processes of Lake Balaton; feeding, population dynamics and production of aquatic invertebrates; biological role and dynamics of fish populations; monitoring lake pollution; and mechanisms of the biological effects of heavy metals and organic pollutants.

Research facilities: research vessel, motor boats, collecting devices, aquaria, chemical laboratory, isotope laboratory, mass spectrometer laboratory, morphological laboratory with electron microscope, algological laboratory with culturing devices, zoological laboratory with physiological equipments, ichthyological laboratory, library.

The Institute has wide international links established with institutions of Germany, Japan, USA etc.

Open and dry steppe-forest with hairy oak trees

Síkfőkút LTER Site

The "Síkfőkút Project" was established in 1972. It is a model area for the climazonal typical forest community of sessile oak and turkey oak. Now 64 hectares of the area is under protection and is part of the Bükk National Park.

The long-term research here can be divided into three main phases: In the first period (1972-1979) the research connected to the IBP and MAB international programs and focused on the structure, production and function of the ecosystem. The results were summarized in the book "Ecology of an oak forest in Hungary. Results of Síkfőkút Project" edited by Pál Jakucs (Akadémiai Kiadó, Budapest, 1985).

In the second phase of the research (1979-90) a new type of forest decay received great attention. Beginning in 1979-80, a large-scale decline of *Quercus petraea* appeared, which had serious consequences for the structure of the shrub and herb layer as well. Research involved studies on the potential causes of the sessile oak decline.

The third phase of research involves both the continuous monitoring of the background environmental factors, as well as intensive studies on

Affiliation/Ownership	Site Manager or key scientific contact	Official postal and e-mail address	Area extend	Latitude, longitude, elevation,	Travel distance to nearest town
Hungarian State, the Balaton Limnological Research Institute belongs to the Hungarian Academy of Sciences.	Sándor Herodek, director	Balaton Limnological Research Institute of the Hungarian Academy of Sciences, H-8237 Tihany, PO.Box 35. e-mail: intezet@tres.blki.hu Web URL: http://www.botanika.hu/LTER/BALATON http://www.blki.hu	Areal extent of the lake: 593 km^2	46°42'-47°04'N latitude, 17°15'-18°10' E longitude, 104.8 m above sea level.	140 km from Budapest to the SW.
Kiskunság National Park, managed by Institute of Ecology and Botany, HAS	Edit Kovács-Láng	Institute of Ecology and Botany of the Hungarian Academy of Sciences H-2163 Vácrátót, e-mail: lange @ botanika.hu http://www.botanika.hu/LTER/KISKUN	3700 ha	46°48' N, 19°28' E, 120 m above sea level	110 km from Budapest to the SE, 22 km from Kecskemét to the SW.
Bükk National Park	Program director: Dr. Pál JAKUCS Program manager: Dr. János Attila TÓTH	Ecological Institute, University of Debrecen H-4010 Debrecen Pf. 71. E/mail: tja@tigris.kltehu URL for Website: http://micro2.ecol.klte.hu http://www.botanika.hu/LTER/SIKFOKUT	64 ha	47°90' N, 20° 46'E, 320-340 m above sea level	6 km from Eger city to the E

the ecological state and function of the declining forest. The main emphasis is on the dynamics and structure of understory, the ecophysiology of declining oak trees, the ecophysiological behavior of dominant plant species in canopy gaps and ecotone, the dominance pattern and role of phytophagous insects, litter decomposition, and the role of soil microbial communities. There are efforts to collect information on the changes in floristic and faunistic diversity as well.

Research topics are: long-term monitoring of environmental variables; description of the changes in forest structure, tree-, shrub- and herb-layer dynamics; determination of the biomass and production of trophic levels; analysis of the efficiency of energy flow through the food chains; study of element circulation among the compartments of the ecosystem; revealing the animal and plant interactions; determination the causes of recent oak decline; study of the effect of climatic change on the forest decline; structure and role of forest ecotone; mechanism of water transport in trees.

International research co-operation is continues with: Nancy I. University, Nancy, France; INRA, National Institute for Research in Agronomy (France); Institute of Environmental Analysis and Remote Sensing for Agriculture, Florence, Italy; Radiological Centrum of Philipps University, Marburg, Germany.

Involvement of students at site

The research topics carried out at the site are related the ecologist graduate training program at the Debrecen University; it is also a permanent site for the Terrestrial Ecology Ph.D program.

Mycorrhiza sampling at KISKUN Site in open sandy grassland

KISKUN LTER Site, Orgovány

Floristic and faunistic surveys in the Kiskunság Region were begun in the last century and resulted in publication of the Fauna (1986) and Flora (1993) of Kiskunság.

Phytosociological studies conducted since the 1950s served the characterization and classification of the vegetation types. Turnover of organic matter and mineral elements have come into foreground since the late 1960s, motivated by IBP the studies on primary and secondary productivity.

The need for research on fine scale pattern detection, population interactions, ecophysiology of plant species, herbivores activity, population dynamics of insects, resulted in the establishment of two small research houses by the Budapest and Szeged Universities in collaboration with the Kiskunság National Park.

Long Term Ecological Research Sites in Hungary

A. Lake Balaton

B. Sikfokut Forest

C. Kiskunsag Forest—Steppe

The organization of the KISKUN LTER Programme started in 1994 with the aim to canalize and coordinate the numerous independent studies carried out in Kiskunság. A major driving force in selection was the sensitivity or the transitional biome type to climate change. Recently the KISKUN LTER Programme is supported by 26 different research grants. In 1997 Kiskunság National Park provided the program with a study area of 3700 ha that well represents the heterogeneous landscape of the region. In cooperation with the national park and the institutes concerned, the security of the long-term studies hopefully will be ensured. The establishment of the site infrastructure is under development according to the requirements of the LTER standard installations.

Research topics: monitoring of climatic variables; analysis of the hierarchical mosaic structure of the semi-natural landscape at different scales; landscape and landuse history; analysis of biodiversity; pattern of and control on primary production; effects of and interaction among climate change, land use change, and the decrease of the water table; mechanisms of competition, patterns and effects of disturbances (fire, herbivory, invasion), the role of population interactions in structuring ecological communities; comparative analysis of host-parasitoid systems in orchard types under various pest management; long-term fluctuation patterns of various insect groups based on ligh trap collections; and restoration studies and experiments.

International research cooperation at the KISKUN site is rather intensive. In GTOS/NPP project Czech Republic, Slovakia, Romania, Ukraine, UK and the US are the ILTER partners. The Kiskunság National Park organizes the cooperation with Austria and Serbia.

In the Hungarian LTER network information management is most centralized at Lake Balaton LTER site and is still not centralized at the KISKUN and SIKFOKÚT sites.

Cross-site research: inside the country there are established links between SIKFOKÚT LTER site and the REJTEK Forest Research Project.

The KISKUN LTER site carries out cross-site grassland studies in the United States with the Sevilleta and Jornada LTER sites;

Application of LTER research: the results and data coming from LTER research have wide applicability in national park management; for Nature Conservation Authorities in prognoses for biodiversity changes; pest control in forestry and agriculture; in assessing the status of environment in Europe by the European Environment Agency; in education of graduate and postgraduate students at universities; and in averting the consequences of ecological catastrophes.

Partnerships: LTER in Hungary is supported by universities, the Hungarian Academy of Sciences, the Hungarian Nature Conservation Authorities, and different national parks

Collaboration among networks: There are close contacts with the US LTER Network, the UK ECN Network, and rapidly developing collaboration with the networks of Czech Republic, Slovakia, Romania and Poland.

Long Term Ecological Research in Poland

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Poland has been invited to join ILTER in 1996. After recognizing the tasks and rules of this organization it has been accepted as member on the basis of a bilateral decision of the ILTER Chairperson and the President of Polish Academy of Sciences in 1998.

Both the Division of Biological Sciences, PAS and the Committee of Ecology PAS have appointed Prof. Tadeusz Prus as National Representative to ILTER and Doc. Kajetan Perzanowski co-chair. It obliged the International Centre of Ecology PAS to develop the national network of LTER in Poland.

In 1998 the first Regional ILTER Workshop for Central Europe was organized in Poland (Mądralin, 16-18 September) to outline the research achievements and discuss the condition of cross-site and international cooperation. The workshop resulted in selection of major topics for the region:

I. Carpathians as integrating factor for transboundary cooperation;
II. Effects of air pollution and other factors on the condition of forests in the Carpathians;
III. Processes linking an aquatic ecosystem with its watershed;
IV. Lowland forest under an anthropogenic stress. The two first topics are performed in cooperation with Slovakian, Ukrainian and Romanian scientists.

There is no separate sponsorship of the network. All costs are covered by the budget of International Centre of Ecology, PAS. *Partnerships:* National Parks, Universities, and institutions of Polish Academy of Sciences.

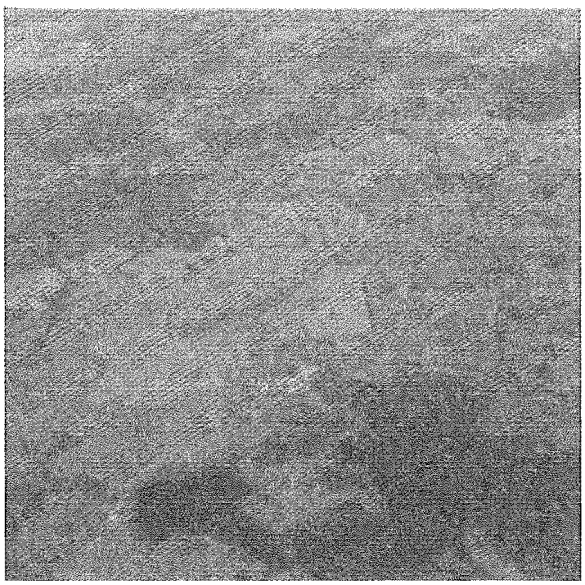
Masurian Lakeland

A. River Jorka catchment (Anna Hillbricht-Ilkowska)

The catchment of river Jorka (65 km^2) is the typical fragment of postglacial Quartenary landscape. Two types of relief can be distinguished: a hilly-morainic covering about 60% of the catchment area and outwash-plain (40%). Terminal moraine hills, kames and eskers attain considerable absolute heights (160-206 m. a.s.l.) and a slope gradient 5--20. About 28% of the area comprises hollows without surface runoff (land depression, potholes) of various size (3-4 ha). These land forms and accompanying wetland patches are very characteristic of the area. Geological substrate as well as the soil conditions are highly spatially mosaic, causing a complicated pattern of water infiltration, erosion and water movement in the area. Discharge rates measured in the different part of river Jorka system ranged between 0.1-- 1.5 m^3 s^{-1}, the highest being in spring. Meteorological conditions are those typical for continental type of weather: mean annual air temperature -6.8 to 23Ç, yearly average precipitation 560 mm.

Land use and land cover (Fig. 1) is typical for the region. Forests cover about 30%, arable land about 46%, pastures and wetlands about 12%, lakes – 8%, urban areas – 4%. The area is not overpopulated and not strongly affected by the tourist impact. Main plant communities include: deciduous forest (*Tillio-Carpinetum*) in the southern part (see photo), numerous forest islands of spruce wood on peat (*Sphagno-Piceetum*) in the arable land, wet alder wood (*Carici elongatae-Alnetum*) in land depressions as well as along the lake shores, and pine afforestations on most elevated places. Land depressions numerous among the fields are covered with reeds, sedge moors, bogmoss swamp, birch, alder or willow shrubberies. The river flows through five lakes (Fig. 1) of different sizes, depth, trophic status and vegetation cover.

The following parameters were investigated in late 1970s and from 1993 through the present: landscape structure (e.g. density and size of the patches of different barrier capacity) based on air photos, water movements and fluxes to lakes, nutrient (P, N) and other elements (Cl, Ca) exports from a dozen controlled subwatersheds drained by small effluents to lakes. Nutrient retention and export from subsequent lakes were measured and monitored, the rate of eutrophication was assessed together with the correlation between trophic parameters. Since late 1970s the diversity, dynamics and succession of vegetation in wetland patches and wetland zones close to lake and river shores were studied . Analysis of nutrient removal and transformation in wetland zones while passing with subsurface waters was done. In late 1970s and late 1990s the composition and dynamics of selected biota (phytoplankton, zooplankton, molluscs, benthos) was studied. About 30 research papers were published on long-term changes in catchment and lakes.



Aerial view of river Jorka catchment basin Photo by Jerzy Miotdun

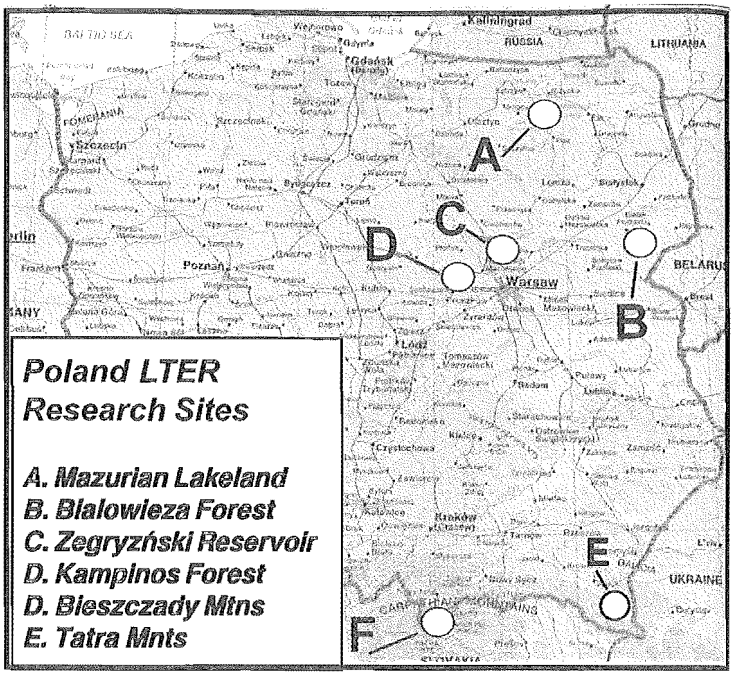
B. Great Masurian Lakes (Jolanta Ejsmont-Karabin, Lech Kufel)

The Great Masurian Lakes are a complex of interconnected lakes (25 in the main stream and several dozen in the direct watershed) of postglacial origin situated in north-eastern Poland. The lakes differ in morphology, mixing regime, flushing rates, external nutrient loading and the trophic status. There is no

heavy industry in the region, but the complex is affected by intensive tourism, recreation and by agriculture. Lakes are also exploited by commercial fishery. That is why eutrophication is the main topic addressed in numerous research performed in the lake system.

The Great Masurian Lakes have been the object of limnological studies for many years. Based on data from this region more than 600 scientific papers covering various aspects of lake functioning (hydrology, hydrobiology, ornithology, fishery etc.) were published through the 1990s. Since 1985 the team of Hydrobiological Station of the Institute of Ecology, PAS has executed the program called *Ecological Monitoring of the Great Masurian Lakes*. The program is generally intended to follow the long-term changes in lakes trophic status and covers such aspects as: water chemistry (nutrients), phytoplankton, zooplankton and littoral higher vegetation. Other studies dealing with land impact on lakes, nutrient turnover, succession in small water bodies, biological diversity in freshwaters etc. are also carried out.

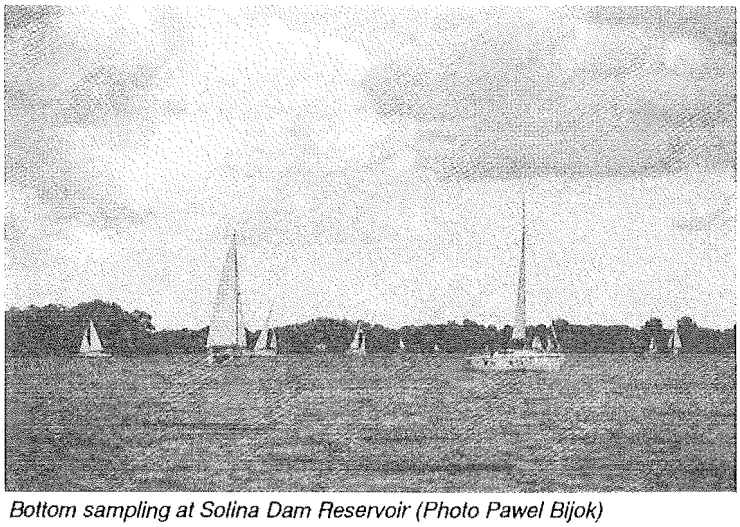
Hydrobiological Station, Institute of Ecology PAS (established in 1951) is the largest and the oldest scientific station in the region. The Station runs training courses for students and environmental service staff of local and state administration, as well as seminars and conferences. Except laboratories, library, road and water transportation, technical services, the Station provides convenient lodging facilities, lecture halls etc., which enable to host up to 40 visitors at a time.



Primeval Deciduous Forest (Białowieża)

A: Plant communities (Janusz B. Faliński)

Białowieża Primeval Forest today covers some 1300 km^2 on the Poland-Belarus border. It represents types of forest appropriate to the boreo-nemoral zone growing on formations from the time of the Riss glaciation. The short vegetation period (mean 185 days according to synphenological criteria) together with the long duration of snow cover (mean 92 days a year) favors the occurrence of boreal elements in the plant cover and fauna. However, a high degree of annual climatic variability allows the co-occurrence of elements of more varied biogeographical character resulting in transitory biogeographical nature of the forest. It is manifested in the dominance of geophyte-rich, essentially central European, multi-species deciduous forests (*Tilio-Carpinetum* of the *Carpinion betuli* alliance), along with some mixed and coniferous forests (of the *Dicrano-Pinion* and *Vaccinio-Piceion* alliances). The unique regional characteristics of the Białowieża forests are emphasized by the co-occurrence in the landscape of thermophilous oak forests (*Potentillo albae-Quercetum* of the order *Quercetalia pubescentis*) and spruce bog forests (*Sphagno girgensohnii-Piceetum* of the *Vaccinio-Piceion* alliance). The universal presence of spruce in almost all forest communities, the ease with which it dominates in favorable circumstances in all habitats and the influence it has on the most important ecological processes is of a great significance. The best preserved forest communities with tree stands of primary origin have been protected in Białowieża National Park since 1921 (47 km^2) augmented in 1996 (to 105 km^2).



Bottom sampling at Solina Dam Reservoir (Photo Pawel Bijok)

Long-term studies on permanent plots in northern-eastern Poland (mainly in Białowieża Forest) are supplemented with the comparative studies in southern Italy (Promontorio del Gargano) and in Russia (southern-western Siberia). The studies include seasonality of forest communities (since 1952); ecotone between forest communities; the role of tree windfall in forest dynamics; geophytes/hemicryptophytes relation under the influence of wild boar rooting (1975-1982; since 1991); modification of plant population in forest and meadow communities; plant demography in vegetation succession (since 1972); vegetation fluctuation, regeneration and succession; phenomena related to secondary succession on abandoned farmland (since 1971); species turn-over; the role of dioecious species; return of native species; differentiation and integration of community structure; course of succession; fire impact, stochastic processes during succession; the role of cryptogamous species in the structure and function of forest communities; invasion of foreign species upon native plant communities (neophytism); and the formation of anthropogenic communities and synanthropic flora in the compact forest complex (synanthropisation of plant cover).

B: Animal communities (Zdzisław Pucek)

Since 1959, three times per year (in spring, summer, autumn) small rodents and shrews have been trapped on a small grid and two transects located in an oak-lime-hornbeam forest of the strict reserve of Białowieża National Park. The results show a dependence of rodent population dynamics on the fruiting pattern of the main deciduous trees: oak, hornbeam, and maple. Outbreaks of rodents (followed by deep crashes) occur regularly every 6 to 9 years. Other years are characterized by moderate densities and strongly seasonal population dynamics of rodents. Since 1985, a community of carnivores and raptors that exploit forest rodents has been studied and their predatory impact estimated.

Data on numbers of five species of ungulates (in the form of game inventories and hunting statistics) are available since the 19th century. Since 1969, The Mammal Researches Institute, Polish Academy

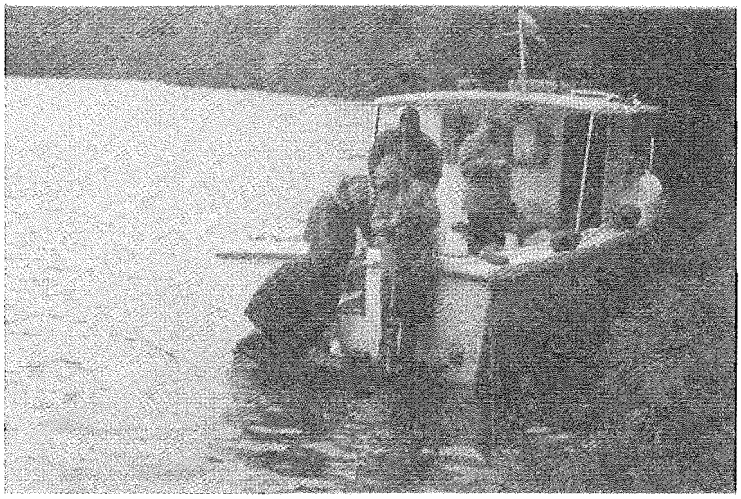
of Sciences has participated sporadically in the inventories and since 1991 it has been conducting annual censuses of ungulates and large predators. Predatory impact of wolf and lynx on ungulates as well as roles of other factors on their population dynamics have been estimated. In co-operation with Białowieża National Park, numbers of free-living European bison have been censused annually.

Zegrzyński dam-reservoir (Zdzisław Kajak, Paweł Prus)

The Zegrzyński dam-reservoir is a typical lowland reservoir. It was created in 1961-64 about 30 km north from Warsaw for a drinking water source, recreation, angling, and industrial fishing purposes. The reservoir is about 70 km long, has the surface area of 33 km^2, the average depth 3.5 m and the maximum depth 9 m. The potential capacity of the reservoir is 100 mln m^3, water level fluctuations come to 0.5 m. The reservoir is highly eutrophic; the load of nutrients from the catchment (exceeding 100 thousands km^2) is extremely high.

The Zegrzyński reservoir can be considered as a good subject for long term studies of environmental and biocenotic situation as depending on hydrological and trophic changes. The reservoir has been a subject of ecological research for almost 40 years. Some initial studies were done even before its construction. A number of studies on different aspects of ecology of the reservoir were carried out by the Institute of Ecology PAS and other institutions, such as the Academy of Podlasie, Institute of Meteorology and Water Management (IMGW). Those studies considered water quality and its indicators, phytoplankton, zooplankton, meiobenthos, macrobenthos, fish and birds. Some synthetic characteristics of the Zegrzyński reservoir ecosystem have alsobeen done.

Several projects, especially on the ecology of benthic invertebrates, are currently being conducted at the Zegrzyński reservoir. Problems of the *Chironomus plumosus* L. population dynamics have been studied since the 1980s, based mainly on the field-experiment techniques.



Great Masurian Lakes (Photo Andrei Karabin)

Kampinos Forest (Jerzy Misiak, Anna Andrzejewska)

The Kampinos Forest site encompass the area of Kampinos National Park. It is situated in the largest water junction created by valleys of the Vistula, Bug and Narew rivers. It is connected by a system of ecological corridors with natural areas significant for conservation and restoration of rare species of plants and animals in Poland.

The Park and the valley of the unregulated Vistula river are extremely important biotopes: old river-beds, sand dunes, isles, marsh meadows and shrub areas. About 1,250 vascular plant species, 115 species of moss, 150 lichens, 10 liverworths and many species of fungi have been identified. The species diversity of fauna was estimated as at least 50% of Poland fauna species, i.e. 16,500 species with only 3,000 identified.

The park with its mosaic of different habitats e.g. inland dunes (up to 30 m high, unique in Europe), gives to the area undulated configuration with variegated landscape.

Forest covers about 80% of total surface area of the site. The most important forest-making species include common pine (72%), black alder (13%), oak (8%), verrucose birch (6% of the total area). Dominant habitats are fresh forest followed by fresh mixed coniferous forest, fresh mixed forest, humid forest and ash swamp. The most common non-forest association: *Spergulo-Corynephoretum*, *Festuco psammophilae-Koelerietum glaucae*, *Arctostaphyllo-Callunetum*, *Geranio-Trifolietum alpestris*, *Cirsio-Brachypodion pinnati*, *Arrhenatheretum medioeuropaeum*, *Scirpo-Phragnitetum*, *Carici-Agrostetum caninae*.

The Park, being situated at the boundary of the capital – Warsaw, has a potential to become one of the major centers of specialized tourism in Poland. Since January 2000 it has become a Biosphere Reserve called *Puszcza Kampinoska* MaB.

The Kampinos Forest plays the key role, as a ventilation tract for the city and supplying oxygen-rich air. A plan for protection of the Kampinos National Park was elaborated in 1995 and established in 1997. The essence of the protection plan for the Kampinos National Park and its buffer zone is to establish protective, recultivating, restituting and renaturalizing actions for particular types of ecotones and natural landscapes. The plan has been prepared for 20 years.

One of the priorities in Kampinos National Park is research on ground and surface water circulation and long term changes. Cooperation with American National Park Service the research project on water balance began in 1999. The main goal of the project is to develop a model for hydrological and hydrogeological balances. The project is financed by US-Poland Maria Skłodowska-Curie Joint Fund II.

The Kampinos forest, and especially the Kampinos National Park, have served as a site for ecological studies carried out for the past 50 years by various scientific institutions, including the Institute of Ecology PAS, Warsaw University, Łódź University, Institute of Forest Research, Catholic University of Lublin and others. It provides excellent conditions for educational purposes for high schools and colleges located in Warsaw.

Bieszczady Mountains, Carpathians

A. Terrestrial communities (Kajetan Perzanowski)

Bieszczady Mountains (i.e. the mountain range in the southeastern corner of Poland, bordering with Slovakia and Ukraine), cover about 2000 km^2, with elevations of 500– 1346 m a.s.l. Its soils (mostly Cambisols) and geology (Flysch formations) are typical for the Carpathians. Rapidly and frequently changing weather is strongly influenced by a continental climate of Ukraine and western Russia.

Bieszczady are forested in over 60% with dominating natural beech-fir forest association (*Fagetum Carpaticum*). Forest stands are composed of 60 - 75% of beech *Fagus silvatica* and fir *Abies alba*, with an admixture of alder, spruce, sycamore, pine, larch, aspen, and willows. The majority of agricultural land, formerly cultivated by state farms remains abandoned under various stages of secondary succession. The number of vascular plants is estimated for about 700 species. There were 284 vertebrate species tecorded there, including all large European predators (wolf, brown bear, lynx, wildcat), and almost all herbivorous species, such as European bison, red and roe deer, moose, and wild boar. The density of local human population, among the lowest in the country, ranges between 5 - 10 people per km^2.

The most spectacular and least affected by an anthropogenic influ-

ence part of Bieszczady (over 29 thousand hectares) remains protected by the Bieszczadzki National Park. In 1992 a Biosphere Reserve called *Eastern Carpathians*, which encompasses the national park and two landscape parks, has been established over the area of 108 thousand hectares. An international agreement to create an International Biosphere Reserve, covering over 160 thousand hectares including Slovak and Ukrainian protected areas, has been successfully negotiated.

Research topics:

(1) Influence of historic changes in land use patterns on biodiversity, the structure and composition of vegetation, and trends in natural and secondary succession (2) Sustainable development based on early warning system (3) Predator-prey relationships among large mammals inhabiting the area (4) Present status and perspectives for re-establishing the bison (*Bison bonasus*) over its former natural range in the Carpathians and Ukraine. Research topics (1), (3), and (4) are transboundary projects, carried out in the collaboration with Ukrainian Academy of Sciences (Institute of the Ecology of Carpathians in Lvov), and the Institute of Forest Research in Zvolen, Slovakia. The partner in the project (3) is also the Department of Ecoregion Science, Tokyo Noko University, Japan. In the project (1) involved are scientists from the Technical University Cottbus, Germany.

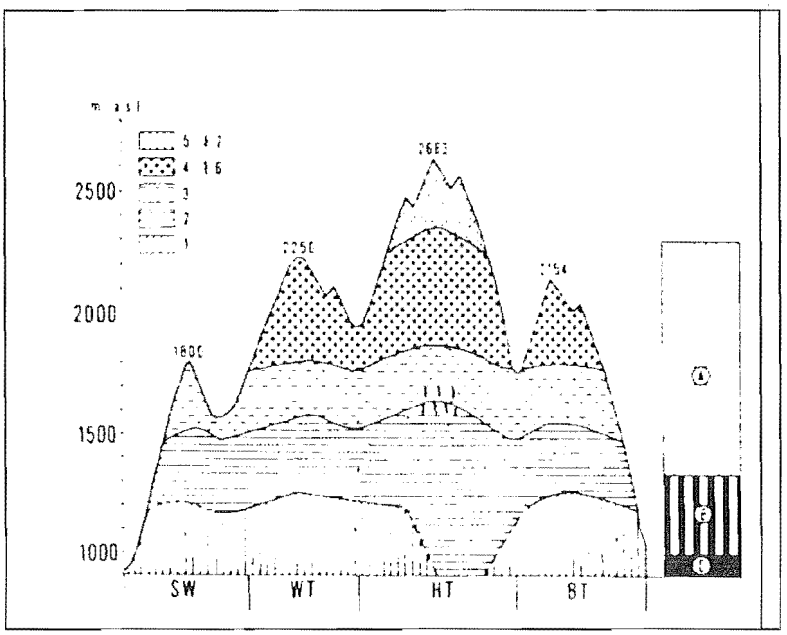


Fig. 2. Natural vegetation belts (after Mirek & Piekos-Mirkowa 1992, slightly modified).
1-lower montane belt, 2-upper montane belt, 3-dwarf pine belt (=subalpine belt), 4-alpine belt, 5-subnival belt, 6-Larix decidua, 7-Pinus cembra; belts of cultivated vegetation: A-oats and potato, B-manured meadows and pastures, C-non-utilized areas. SW - the Siwy Wierch massif, WT - the Western Tatras, HT - the High Tatras, BT - the Bielskie Tatras

B. Aquatic communities – Solina and Myczkowce Dam Reservoirs (Tadeusz Prus)

In the Bieszczady Mountains region, the aquatic site consists of two dam reservoirs, Solina and Myczkowce, situated one after another forming a two-threshold cascade. The whole system holds almost 20% of total water storage in Poland and the aims of constructing the cascade in 1968 were power generation, flood control and tourism and recreational functions. The reservoirs differ in size, Solina ca 2100 ha being over ten times larger than Myczkowce. It is the largest dam reservoir in Poland. Water volume turnover is twice a year in the larger water body and 12 times a month in the smaller one. As the outflow of water from upper reservoir follows from the level of hypolimnion, the water in lower reservoir is by about 10Ç cooler than in the upper during the vegetation season.

The littoral zone is affected by a large range of water level changes (up to 10 m) weekly or monthly in Solina, and 1-2 m daily in Myczkowce reservoir. One part of Solina lake is strongly affected by tourist activity, the other is rather natural.

Research topics:

(1) The long-term recording of water transparency, nitrogen and phosphorus forms, composition of bottom deposits, and the analysis of fauna in the vegetation season.

(2) The long-term effects of human impact on biodiversity of fauna in littoral and profundal zones and also in main rivers Solinka and San.

The Carpathian Branch of ICE PAS offers also summer training programs, lectures and courses on wildlife ecology for foreign students. Infrastructure: Research facilities: Basic laboratory allowing for preliminary processing of biological samples, standard computer equipment are available at the Carpathian Branch of the International Centre of Ecology PAS at Ustrzyki Dolne. Library and biological reference collections are available at National Park Museum situated within 100 m distance. Housing: the building of ICE PAS at Ustrzyki Dolne can accommodate up to 30 people. The same capacity is designed for lectures/conferences.

Tatra Mountains, Carpathians (Krystyna Grodzińska)

The Tatra Mts. (785 km^2) form the highest chain in the Carpathians. They are located on the Polish-Slovakian border. Due to differentiation of climatic conditions on the latitudinal gradient, rich relief, various geological substrata and soils contribute to a great diversity of habitats, resulting in a wealth, diversity and distinction of the flora and plant communities in the Tatra Mts. The Tatras have been divided into 4 geobotanical subdistricts: the Siwy Wierch, the Western Tatras, the High Tatras and the Bielskie Tatras (only the Western and High Tatras in Poland). In the whole Polish Tatras (175 km^2) a Tatra National Park (TPN) was proclaimed in 1954 In 1993 TPN in Poland, and Slovakian Tatra NP (TANAP) were nominated as a Transboundary Biosphere Reserve.

Western Tatras are composed of Jurassic and Triassic limestone and dolomites while the High Tatra of granite. Some parts of the Tatra Mts. were glaciated. The climate is characterized by polar influences, high precipitation, strong foehn winds (halny) and a long winter season. The number of days with snow cover ranges from 135 to 230.

In the Tatra Mts. five vegetation belts corresponding with climatic zonation are distinguished: lower montane belt, upper montane belt, dwarf pine (subalpine) belt, alpine belt and subnival belt (Fig. 2).

The flora of the Polish Tatras comprises over 1000 vascular plants, about 450 mosses and 200 liverworts, 700 lichens, 300 fungi, 700 myxomycetes and 1000 algae species. The flora and vegetation of the Tatras were strongly influenced during the Pleistocene and were changed during the Holocene. For this reason the Tatra Mts. being a center of West Carpathian endemism and refuge for relict species.

A rich wildlife is represented by rare and endangered animal species. The best known are bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Vulpes vulpes*), eagle (*Aquila pomarina*), chamois (*Rupicapra rupicapra*), and marmot (*Marmota marmota*).

As a result of historically intensive exploitation of the natural forest for industrial purposes, actual forest stands possess lowered resistances to pest, diseases, wind damage and pollution including both long distance and local pollution. Another important threat to the Tatras nature comes from mass tourism (over 3 million visitors yearly).

Key References

Site: Masurian Lakeland

A; River Jorka Catchment

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B: Great Masurian Lakes

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Warszawa No 28

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Site: Zegrzyński reservoir

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Site: Kampinos Forest

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Site: Bieszczady Mountains, Carpathians

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Site: Tatra Mountains, Carpathians

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Mirek Z., Piekos-Mirkowa H. 1992. Plant cover of the Polish Tatra Mountains (S Poland). In: K. Zarzycki, E. Landolt and J.J. Wójcicki (eds.). Contributions to the knowledge of flora and vegetation of Poland. Ver(ff. Geobot. Inst. ETH, Stiftung R(bel, Z(rich 107.

Basing on the two previous projects on evaluation of ozone air pollution and ozone monitoring (Poland Czech Republic, Slovakia, Ukraine and the United States), a new project: „Long-term effects of air pollution on selected forest ecosystems in the Tatra Mts. (Polish & Slovakian parks)" which started in the year 2000 includes 20 permanent plots (1 ha each) located in natural and managed spruce forests, at the altitude 900-1700 m a.s.l. Air pollution (O_3, SO_2/NO_x), forest health, biodiversity, bark beetle population, genetic diversity, are studied. (USDA Forest Service, Dr. A. Bytnerowicz, Institute of Botany PAS, Doc. Dr. B. Godzik, Prof. Dr. K. Grodzińska - principal investigators).

Poland: Table of Site Information

Site Name/Location	Date established as a research site:	Principal biome Main communities	Research themes	Types and length of datasets
MASURIAN LAKELAND				
A. River Jorka catchment	1976	Temperate deciduous and mixed forest, temperate cold lakes, lowland stream, arable fields, pastures, meadows, wetlands.	Landscape structure, catchment management, nutrient export, lake eutrophication, wetlands, lake ecosystem, plankton, benthos, sediments.	nutrient export (16 subcatchments) and retention in lakes (5 lakes) - 25 years, wetland patch (vegetation functioning) - 20 years, lake eutrophication rate - 20 years, plankton and benthos composition and abundance - for 1970's and 1990's
B. Great Masurian Lakes	1951	System of about 25 lakes surrounded with pine forest meadows, arable lands.	nutrients cycling, lake eutrophication, land impact, littoral functioning, long term changes, biological diversity.	Regular monitoring of nutrients, chlorophyll, phytoplankton, zooplankton, littoral vegetation - since 1985, avian fauna, benthos - since 1925
PRIMEVAL DECIDUOUS FOREST (BIAŁOWIEŻA)				
A. Plant communities	1951	Multi-species temperate deciduous forest	Dynamics of vegetation and plant population in the natural landscape, geobotanical cartography and vegetation remote sensing.	Seasonality of forest communities 1952-1958. Influence of wild boar rooting 1975-1982. Plant demography in vegetation succession since 1972. Secondary succession of abandoned farmland since 1971, seasonality in 10 forest communities since - 1951, forest canopy and ground vegetation, phenology of tree populations - since 1972.
B. Animal communities	1959	Multi-species temperate deciduous forest	small mammal population dynamics in primeval temperate forest, population dynamics of ungulates and their large predators (wolf and lynx)	Small rodents and shrews population data since 1959, carnivores and raptors communities since 1985, ungulates, wolf and lynx populations dynamics since 1969.
Zegrzyński Dam Reservoir	1962	lowland euthrophic reservoir	basic hydrochemical analysis, phytoplankton. zooplankton, benthos composition and abundance, *Chironomus plumosus* population, fishery management, birds	Phosphorus, Nitrogen, chlorophyll, seston concentrations, benthos and plankton abundance, fish and birds - 10-20 year series of records, water flows and temperature 50 years data
Kampinos Forest Terrestrial communities	1985	Forest and bush ozier hope, marshy alder carr, river side alder carr, willow – poplar alder carr, dry – ground forest, bright oak wood,, mixed coniferous forest, pine bilberry coniferous forest, cup – moss coniferous forest, marshy coniferous forest	hydrology, water balance, ecological succession, flora, plant communities, reintroduction of flora and fauna species, integrated monitoring	Water balance research since 1985. Gas and dust air pollution since 1986. Succession on meadows since 1991. Restitution of elk since 1951, larch since 1965, beech 1977, yew since 1964.
BIESZCZADY MOUNTAINS, CARPATHIANS				
A. Terrestrial communities	late 1950ties	Carpathian beech-fir forest (Fagetum carpaticum), mountain alderwood (Alnetum incanae), alpine medows, abandoned agricultural area	Change in land use patterns, succesional trends, biodiversity, sustainable development, predator –prey relationships. population ecology of large mammals	history of land use - 1850, populations of rodents - mid 1950ties, large mammals - 1980, climate, hydrology, forest structure since 1960, invertebrates 1960
B. Aquatic communities	late 1980ties	Cascade dam reservoirs (largest in Poland) Solina - Myczkowce	Biodiversity, sustainable development. macrobenthic fauna, in-shore zone fauna with affluents' impact.	Hydrochemistry since 1973, benthic fauna since 1989.
Tatra Mountains, Carpathians	XIX Century	Spruce forest, mixed beech - fir and dwarf pine forest, alpine grasslands, rocks and lakes.	floristical, faunistical, ecological and environmental studies, biodiversity, ozone air pollution, long - term effects of air pollution on forest ecosystems	floristical, faunistical, ecological - almost 200 years, environmental - 40 years ozone studies - 3 years

Affiliation/Ownership	Site Manager or key scientific contact	Official postal and e-mail address	Areal extend	Latitude, longitude, elevation,	Travel distance and direction to nearest town
Institute of Ecology Polish Academy of Sciences	Prof. Dr. Anna. Hillbricht-Ilkowska	Institute of Ecology Polish Academy of Sciences, Dziekanów Leśny, 05-092 Łomanki, Poland e-mail: ahillbricht@post.pl	6500 ha	53°50'N, 21°23'E, 116-206 m a.s.l.	60 km E from Olsztyn
Hydrobiological Station, Institute of Ecology, Polish Academy of Sciences	Dr Jolanta. Ejsmont – Karabin Dr Lech Kufel	Hydrobiological Station, Institute of Ecology, Polish Academy of Sciences, Leśna 13, 11-730 Mikołajki, Poland, e-mail panmikol@priv2.onet.pl	310 km^2	54°11'-53°35'N, 21°33'-21°42'E 116-119 m a.s.l.	90 km E from Olsztyn
Białowieża National Park, Białowieża Geobotanical Station, Warsaw University	Prof. Dr Janusz. B. Faliński	Białowieża Geobotanical Station Warsaw University Sportowa 19, 17-230 Białowieża, Poland fax (48 85) 6802479	1300 km^2	23°50'E, 52°42'N 160 m a.s.l.	70 km SE from Białystok
Białowieża National Park, Mammal Research Institute , Polish Academy of Sciences	Prof. Dr hab. Zdzisław. Pucek	Mammal Research Institute Polish Academy of Sciences 17-230 Białowieża, Poland, e-mail: mripas@bison.zbs.bialowieza.pl	600 km^2	23°50'E, 52°42'N 160 m a.s.l. 1300 km^2	70 km SE from Białystok
State ownership Institute of Ecology Polish Academy of Sciences	Prof. Dr. Zdzisław Kajak M.Sc. Paweł Prus	Institute of Ecology Polish Academy of Sciences Dziekanów Leśny, 05-092 Łomanki, Poland, e-mail: ekolog@warman.com.pl	33 km^2	52°30' N, 21°0' E	30 km N form Warsaw
Kampinos National Park	M. Sc. Jerzy. Misiak M. Sc. Anna Andrzejewska	Kampinos National Park Tetmajera 38, 05-080 Izabelin, Poland, e-mail: kampn@medianet.pl	38 544 ha	52°25'-52°15'30"N, 20°17'-20°53'E 104.8 m a.s.l.	10 km W from Warsaw
Bieszczady National Park Directorate of State Forest at Krosno, Institute of Meteorology and Water Management, International Centre of Ecology, Polish Academy of Sciences	Dr Kajetan. Perzanowski,	Carpathian Branch, International Centre of Ecology Polish Academy of Sciences Belzka 24, 38-700 Ustrzyki Dolne, Poland, e-mail:icepas@mikrotech.com.pl	2000 km^2	49°00' – 49°50' N, 22°23' E 500-1346 m a.s.l.	75 km SE from Krosno
Hydro-powerstations Solina-Myczkowce, International Centre of Ecology, Polish Academy of Sciences	Prof. Dr Tadeusz. Prus	International Centre of Ecology, Polish Academy of Sciences, Dziekanów Leśny, 05-092 Łomianki, Poland, e-mail: mce-pan@mail.unicom.pl	2130 ha	49°30'N, 22°23'E 600m a.s.l.	75 km SE from Krosno
Tatra National Park Institute of Botany, Polish Academy of Sciences	Prof. Dr hab. Krystyna Grodzińska	Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31-512 Kraków, Poland, e-mail: grodzin@ib-pan.krakow.pl	20 hectars	49° 14' - 49° 16' N, 19° 46' - 20° 08' E 900 - 2240 m. a.s.l.	100 km S from Kraków

Long Term Ecological Research in Slovakia

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Slovakia was first made aware of the LTER Network in the USA and the effort to establish an international network of ILTER sites during the 7th European Ecological Congress in 1995 in Budapest, Hungary. Slovakia was invited to participate in the Programme by LTER officers and colleagues in Hungary, Poland and Czech Republic. We started with examining the possibility of revitalising some formerly active ecological research sites and we continued by selecting a few sites for our LTER network based on relevant criteria. During this process Slovakia participated in the regional ILTER workshop in Budapest, Hungary, in 1999. It was accepted as a member of the ILTER Network in March, 2000. And from May 23-26, 2000, Slovakia organized and hosted the third regional ILTER workshop in Central and Eastern Europe.

Long-term ecological research in Slovakia

Slovakian ecological research on permanents plots and long-term ecological research has a long tradition (ELIÁŠ 1994, 1999, 2000). The first permanent plots were established at the end of the 19th century and the beginning of 20th century in Central and Easten Slovakia in forest ecosystems.

A register of permanent research plots was prepared by the Slovak Ecological Society (SEKOS) in 1992 and the first version was published in 1994 (ELIÁŠ, 1994). The scheme of the register was based on that used for the British Isles and the USA. This register includes data on more than 800 permanent research plots established in different periods and used for different types of research. The second version of the register is under preparation.

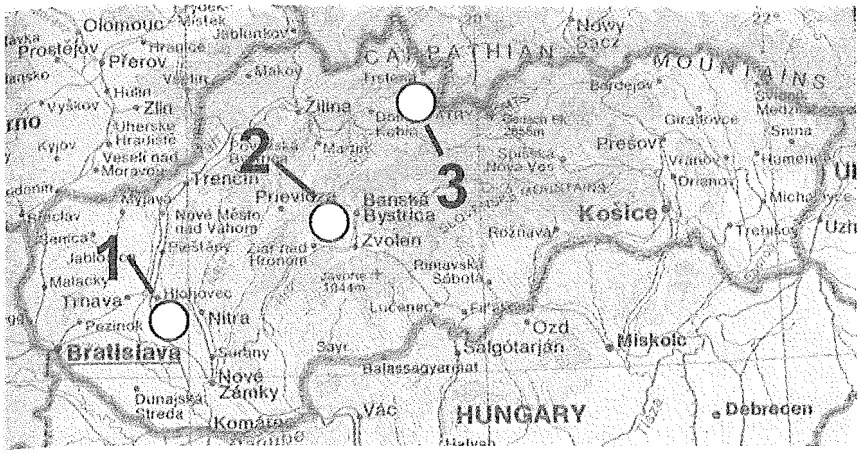
ILTER sites candidates from Slovakia

During the ILTER regional workshop in Budapest, Slovakia presented the following site-candidates for its ILTER network (ELIÁŠ, OSZLÁNYI, 1999):

1. Former I.B.P. forest site at Báb (SW Slovakia) with an oak-hornbeam deciduous forest ecosystem.
2. Former MaB Research Sites at Biely Kriz, Male Karpaty Mts., Western Slovakia, with a serie of different types of deciduous (oak, oak-hornbeam, beech, alder and ash Fraxinus) and evergreen (spruce) forest ecosystems
3. Former Forest Research Plots of Prof. Zlatnik, Vysoke Tatry (High Tatras), with several evergreen mountaneous forests
4. The Polana Biosphere Research Site, Hukavsky grun Forest Plot, Central Slovakia, with beech and spruce forest,
5. Vychodne Karpaty Biosphere Research Site, Eastern Slovakia, with grasslands ecosystems;

Slovakia: Table of Site Information

Site Name	Date	Principal biomes	Research themes	History/types of data collected
Bab Forest Research Site, SW. Slovakia	1967	Temperate deciduous forest, oak-hornbeam forest (*Carpinus betulus, Quercus petraea, Quercus cerris, Acer campestre*)	Biodiversity, primary (and secondary) productivity, eco-physiological processes (photosynthesis, water relations, stomatal conductance etc.), energy flow, nutrient (and hydrological) cycles, microclimate (atmosphere) and soil properties, horizontal and vertical structure of the ecosystem (plant community), population dynamics.	General characteristics of the Research Site and first results of field research (biodiversity, ecosystem) were published in Research Project Bab (IBP) Progress Report I. (Jurko, Duda, eds., 1970). List of specialists participated in the field research (more than 60 researchers) as well as first list of publications (papers, reports) was published in 1975 in Progress Report II (Biskupsky, ed., 1975).
Biely Váh Research Site, North Slovakia	1948	Coniferous forests (*Picea abies* with admixture of *Abies alba* and *Fagus sylvatica*)	Species diversity development in relationship with the stand age Production, productivity of biomass Needles loss Leaf area index Ozone and its influence on health state of trees Litterfall (structure and biomass) Soil characters Precipitation Growth intensity after different kinds of thinning Herbaceous layer, its species diversity and biomass production.	At that time it was founded it was fenced (prevention from browsing). Studies on natural regeneration of spruce and fir after various types of regeneration felling of old trees. Studies on structure changes.
Pol'ana Research Site, Central Slovakia	Approx. 10 years ago	Natural mixed mountaineous forest (*Fagus sylvatica, Picea abies, Acer pseudoplatanus*)	Species diversity development Production and productivity of biomass Leaf area index Litterfall Soil characters Precipitation and its distribution Climatic factors within the above ground part of the production space and their distribution Illumination of canopies Light factor and its distribution in the production space Herbaceous layer (production studies) Precipitation and its distribution	Founded as a demonstration project for University students for studying the ecological data in natural forest ecosystem.



Long Term Ecological Research Sites in Slovakia

1 Bab Forest
2 Biely Váh
3 Polana

6. Other Monitoring sites subject to intensive forest ecosystems monitoring, ozone effects monitoring, etc.

At the ILTER regional workshop in May 2000 in Nitra, Slovakia, we presented data and information collected and obtained at the sites in the past (OSZLÁNYI, 2000, ELIÁŠ, 2000, KUBICEK, 2000).

Research Agenda on patterns and processes for ILTER sites in Slovakia include: monographical synthetized studies in English; biodiversity research; biotope/community type mapping; environmental factors, including atmosphere and soil characteristics; primary production and productivity studies, and; ecophysiological measurements.

Parallel activities

Participating in the NPP demonstration project of GTOS at the Báb Research site can be considered a parallel activity which can help to revitalise research at this former I.B.P. research site.

Conclusions

Slovakia selected three permanent plots for long-term ecological research and is now part of a regional ILTER group in Central and Eastern Europe and the global LTER network. Slovak ecologists are invited to participate in ecological research to revitalise the formerly productive research efforts carried out on natural and man-made ecosystems in Slovakia.

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Affiliation/ownership	Site manager/principal contact	Address	Area extent in hectares	Location, elevation	Travel distance and direction to nearest town
Institute of Botany, Slovak Academy of Sciences, Slovak National Council	Dr. Pavol Elias, Dept. of Ecology	Slovak Agricultural University Marianska 10, SK-949 76 Nitra, e-mail: elias@afnet.uniag.sk	100 ha, in 60-ties only 66,38 ha	48° 10' N, 17° 53' E, 210 m	70 km NW from Bratislava at the village Bab, county of Nitra
Institute of Landscape ecology of the Slovak Academy of Sciences	Dr. Július Oszlányi,	Institute of Landscape ecology of the Slovak Academy of Sciences Štefánikova 3 P.O.Box 254, SK-814 99 Bratislava, Slovakia		49°02' 53", 19°54' 19"	
Poľana Biosphere	Administration	Poľana Biosphere Reserve Hurbanova 20 SK-960 01 Zvolen, Slovakia		48°38'17", 19°32'28"	

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Ukraine
Long Term Ecological Research

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Ukraine has been invited to join ILTER in 1999 on the basis of decision of ILTER Chairperson and Vice –President of Ukrainian Academy of Sciences. The National Academy of Sciences has appointed Prof. Igor Akimov as National Representative to ILTER and Doc. Igor Kozak as co-chair.

In 1998 Prof. I. Akimov and Doc. I. Kozak presented perspective sites for ILTER in Ukraine at the first Regional ILTER Workshop for Central Europe (Madralin,Poland 16-18 September 1998).

Long term ecological research motivated either by environmental problems or by scientific purposes has a long tradition in Ukraine. The National Academy of Sciences of Ukraine initiated the development of a national ecological research network to increase the effectiveness of the research work. At the beginning five Biosphere Reserves (Askania Nova, Chornomorskij, Dunajskij, Carpathians and Beskidy as Ukrainian Part of East Carpathians Biosphere Reserve) representing various ecosystems, and with a solid scientific background from earlier research activity, will serve as ILTER sites and take part in regional and global networking activities.

The main goals of the programme include studying the long term dynamics in space and time on vegetation and animal communities, the role of biodiversity in ecosystem functions, the change on structure of biomass and productivity of ecosystems and so on.

The sites are also the subjects of scientific investigations by a number of scientific institutions of National Academy of Sciences and universities. For example, there are many data on monitoring of plants and animals in Chornomorskij, Dunajskij and Askania Nova sites stored at the Institute of Botany, Institute of Hydrobiology and the Schmalhausen Institute of Zoology of National Academy of Sciences of Ukraine, or in Carpathian and Beskidy sites at the Institute of Ecology of the Carpathians National Academy of Sciences of Ukraine. Partnerships include Biosphere Reserves, National Parks, and Institutions of National Academy of Sciences of Ukraine and Universities.

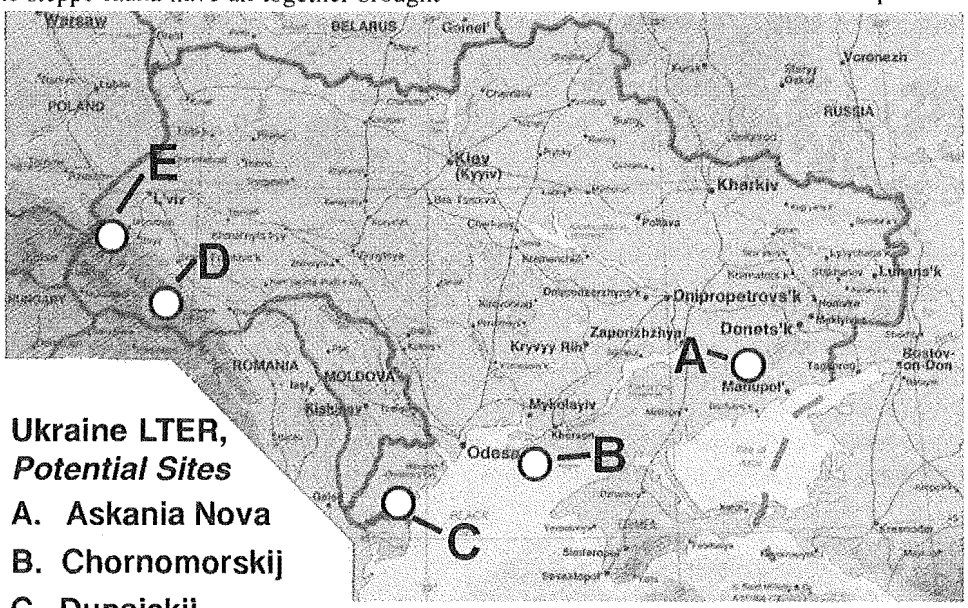
Sites description

Ascania –Nova Biosphere Reserve (Dr Gavrylenko V. S.)

"Askania-Nova" site is the oldest one in Ukraine, situated in Chaplinsky district of Kherson region. The reserve is recognized as a pioneer in nature conservation in Ukraine. The history of the creation of the reserve dates back to the late 19th century when F.E.Falz-Fein declared the protection of certain pasture areas of his economy.

The reserve covers an area of 33 397 ha and consists of the following sections: the virgin steppe and fallow land, the arboretum and the zoo. The Institute of Animal Husbandry, farms and settlements occupy the rest of the area. The area of reserve is flat (elevations in between 19 and 34 m above sea level). The climate here is temperate-continental, summer hot and dry, winter mild and unstable. The average annual air temperature consists 9.5 Ç (absolute temperatures fluctuate from 32^0 below to 40.3^0 above zero). Average precipitation reaches almost 400 mm (minimum 164 mm in 1943 and maximum 703 mm in 1997). Short-lived streams appear only in early spring during the melting of the snow cover as well as during heavy rains. The groundwater table lays deep (the first hori-zon is at 18-30 m). Harsh climatic conditions, seasonal development of vegetation on loess, peculiar impact of the steppe fauna have all together brought into being the southern chernozems and dark chesnut soils.

The most significant part of the reserve is, of course, the plot of virgin steppe. This is the sole in Europe intact piece of a fescue-feathergrass steppe ecosystem. Here are preserved and studied the whole complex of living and non-living nature. Four types present the vegetation cover: genuine, meadow and bushy steppe vegetation, and marsh vegetation (in selected places of the Velyki Chapelski Pod).



Florists have recorded here 478 flowering plant species, many of them being of fodder, medicinal, meliferous, decorative importance. A fairly large portion is consisted of rare, endemic and declining species - 85, out of which 33 are listed in the Ukrainian Red Data Book, 12 - in similar international records. The native fauna numbers 28 mammal species, a third of them are rodents. Common species are the fox, brown hare, red deer, and marmot.

Grasslands are inhabited by a great number of invertebrates (above 2000 species), snakes (grass snake, viper etc.) Up to 20 bird species nest in the open steppe, together with those nesting in the park area and visiting the place during migrations the bird fauna totals 272 species. 19 species of insects, birds and mammals of the native fauna are listed in the national Red Data Book. From the surroundings birds come to the reserve and concentrate here during migrations in big numbers: cranes (9-15 thousand), grey lag (5-10 thousand) and white-fronted geese (20-500 thousand). Mallard is met in numbers reaching tens of thousands, other species are abundant as well.

The arboretum consists of two parts: the older one and the new one where trees have been planted 20-30 years ago. The collection embraces 984 species and varieties of trees and bushes from various continents. About 90 rare, relic and/or declining species are cultivated here. 68 of them are listed in the Red Data Book of Ukraine, 3 are under international protection. It is impossible for trees and bushes to grow here without irrigating the place as far as naturally only two species (Amygdalus nana and Caragana scythia), now rare and protected, can survive in the steppe.

The zoo is one of the biggest in the former Soviet Union and one of the leading zoos in the World. It has specialized in breeding and studying the biology of hoofed animals of the steppe, savannas, deserts and mountainous regions, waterfowl and rare bird species of the Steppe Zone. The zoo maintains 72 both exotic and native bird species. 15 of them listed in the Red Data Book of Ukraine breed in the zoo (tawny eagle, crane, demoiselle crane, ruddy shelduck etc.) 36 mammal species have been introduced, totalling together 900 heads. Rare species are: Przewalski's wild horse, onager, Grevy's zebra, makhor, barbary sheep, saiga, Siberian ibex (together they number 370 heads).

Since 1985 "Askania-Nova" has been included to the UNESCO world network of Biosphere Reserves. Today this is a scientific institution of national and international importance. The Biosphere Reserve "Askania-Nova" is a recognized centre for ecological education in the south of Ukraine. The scientific work in the "Askania-Nova" is directed to the development of protection conditions for the natural steppe complex, study of patterns of the evolution of the stipa steppe, the dynamics of the change of ecosystems affected by the anthropogenic factor and problems of introduction of the plant life and acclimatization of animals.

Chornomorskij Biosphere Reserve (Dr Majatskyi G. B.)

Chornomorskij site is located in Kherson and Mikolajiv regions on the north-western coast of the Black Sea. In 1933 the reserve become independent nature-protected and researches object. The status biosphere the reserve has received only in 1983. In 1998 according to the Decree of the President of Ukraine was organized in modern borders of an area of more than 100 000 hectares from which 77900 hectares are areas of the Tendrivs'ka and Yagorlyts'ka Bays and open sea zone 1 kilometre length.

Dry land is only 14 148 hectares. It is the biggest reserve of Ukraine and includes some parts which represent diversity of seaside south-Ukrainian landscapes: azonal forest-steppe, azonal sand-steppe, zonal desert-steppe and seaside saline lands.

Relief of the reserve is mainly plain with numerous depressions along sea. The elevations resemble small hills. The littoral bank formed by sand and shells is typical for the seaside. Sand lands are duty hollows and hills 3-5 meters height. Sands are spread beneath limestone. Land's and coastal sands are relatively young and very dynamic structure.

Climate of the reserve is temperate continental. The summer is hot and dry but winter is mild with thaws and unstable snow covering. Strong winds blow in winter and especially in early spring. Average temperature is -2 °C for January and +24 Ç for July, precipitation - about 320 mm for year.

The reserve is a inseparable system which combine not seen elsewhere different (marine, river, land and others) nature associations of forest, meadow, marsh, wetland, steppe and halophyte vegetation,

diversity of animal associations in accordance with plant complexes. It seems a real paradise for wildlife in the South.

The main objective of the reserve is protecting birds which nest, hibernate or situated here while in flight and also protecting unique complexes of sand lands and desert-steppes of Nyzhniodniprovya.

The rare nature associations of Nyzhniodniprovs'ky sands are protected on the partially-wooden steppe. They are represented by mosaic of sand steppes, meadows, and little groves consist of oak, endemic species - Betula borysthenica, pear-tree, steppe shrubs and also marsh and salt-marsh plant around lakes and bays.

Relic groves is remains of the legendary Gileya - forest country in the lower reaches of the Dnipro River - glorified by Herodotus in V century Before Christ.

Tendrivs'ka Spit is a real pearl of the reserve. It is a narrow sand zone extending for 80 kilometres. Ancient Greeks called it Achilles's Way. The temple was dedicated to Achilles tower above the Spit in ancient times. There are many endemic species with narrow range on the Spit. All of them are absolutely unique therefore they include into the Red Date Book of Ukraine and to the European Red List of species are disappearing in whole world. It is Medicago tendrivska, Medicago marina, Melica chrysolepis, etc.

Bays of the reserve with their islands are a real kingdom of birds. They are included into the list of wetlands of international importance.

The store of algae, for example Phyllophora, and water-plants like eel-grass Zostera in the marine ecosystems and bays is relatively big. It is main source of oxygen, substance cycle in water here, in one of the most important region of spawning 49% species of fishes. Unfortunately this reservate of genetic and coenotic diversity of coastal water associations is going to poor in connection with worsening ecological situation. The main cause of it is pollution by raw sewage and irrigation water.

Territory of reserve presents whole diversity of living organisms of steppe south of Ukraine. The number of plants included into the European Red List gets fourth place in Ukraine. Black Sea Biosphere Reserve now is practically main centre with the richest nature associations of southern flora which before human beings were reaching from eastern to western border of Ukraine.

There are more then 700 species of vascular plants, 90 - lichens, 61 - mosses, 87 - fungi and 84 - fungi-parasitic. It is only beginning, because algae and myxomycetes take not into account. In all approximately 20 Red Book plant species are found in this territory, from them - 17 species include in European Red List that underlines its world importance.

The geographical position, high diversity of landscapes caused the formation rich animal world of reserve. It has connections with nature associations of sand-forest-steppe, marine, desert-steppe and coastal-island. There are more than 4000 species of insects, more 250 species macro-zoobenthos, 10 - sponges, 64 - crustacean in the reserve now. Fauna is presented: 452 - animals from them 68% - birds.

Reptiles have 9 species. The fauna is one of the most rich in the Ukrainian reserves. The 74 species of fishes are found in the sea water during time existents the reserve. It is 49% of all species of Black Sea. Mammal fauna has 48 land's and 3 marine species.

The reserve is real bird kingdom. There are 305 species. Among them, 110 species nesting, others are wintering or situated here while the flight.

All number of birds which hibernate on the bays is 120 000. The coastal-island complex is the most important for birds where registered 125 wetland species. Islands ornithocomplex is the most valuable. It is 60-70% of whole number sea birds of the south of Ukraine.

The reserve is base place nesting of black-headed gull in Europe. Ornithocomplex of steppe-forest areas has 100-120 species. Among them, 40 species are nesting, for 60 species these areas are fodder and resting places. The species of Caprimulgus europaeus, Strix strix, Streptopelia tur-tur live in pine forests. In seaside steppes 180 species are found. Among them Melanocoripha calandra, Galerida cristata, Alauda arvensis, on the lakes - Cygnus olor, Podiceps cristatus numerous duck's and heron's flocks, in summer season flocks of Calidris, Passeriformes and birds of prey fly in here.

The reserve plays special role in protection of rare bird species, forming about 18,7% of its species. It is centre of nesting such rare species us Haematopus ostralegus, Charadrius alexandrinus, Somateria mollissima, Himantopus himantopus, Mergus serratur, Larus ichthyaetus. Otis tarda, Haliaeetus albicilla, Pelecanus onocrotalus are few numerous. Phalacrocorax carbo, White little heron (Egretta garzetta), have began to nesting.

This very short number illustrate that territory of Black Sea Biosphere Reserve is unique nature complex of pan-European standards. And the main objective for people working in the reserve is saving this pearl of Black Sea for future generations.

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Dunaiskij Biosphere Reserve (Dr Voloschkevich A. N.)

Dunajskij site is situated in Kiliv district of Odessa region. Its location is in the low districts of the Kiliy river-bed of the Danube, including some islands and waters of the black sea. The natural complexes of the reserve are typical of the Danube delta and represent different in sizes alveolar islands separated with deep river-beds and shallow channels, flowing into the black sea or the shoal-water gulfs.

According to the Ramsar Convention all the area of the reserve is considered to be a wetland of international importance, particularly as a habitat for waterfowl and waterbirds, numerous fish species. Here in the reserve we find the youngest in continental Europe created by natural forces mainland. The delta, especially in its maritime portion, is a highly dynamic system and, particularly of importance to wildlife, highly mozaic in its spacial stucture. This is the reason why the reserve harbours tremendous biodiversity, greater than elsewhere in the surroundings. The landscape presents a diverse pattern of lakes, channels, backwaters, marshes, islands and is a paradise for birdlife, a unique natural formation located in the middle of Europe.

The Dunaiski Biosphere Reserve was declared by Presidential Decree in 1998 and was built upon the former nature reserve "Dunaiski Plavni". Far before that the area was a branch of the Chornomorski (Black Sea) Reserve, occupying an area of 7 758 ha. Nowadays the reserve covers an area of 46 403 ha, 6 890 of which are open water.

The protected delta is a flat area, the sole elevated areas being coastal sand ridges, river levees and the nowadays inland sandy ridge Zhebrianske Pasmo. The area of the delta is considerably partitioned by river arms, channels, canals, numerous big and small lakes. The reserve includes as well a number of islands, the largest ones being Ermakiv, Kubanu, Kubanski, Ankudyniv, Poludenni, Stambulski. Much of the delta consists of alluvial deposits of sand alternated by layers of silt. Most of the area is inundated at least by 30-50 cm of water.

Habitat diversity is most significant in the Zhebrianske Pasmo, littoral portions of reedbeds (locally "plavni") and reservoirs. Soils in the plavnis are of boggy type, less common are meadow boggy soils or saline soils. Coastal ridges are characterised by sandy soils with poorly developed turf. The climate is temperate continental, winters mild and summer hot. Average temperature of January consists - 1 Ç and of July + 24 Ç. Thaws in the winter are common and the snow cover is unstable, staying for about 30 days. Annual precipitation averages 370 mm.

Widlife in the area is extremely rich and impressive, so is the peculiar nature, local culture and traditional landuse.

The flora of the reserve totals 950 vascular plant species, many of which are sand-loving are met only in few places, certain species are met only in the surroundings of the Black Sea. A larger group consists rare and rare in the region species. Together they total 66 species, 14 of them are in the Ukrainian Red Data Book, 3 in the European Red List. Most of them are psammophilous, aquatic or marsh plants.

Animal wildlife in the reserve is presented by above 5 thousand species. Most numerous are insects, about 4.5 thousand species, of which 36 are in the Ukrainian Red Data Book and European Red List. These are Osmoderma eritima, Proserpinus proserpina, Liomepotum microcephalum, Satanas gigas, Catocala fraxin etc. Specific insect compostions feature communities of reed, halophyte, scrub, forest and other types of vegetation. Studies of these communities have helped to elaborate measures aimed to protect the insect fauna. In total studies have recently revealed within the reserve 7 new to science species and 19 have been recorded in Ukraine for the first time.

One of the most important constituents of the biota in the delta is bird. Here are found above 250 species, more than a half of the Ukrainian ornithological fauna. Impressive is the diversity of species and numbers of birds. Most of the diversity is found in the coastal area. Here it is possible to see flocks of white pelican numbering up to 1 000 individuals, while in total in the summertime the area is populated by 5 000 of these birds. In the wintertime concentrations of white-fronted geese reach the number of 115 000, or 10% of the number of the population in the Black Sea-Mediterranean area. In certain years here may winter up to 7 000 red-breasted geese (7% of the World population). This is a real paradise for birdlife.

Significant as well is the role of the delta in preserving rare species. Ukrainian Red Data Book and European Red List species alone number here 43. For many of them the Danube Delta is the sole refuge. Such are the ferriginous duck, pygmy cormorant, Dalmatian pelican, spoonbill etc. The white-tailed eagle is one of the largest raptors in the area. Seven pairs of this species nest in the reserve. Such a concentration of wildlife in the delta requires its strict protection.

10 amphibian species have been recorded in the Danube Delta. Of high abundance are frogs (Rana), reaching in certain places up to 10 - 20 thousand individuals per hectare. Less abundant are the fire-

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bellied toad, common spadefoot, common newt etc. Only 5 reptile species have been found in the reserve: the grass snake, European pond turtle, the lizard species.

The waters of the reserve are of special importance to fish which total here 91 species. All fishes listed in the European Red List are met here. Among them; Acipenser nudiventris, A.sturio, Saimo trutta labrax, Hucho hucho, Umbra krameri. Out of 32 species listed in the national Red Data Book 15 are met in the reserve: Gymnocephalus schraetser, Zinger streber streber, Saimo trutta labrax etc.

Mammals are presented by 40 species. Offshore are permanently visited by the 3 species of Black Sea dolphins. Of special interest is the monk seal, listed in the European Red List. Records have been made recently of the species within the reserve. Among other rare mammal species the reserve gives shelter to the otter, ermine, European mink. Fairly rare is the wild cat.

This, of course, is only a short account of the value and beauty of the Danube Delta. One should see it in reality and get the unforgettable impression of the largest reedbed area in Europe, its wildlife and originality of cultural life in the delta.

Carpathian Biosphere Reserve (Prof. Hamor F. D.)

Carpathian site is situated in Tyachiv, Rakhiv and Khust districts of the Transcarpathian region. Protection in the area started in the early XXth century. More vigorously protection activities developed after World War II which resulted in creating the basis for establishing a representative biosphere reserve in the Ukrainian Carpathians.

The Government of Ukraine in 1968, occupying at that time declared such a reserve (the Carpathian Reserve) an area of 12.6 thousand ha. Since then the area of the reserve has been extended and almost 2.5% of the region is by the reserve. In 1992 it was included to the UNESCO world network of biosphere reserves.

The Carpathian Biosphere Reserve now occupies an area of 57 880 ha and consists of 6 separate massifs, including as well botanical sanctuaries (zakaznyks) "Chorna Hora" and "Yulivska Hora". The protected massifs are located at 180 to 2061 m above sea level in the western, central and eastern sectors of the Ukrainian Carpathians. Such territorial structure of the reserve provides the presentation of most of the landscape and biological diversity of the region. Well presented are mostly intact oak forests at the foothills of the mountains, mountain beech forest, mixed and coniferous forests, subalpine meadows with elfin woodland, rocky landscape and lichen cover of the mountain tops.

Within the reserve are protected more than a thousand plant species, 65 mammal species, 179 bird species, 9 reptile species, 13 amphibian species, 23 fish species, more than 15 000 invertebrate species. The flora houses 40 endemic and 74 rare species listed in the Red Data Book of Ukraine. The fauna numbers above 100 endemic species, 2 of which are found solely in the reserve. In general 73 animal species listed in the Red Data Book of Ukraine are protected here.

The status of a biosphere reserve has set new objectives, such as sustainable development of the region and preservation of its cultural and historical heritage. Of special interest is the preservation of the natural environment of Ukrainian highlanders - hutsuls, boikya, and lemky. Landuse practices, for instance, sheep-breeding, handicrafts and traditions are of unique character in present-day Europe.

The Ukrainian Carpathians are mountains of moderate hight and do not reach the snow line. The most elevated parts are Chornohora (2061 m), Marmaroshski Massif (1946 m), Svydovets (1883 m), Horhan (1836 m).

The Carpathian Biosphere Reserve occupies the southern macroslope of the Ukrainian segment of the Eastern Carpathians. Only the massif "Dolyna Nartsysiv" (or, otherwise, "Daffodil Valley") and the two botanical sanctuaries are located in the lowlands.

The climate varies from temperate warm in the "Daffodil Valley" (January - 1,7 Ç,June + 19 "C, precipitation totalling 650 mm annually) to cold on mountain tops (January -7-8,5 Ç, June + 11-15 Ç, precipitation totalling 980-1500 mm annually).

The area of the reserve is covered mainly (up to 90%) by forest vegetation. Meadow habitats occupy only about 5% of the area and are located down in "Daffodil Valley", on the mountain tops and in forest clearings.

The virgin forest consisting of 25 tree species of which 8 form forests composes an important portion of forest vegetation. Mostly developed in the lowlands are oak, hornbeam-oak, oak-beech, beech-oak forests. They are well presented in the botanical sanctuaries "Chorna Hora" and "Yulivska Hora". Besides these sites, they occupy sporadically the warmest places in the massifs located in the mountains.

Moving uphill numbers of beech increase. Under optimal conditions these species forms monodominant communities. Pure beech stands are presented in all of the protected massifs. Only in the coldest and most elevated massif "Chornohirski" they are found in selected places.

In the reserve these are presented by spruce-fir-beech, fir-spruce-beech, beech-fir-spruce forests. Natural spruce forests occupy the highest elevations. Climax forests of such kind are met in Chornohora, Svydovets and Marmarosh range.

Above the treeline are located subalpine and alpine meadows with fragments of elfin woodland. Chornohora and Marmaroshy harbour climax communities of pine (Pinus mugo), alder, juniper. Rare plant communities are met here such as ones formed by rosebay (Rhododendron kotschyi), willow (Salix herbacea and S. retusa) and tall grasses (Adenostyles alliari-ae, Cirsium waldsteinii). Grass communities consisting of tussock-grass (Deschampia caespitosa), wood-reed (Calamagrostis villosa), less by wire-bent (Nardus stricta) occupy large spaces. Most abundant are sweet vernal-grass (Anthoxathum odoratum), bent-grass (Agrostis tenuis), fescue (Festuca rubra), and species of meadow-grass, in particular, Poa alpina and P.pratensis. In the Svydovets above the treeline is developed elfin woodland consisting of Duschekia viridis and juniper.

Amongst habitats noteworthy is to mention caves (both natural and man-made). There are about 50 of them in the reserve. They house a unique cave community and as well accommodate bats in the wintertime.

The flora of vascular plant totals 1962 species (50% of the flora of the Ukrainian Carpathians) 64 of which are listed in the national Red Data Book.

Within the massif "Daffodil Valley" 400 vascular plant species have been recorded, among them such rare ones as orchids (Dactylorhiza fuch-sii and D.majalis, Orchis coriophora), adder's tongue (Erythronium dens-canis), Gentiana pneumonanthe, sword-flag (Iris sibirica), cinquefoil (Potentilla alba) etc. The uniqueness of this site is explained by the presence of one of the biggest lowland populations of the highland daffodil species, Narcissus angustifolius.

The core of the flora of the forest belt is composed of nemoral, boreal and montane species, such as scopolia, snowdrops, hellebore, turk's-cap lily, stonecrop (Sedum hispanicum), helleborine (Cephalantera rubra), twayblade (Listera cordata) etc. Richest flora is found in calcareous habitats, particularly in the Uholsko-Shyrokoluzhanski Massif are found Cotoneaster integerrimus, Juniperus sabina, purging buckthorn, linden (Tilia platyphyllos), yew (about 1.5 thousand trees), petrophilous and alpine herb species of notice are the helleborine (Cephalanthera longifo-lia), crown vetch (Coronilla elegans), bear's-ear sanicle (Cortus matthi-oli), sword-flag (Iris pseudocyperus), Jovibarba preissiana, Saxifraga pan-iculata. Nemoral and arid species are presneted by arum, Corallorhiza trifi-da,

Epigonium aphyllum, Ophioglossum vulgatum, Viola dacica etc.

The alpine and subalpine belts house such rare species as Anemone nar-cissiflora, Aconitum firmum, Anthemis carpatica, Chrysosplenium alpinum, Gentiana acualis, G.lutea, G.punctata, G.verna, Melampyrum saxosum, Narcissus angustifolius, Pedicularis verticillata, Pulsatilla alba, Rhodiola rosea.

Of special interest is the area of the summits of Mala Biyznytsia (1778 m) and Velyka Biyznytsia (1883 m) which have been added to the reserve in 1997. Here are found such rare plants as Aster alpinus, Bartsia alpina, Dryas octopetala, Lloydia serotina, Salix hastata. Only in the Ukrainian Carpathians are found Draba aizoides, Euphrasia salisburgensis, Saxifraga androsacea, etc. Extremely rare are the edelweiss, Aquilegia nigricans, Swertia alpestris.

The number of animal species recorded in the Carpathian Biosphere Reserve totals 2423. Of this number 2135 are invertebrates. The number of endemic Carpathian species protected in the reserve reaches 100.

The core of the highland fauna is composed of alpine and northern coniferous forest (taiga) elements. In the highest places (above 1700 m above sea level) are found the snow vole and alpine accentor, both listed in the Ukrainian Red Data Book. The elf woodland is populated by a particular race of blackcock which has become rare. Common reptiles are the viper and viviparous lizard. Small stagnant waterbodies are used by newts (Triturus montandoni and T.alpestris) for spawning. Fairly common as well are Bombina variegata and the toad (Bufo bufo).

Highlands of Marmaroshski and Chornohirski massifs have preserved the conditions for the dwelling here of the alpine marmot and chamois which disappeared from the place in the early XXth century. The reintroduction of these species should stabilize the fragile highland ecosystems.

Usual inhabitants of the coniferous and mixed forests are the three-toed woodpecker, Regulus regulus, Turdus torquatus, Loxia curvirostra, the Carpathian subspecies of the capercally, lynx, brown bear etc. The Tatra pine vole has been found here as well. It is natural to meet here the red-deer, wild boar, roe-deer, the wolf, Cinclus cinclus etc.

The rocky landscape of Marmaroshski Massif house the peregine falcon. More numerous are smaller falcons (Hypotriorchis subbuteo and Cerchneis tinnunculus).

The fauna of virgin forests has its peculiarities. Here are met species common to the taiga - lynx, black woodpecker, bullfinch, and species met usually in broad-leaved forests - blackbird, several woodpecker species, flycatcher, the hazel dormouse, wild cat, wild boar, salamander. Common inhabitants here are red-deer, common marten, bank vole, buzzard, tree creeper, the brown frog (Rana terrestris). Rare species are the lesser water shrew, ermine, otter, eagle owl, black stork etc. Rare insect species are presented by Lucanus cervus, Osmoderma eritima, Rosalia alpina, Parnassius mnemosyne etc. Very diverse is the fauna of bats which numbers 21 species.

Cold waters of the mountain streams are inhabited by a variety of fish species, Hucho hucho and Thymallus thymallus migrate to area coming upstream from the Tisza River.

The Carpathian Biosphere Reserve is one of the biggest scientific and educational centres in the region. The reserve has become a laboratory for scientists in Ukraine and from abroad. The reserve staff has established several nature trails for visitors, built a visitors centre with a museum devoted to the ecology of mountains and landuse. The reserve issues a scientific and popular magazine "Zeleni Karpaty" (i.e. "The Green Carpathians").

Recently the reserve has been awarded the European Diploma of the CoE, recognizing in this way the achievements of the Carpathian Biosphere Reserve and its staff.

Beskidy (Doc. Kozak I., Kopach V.)

Beskidy site is represented the Ukrainian part of the Eastern Carpathians Trilateral Biosphere Reserve. The area of Biosphere Reserve is 58587 ha and includes the Uzhanski National Park and Nadsanski Regional Landscape Park.

Those reserves directly borders Slovakia Poloniny and Polish Bieszczady National Park and Polish "San Valley Landscape Park and form a unified protected natural complex in Carpathians. The geographical location and natural features of Uzhanski National Park and Nadsanski Regional Landscape Park increase the area's ecological importance and provide the diversity and representatives of landscape.

The history of nature protection in Uzhanski region began since 1908 year when was created the Stuzica Reserve (331 ha) to protect virgin beech and fir forests. The area of Reserve increased to 560 ha in 1932 year, 2542 ha in 1974, 14665n ha in 1995 and to 39159 ha as a total area of the Uzhanski National Park in 1997 year. Nadsanski Regional Landscape Park was created in 1998 on the area 19428 ha. His organization has ecological and socio-economic motives.

The geological base was formed by flysch deposits. The highest mountains in Uzhanski National Park are Stinka (1066 m), Kremenets (1221 m), Kinczyk Dukovski (1251m), Rozsypanets (1273 m) and in the Nadsanski Regional Landscape Park are Kicherka (769 m), Sankovska Kichera (870 m), Vershok (815 m), Sanski (884 m) and Buchok (950 m). According to the data from Stavne Meterological Station (379 m a.s.l.) the average temperature in the Uzhanski National Park was –5.2^{0}C in the January and 17.4^{0}C in the July. The average temperature for the year was 8.6^{0}C and the yearly precipitation was 770 mm. Within Nadsanski Regional Landscape Park at the meteorological station in Turka (594 m) the average January temperature was –6.1 ^{0} C, July 16 ^{0}C, average annual temperature was 5.6 ^{0}C. The average sum of precipitation was 841 mm. The brown soils dominated on those two areas. The flora of Uzhanski National Park includes about 900 vascular plants. More than 30 of them was included in the Red Data Book of Ukraine. Within Nadsanski Regional Landscape Park the flora numbers around 700 vascular plant species. There are 119 vertebrate species, 7 reptilian, 8 amphibian, 82 of bird and 22 of mammal.

Within the vertical profile of the National Park was possible to define four vegetation belts: the beech
forest belt (Fagetum sylvaticae), fir-beech forest (Abieto-Fagetum), dwarf forest of green alder (Alnetum viridis) and the subalpine meadow belt (Prata subalpina). On the territory of Nadsanski Regional Landscape Park two vegetation belts occur: beech forest and beech-fir forest belts. Natural spruce forests have had limited distribution and grew only in cold glens and on stony northern slopes. Man-made spruce tree stands now dominate in the Nadsanski Regional Landscape Park. They have turned out to be biologically unstable and require reconstruction. As a results of the agricultural impact, a significant forest area has been transformed
into post-forest meadows and pastures. The density of local human population ranges between 40-50 people res km^2. The changes in the natural landscape caused that the faunal species composition is poor.

The main goals of the programme include studying the long term dynamics in space and time on vegetation and animal communities, the role of biodiversity in ecosystem functions, the change on structure of biomass and productivity of ecosystems. The comparative studies in Nadsanski Regional Landscape Park and in the Polish part of Eastern Carpathians Trilateral Biosphere Reserve are perspective.

Switzerland: The Swiss Long-term Forest Ecosystem Research Programme

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Today, forests in Switzerland must fulfil many different functions. In mountainous regions, their role in providing protection from natural hazards such as avalanches and rockfalls is especially important. Elsewhere, other functions may be more important, ranging from the provision of wildlife habitat, through the provision of recreational opportunities to the provision of employment for more than 90,000 people. The diversity of functions means that many different factors can impact on the value of a forest, necessitating monitoring and research of the pressures affecting forests and their responses to their pressures. The chemical composition of the earth's atmosphere is changing because of human activities and, as a result, European forests and woodlands face new environmental conditions. Several environmental changes pose a real risk for the forest. These include changes in the abiotic environment (e.g.climate and air pollution) and changes in the biotic environment (browsing pressure, changes in the ways in which forests are perceived and valued). Consequently, the monitoring of the processes and phenomena which occur in forest ecosystems is a prerequisite to ensure that the benefits provided by forests are maintained for future generations.

Description of programme, objectives, and core areas

The Swiss Long-term Forest Ecosystem Research (LWF) was established in 1994 under the Forest Observations Programme (now called Forest Monitoring in Switzerland). It is one of four programmes designed to provide basic information about forest dynamics in Switzerland, primarily in relation to the sustainable management of the forest resource. The mission of the LWF is to improve the understanding of forest ecosystem processes through the long-term study of 15 to 20 selected forest plots in Switzerland. A particular emphasis is the possible effects of air pollution and climate change on forest ecosystem processes. The Swiss LWF aims to obtain a deeper understanding of the processes that take place in the forest ecosystem and the cause-effect relationships involved. Detailed investigations should yield information about how the influences of modern society, e.g. changed patterns of forest use, pollution and anticipated climate change, affect the forest. It should become apparent which processes harm the forest in both the short- and the long-term. The Swiss LWF is divided into two main components: long-term continuous monitoring of ecosystem processes, and short-term (1-4 years) research projects. The main aims of the programme are:

1. To monitor the state of ecosystems and provide an explanation of changes in terms of causal environmental factors in order to provide a scientific basis for emission controls and other environmental policies.

2. To develop and validate models for the simulation of ecosystem responses and to use these (a) in concert with survey data to make regional assessments, (b) to undertake ecological risk analyses in relation to actual or predicted changes in environmental stresses.

Site selection

Study areas were selected using a number of criteria, including:

- the areas must be homogeneous with respect to their ground conditions and stand structure (local relief, vegetation);
- must belong to a forest community type that is important in Switzerland;
- must be located in a region sensitive to environmental change; and
- and should have, if possible, already been the subject of past or ongoing environmental studies.

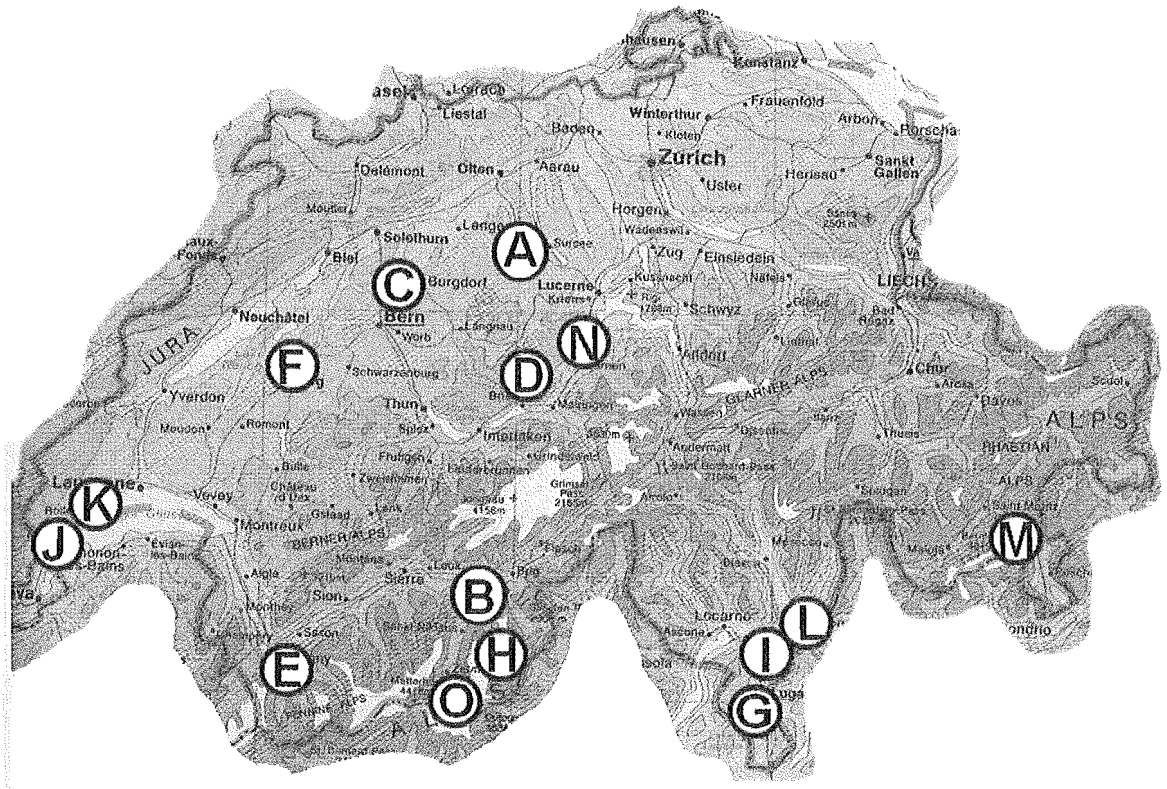
Information management

At each plot, all data collected automatically by continuous measurement systems are on a single data logger. All the data of all the plots (both the data automatically recorded as well as those periodically achieved through surveys) are stored to an integrated Project Database (Relational Oracle(r) Database). Information about the system is available on the Internet.

Switzerland: Table of Site Information

Site name	Date	Principal biomes	Research themes	Type of data sets
Othmarsingen	The plot was installed in September 1994.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Former coppice with standards beechwood	Galio odorati-Fagetum typicum. Soil types (FAO, 1988): Stagnic Luvisols, Haplic Luvisols Humus forms (Green et al., 1993): Vermimull, Mullmoder 7) Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil physics, soil water (tensiometers and lysimeters), crown condition, forest pathology.	Data related to research topics are collected.
Visp	The plot was installed in March 1996.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Scots pine forest - 38: Arabidi turritae-Quercetum pubescentis. Soil types (FAO, 1988): not yet determined. Humus forms (Green et al., 1993): not yet determined.	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology, needle retention-growth-climate relationships.	Data related to research topics are collected.
Vordemwald	The plot was installed in August 1995.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Mixed oak-silver fir high forest - 46: Bazzanio-Abietetum. Soil types (FAO, 1988): Distric Gleysols Humus forms (Green et al., 1993): Vermimull, Hemimor	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers and lysimeters), crown condition, forest pathology, phenology, heavy metals in mycorrhizas, diameter growth monitoring (dendrometers).	Data related to research topics are collected.

Swiss Long-term Forest Ecosystem Research Sites



Information is shared with several international programmes including the "International Cooperative Programme for the Assessment and Monitoring of Air Pollution Effects in Forests" and the "International Cooperative Programme for the Integrated Monitoring of Air Pollution Effects on Ecosystems". In future, all the major data sets will be available through Internet.

Network management

The Swiss LWF network is managed by the staff of the LWF group based at the Swiss Federal Institute for Forest, Snow and Landscape Research in Birmensdorf, near Zurich. The group consists of more than 20 scientists and technicians, together with a number of research students. Day to day site maintenance is undertaken by someone from the local community, usually the village forester. More detailed information about the activities of the Swiss LWF (plots, people, research projects, publications) is available at the url: http://www.wsl.ch/wsidb/wsidb.html

Application of LTER Research (including education)

Conferences, excursions and other information activities are regularly organized by the Swiss LWF research group to inform the public (mainly local foresters, environmentalists, scientists and students).

Partnerships

The Swiss Long-term Forest Ecosystem Research is a joint research and monitoring activity between the Swiss Federal Institute for Forest, Snow and Landscape Research and the Federal Office of Environment, Forests and Landscape. Active collaboration with research institutes and universities in Switzerland and abroad is encouraged. The aims of the Swiss LWF are in agreement with the aims of two international programmes: the "International Co-operative Programme on Integrated Monitoring of Air Pollution Effects" (ICP-IM) and the "International Co-operative programme on assessment and monitoring of air pollution effects on forests" (ICP-Forests).

Collaboration among networks

The LWF is one of the research groups participating in the Center for Terrestrial Ecosystem Management and Protection, based at the Federal Institute of Technology, Zurich.

Site manager	Address	Area extent in hectares	Location, latitude, longitude, elevation, orientation, mean slope, area
Norbert Krovachi	LWF, Swiss Federal Institute for Forest Snow and Landscape Research (WSL/FNP) CH-8903 Birmensdorf, Switzerland phone ++41 1 739 22 16 fax ++41 1 739 22 15	2.0016 ha	Central Plateau (Aargau) 47° 24' 03", 08° 13' 40", 467-500 m a.s.l., S, 27%
(see above)	(see above)	1.9994 ha	WesternAlps (Canton Valais) 46° 17' 53", 07° 51' 34", 657-733 m a.s.l., N, 80%
(see above)	(see above)	2.0035 ha	Central Plateau (Aargau) 47° 16' 32", 07° 53' 16", 473-487 m a.s.l., NW, 14%

Switzerland: Table of Site Information

Site name	Date	Principal biomes	Research themes	Type of data sets
Alptal	The plot was installed in May 1995	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Norway spruce mountain forest - 49:Equiseto-Abietetum. Soil types (FAO, 1988): Mollic Gleysols, Gleyic Cambisols Humus forms (Green et al., 1993): Hydromoder, Mullmoder, Hemimor	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil physics, soil water (tensiometers), crown condition, forest pathology, plant nutrition	Data related to research topics are collected
Beatenberg	The plot was installed in September 1996	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Norway spruce high mountain forest - 57: Sphagno-Piceetum calamagrostietosum villosae. Soil types (FAO, 1988): not yet determined. Humus forms (Green et al., 1993): not yet determined. Halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology, plant nutrition, heavy metals in mycorrhizas.	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne	Data related to research topics are collected.
Bettlachstock	The plot was installed in June 1995.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Mixed (broad-leaved) mountain beechwood - 13 h: Cardamino-Fagetum tilietosum. Soil types (FAO, 1988): Rendzic Leptosols; Calcaric Cambisols Humus forms (Green et al., 1993): Vermimull, Mullmoder	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil physics, soil water (tensiometers), crown condition, forest pathology, heavy metals in mycorrhizas.	Data related to research topics are collected
Celerina	The plot was installed in July 1996.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Subalpine stone pine forest with larch - 59: Larici-Pinetum cembrae. Soil types (FAO, 1988): not yet determined. Humus forms (Green et al., 1993): not yet determined.	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, crown condition, forest pathology.	Data related to research topics are collected.
Chironico	The plot was installed in August 1995.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Mixed coniferous (Norway spruce-silver fir) mountain forest - 47: Calamagrostio villosae-Abietetum. Soil types (FAO, 1988): not yet determined. Humus forms (Green et al., 1993): not yet determined.	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, crown condition, forest pathology, morphology of fine roots, plant nutrition.	Data related to research topics are collected.
Isone	The plot was installed in September 1995.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Coppiced beechwood - 4: Luzulo niveae-Fagetum dryopteridetosum. Soil types (FAO, 1988): not yet determined. Humus forms (Green et al., 1993): not yet determined.	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, forest pathology, soil physics.	Data related to research topics are collected.
Jussy	The plot was installed in May 1995	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Mixed (broad-leaved) oakwood (former coppice) - 35: Galio silvatici-Carpinetum. Soil types (FAO, 1988): Stagnic Luvisols Humus forms (Green et al., 1993): Vermimull, Mullmoder	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology.	Data related to research topics are collected.
Lausanne	The plot was installed in September 1994.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Mixed (broad-leaved-coniferous) high forest - 8: Milio-Fagetum. Soil types (FAO, 1988): Distric Cambisols Humus forms (Green et al., 1993): Vermimull, Mullmoder	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology, heavy metals in mycorrhizas.	Data related to research topics are collected.
Lens	The plot was installed in March 1996.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Scots pine forest - 64: Cytiso-Pinetum silvestris. Soil types (FAO, 1988): not yet determined. Humus forms (Green et al., 1993): not yet determined.	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology, soil moisture limitation and tree-ring growth.	Data related to research topics are collected.
National Park	The plot was installed in October 1995.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Subalpine mountain pine forest - 67: Erico-Pinetum montanae. Soil types (FAO, 1988): not yet determined. Humus forms (Green et al., 1993): not yet determined.	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology, plant nutrition.	Data related to research topics are collected.
) Neunkirch	The plot was installed in July 1995.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Former coppice with standards beechwood - 13: Cardamino-Fagetum tilietosum. Soil types (FAO, 1988): Rendzic Leptosols Humus forms (Green et al., 1993): Vermimull, Mullmoder	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology.	Data related to research topics are collected.
Novaggio	The plot was installed in March 1995.	Woodland association (Ellenberg and Klötzli, 1972): Temperate forest / Mixed broad-leaf oak-chestnut-birch (former coppice) forest - 42: Phyteumo betonicifoliae-Quercetum castanosum. Soil types (FAO, 1988): Haplic Podzols Humus forms (Green et al., 1993): Mullmoder	Stand history and stand dynamics, biogeochemical cycling and ground vegetation, meteorological monitoring, airborne halocarbons, soil chemistry and physics, soil water (tensiometers), crown condition, forest pathology, phenology, chestnut blight, ozone symptomatology.	Data related to research topics are collected.

Site manager	Address	Area extent in hectares	Location, Latitude, longitude, elevation, orientation, mean slope, area
Norbert Krovachi	LWF, Swiss Federal Institute for Forest Snow and Landscape Research (WSL/FNP) CH-8903 Birmensdorf, Switzerland phone ++41 1 739 22 16 fax ++41 1 739 22 15	0.5966 ha	Lower Alps (Canton Schwyz 47° 02' 60", 08° 42' 49", 1149-1170 m a.s.l., NW, 23%
(see above)	(see above)	2.0011 ha	Lower Alps (Canton Berne) 46° 42' 06", 07° 45' 48", 1490-1532 m a.s.l., SW, 33%
(see above)	(see above)	1.2785 ha	Jura (Canton Solothurn) 47° 13' 35", 07° 25' 03", 1101-1196 m a.s.l., S, 66%
(see above)	(see above)	2.0003 ha	Central Alps (Canton Graubünden) 46° 29' 37", 09° 53' 23", 1846-1896 m a.s.l., NO, 34%
(see above)	(see above)	2.0010 ha	Southern Alps (Canton Ticino) 46° 26' 53", 08° 48' 48", 1342-1387 m a.s.l., N, 35%
(see above)	(see above	2.0004 ha	Southern Alps (Canton Ticino) 46° 07' 34", 09° 00' 33", 1181-1259 m a.s.l., NO, 58%
(see above)	(see above)	1.9946 ha	Central Plateau (canton Genève) 46° 13' 52", 06° 17' 30", 496-506 m a.s.l., plane, 3%
(see above)	(see above)	2.0000 ha	Central Plateau (Canton Vaud) 46° 35' 06", 06° 39' 32", 800-814 m a.s.l., NO, 7%
(see above)	(see above)	2.0036 ha	Western Alps (Canton Valais) 46° 16' 11", 07° 26' 13",1033-1093 m a.s.l., SO, 75%
(see above)	(see above	1.9999 ha	Central Alps (Canton Graubünden) 46° 39' 50", 10° 13' 52", 1890-1907 m a.s.l., S, 11%
(see above)	(see above)	2.0000 ha	Jura (Canton Schaffhausen) 47° 41' 06", 08° 32' 13", 554-609 m a.s.l., N, 58%
(see above)	(see above)	1.5037 ha	Southern Lower Alps (Canton Ticino) 46° 01' 26", 08° 50' 08", 902-997 m a.s.l., S, 68%

United Kingdom
Long Term Ecological Research

T W Parr & A M Lane
Co-ordinator of the UK Environmental Change Network, NERC, Centre for Ecology and Hydrology, Merlewood Research Station, Windermere Road, Grange-over-Sands, Cumbria, UK LA11 6JU.

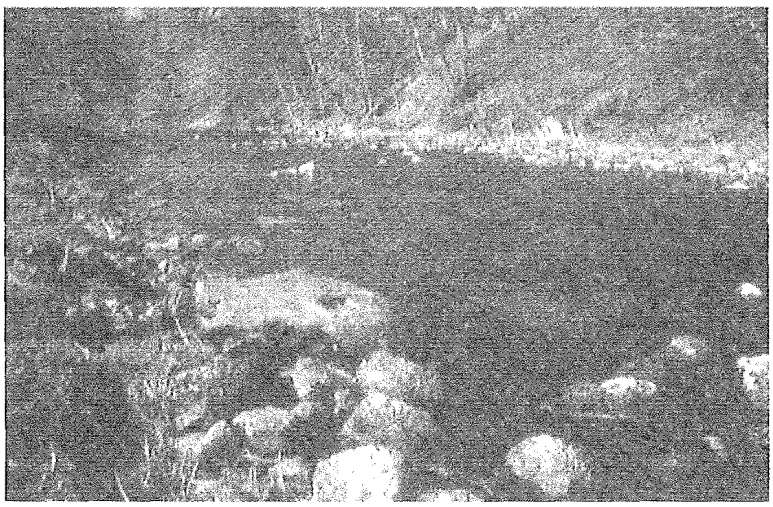
The UK Environmental Change Network (ECN) is a long-term integrated monitoring network which collects data for the detection and interpretation of environmental change. It is designed, in conjunction with other UK sectoral monitoring programmes, to identify and quantify environmental changes associated with man's activities, distinguish man-made change from natural variations and trends, and give warning of undesirable effects.

The ECN programme was established as a response to the concern over forecasts of global environmental in the late 1980's and the recognition of the scientific and policy value of data collected systematically from networks of monitoring sites (Burt 1994, Tinker 1994). It was established in 1992 with the following specific objectives:

- to establish and maintain a selected set of sites within the UK from which to obtain comparable long-term data sets by means of measurement at regular intervals of variables identified as being of major environmental importance;
- to provide for the integration and analysis of these data sets, so as to identify environmental change and improve understanding of the causes of change;
- to make these long-term data sets available as a basis for research and prediction;
- to provide, for research purposes, a range of representative sites where there is good instrumentation and reliable environmental information.

Sites began collecting data using the standard ECN measurement protocols in 1993, although many sites have historical data from before that date. By 2000, ECN had established:

- an expanding network of 54 freshwater and terrestrial sites covering the main environmental gradients in the UK;
- a programme of measurements on over 260 variables which drive, or respond to environmental change. Standardised recording for ECN's terrestrial sites covers 11 sets of measurements on: meteorology, surface water drainage, surface water quality, atmospheric chemistry, precipitation chemistry, soil solution chemistry, soils, vegetation, invertebrates (moths, butterflies, ground beetles), vertebrates (rabbits, bats, common birds, frogs) and site management. Vegetation maps and aerial photograph coverage are available for each site. Measurements at ECN's freshwater sites began in 1994 and covers measurements on water chemistry, water flow, chlorophyll, invertebrates, macrophytes, zooplankton, phytoplankton and epilithic diatoms.
- standard measurement protocols, quality assessment procedures and data validation procedures to ensure that all data collected are comparable in space and time (Sykes and Lane 1996, Sykes, Lane and George 1999);
- links with other sectoral monitoring programmes or surveys in the UK which enable ECN's data to be used in combination with more spatially extensive data from other monitoring networks within the UK;
- a central database and data management procedures designed to create seamless transition from data collection to data dissemination and from data provider to data user;
- an Internet service to provide direct access to its Oracle summary database and real-time data on climate (http://www.nmw.ac.uk/ecn/).



The ECN site on the River Bush in Northern Ireland supports stocks of Atlantic salmon which have been the focus of long term studies (since 1973). The river is an International Council for the Exploration of the Sea (ICES) index river which integrates the results with other salmon research programmes in the North-East Atlantic. The ECN work is sponsored by the Department of Agriculture and Rural Development.

Network management

ECN is funded by 15 sponsoring organisations. Each sponsor contributes towards the monitoring programme at one or more sites or by supporting network co-ordination. ECN's sponsors are: Biotechnology & Biological Sciences Research Council (BBSRC); Countryside Council for Wales (CCW); Defence Evaluation Research Agency (DERA); Department of Agriculture for Northern Ireland (DANI); Department of the Environment, Transport and the Regions (DETR); Department of the Environment for Northern Ireland (DOENI); English Nature (EN); Environment Agency (EA); Forestry Commission (FC); Ministry of Agriculture, Fisheries and Food (MAFF); National Assembly for Wales (NAW); Natural Environment Research Council (NERC); Scottish Environment Protection Agency (SEPA); Scottish Executive Rural Affairs Department (SERAD); and Scottish Natural Heritage (SNH).

The organisational structure of ECN consists of a Steering Committee, a Statistical and Technical Advisory Group, a Central Co-ordination Unit (CCU) and groups of site managers. The Steering Committee deals with policy and finance and consists of representatives from each sponsoring organisation. The Statistical and Technical Advisory Group deals with technical development and data analysis.

Site managers deal with the day to day monitoring at ECN sites and meet annually to discuss operational matters and research opportunities. Finally, the network is co-ordinated by the Centre for Ecology and Hydrology on behalf of the Natural Environment Research Council (NERC), where the Central Co-ordination Unit is also responsible for the management of ECN's central database.

The initial contact point for all general enquiries is:

Dr Terry Parr, Co-ordinator of the UK Environmental Change Network, NERC Centre for Ecology and Hydrology, Merlewood Research Station, Windermere Road, Grange-over-Sands, Cumbria, UK LA11 6JU. (Tel: 015395 32264) (E.mail twp@ceh.ac.uk) (WWW: http://www.nmw.ac.uk/ecn)

Partnerships

ECN is a broad ranging partnership between Government Departments, Government Agencies, Research Councils, Research Institutes and Universities. The main research organisations contributing data to the programme are: Agricultural Development Advisory Service (ADAS) at Drayton; Chemical and Biological Defence, Porton; Centre for Ecology and Hydrology; Department of Agriculture for Northern Ireland; Forest Research, Alice Holt; Freshwater Fisheries Laboratory, Pitlochry; Institute of Grassland and Environmental Research (IGER) at North Wyke; Institute of Arable Crops Research (IACR) Rothamsted; Macaulay Land Use Research Institute (MLURI); and the Environmental Change Research Centre, University College London.

ECN also collaborates closely with research scientists in Universities and Government Research Institutes in the UK and with scientists world-wide on projects related to the detection and interpretation of environmental change.

Special Activities - applications

In the long-term, ECN's data will be used in a range of applications including policy development, policy implementation, environmental reporting, and fundamental research programmes. In the meantime, ECN sites and data are already being used in fields of policy, planning, commerce, education and the public appreciation of science. For example ECN is:

- providing instant access to regularly updated data over the Internet on a broad range of environmental attributes of public interest to inform on the ongoing consequences of such events as global climate change;
- developing indicators and information for use in national "State of the Environment" reports;
- developing data interpretation methods to enable the key features (e.g. long-term trends, seasonal patterns) of the time series data collected to be highlighted (Parr & Hirst 1999);
- providing real-time climate data from an Automatic Weather Station in the Pennines on the Internet;
- developing educational links to promote the use of its data in schools and colleges.

Site level information

ECN aims to provide a network which covers the main range of environmental conditions present in the UK. It uses sites with known management histories, existing data and a background of environmental research. There are currently 12 terrestrial sites (ranging from small 2 km^2 intensively-managed lowland agricultural establishments to large, 65 km^2, semi-natural upland areas) and 42 freshwater sites (16 lakes and 26 rivers). The distribution of sites in the UK is shown in Figure 1 and some additional detail in Table 1. Full details of all sites are available through the ECN Web pages (http://www.nmw.ac.uk/ecn/). All ECN sites undertake the standard set of measurements (Table 2.) and contribute data to the central ECN database.

Table 1. ECN core measurements

Terrestrial sites	
Meteorology	Automatic weather station: 12 variables summarised hourly, manual back-up
Atmospheric chemistry	NO_2 passive diffusion tubes (Two-weekly analyses) ammonia (DETR network)
Precipitation chemistry	UK precipitation composition network protocol Weekly analyses
Surface water discharge, chemistry & quality	Continuous discharge measurements Weekly dip samples for major ions; continuous pH, turbidity, temperature, conductivity
Soil solution chemistry	Replicated suction lysimeters at base of a & b horizons, Two-weekly samples for major ions
Soil properties	Survey at 1:10 000 or 1:25 000, five-yearly cores for major ions; 20-yearly pits for heavy metals and physical properties
Vegetation	Whole site survey with up to 500 systematic quadrats, related to the National Vegetation Classification (NVC). 50 random grid plots every nine years; plots in each NVC type every three years. In addition: linear features, permanent grass, cereals, woodland plots. Annual monitoring of sub-sample of plots.
Vertebrates	Annual census of birds, rabbits, deer, bats, frogs
Invertebrates	Moths daily; butterflies two-weekly; spittle bug nymph density and adult colour morphs; ground predators two-weekly
Soil organisms	Tipulid larvae extracted April and September
Site management	Records of management activities at the site
Freshwater sites	
Surface water	Dip samples analysed for major ions - monthly for rivers, four times per year for lakes. Continuous pH, temperature, conductivity, turbidity recording. Temperature & dissolved oxygen profiles for lakes.
Surface water flow	Stage and discharge at river sites
Chlorophyll a	Monthly for rivers, four times per year for lakes
Invertebrates	Twice-yearly at river sites, annually at lake sites Species presence, abundance and deformities
Macrophytes	Recording annually in rivers, every two years in lakes. Species presence and distribution.
Zooplankton	Sampling at lake sites four times per year
Phytoplankton	Sampling at lake sites four times per year
Epilithic diatoms	Yearly at river and lake sites. Samples archived for future analysis.

Research

ECN undertakes monitoring and research aimed at the detection and interpretation of environmental change in terrestrial and freshwater ecosystems. The measurements made by ECN are particularly relevant to environmental issues associated with some of the key pressures on ecosystems (impacts of climate change, atmospheric pollutants and changing land-use and land management) and their effects on key ecosystem responses (biodiversity, water resources (water quality and quantity) and soil quality and degradation). In recent years particular emphasis has been given to work relevant to the issues of climate change and water quality. ECN's contribution to climate change research centres on the following activities:

- monitoring and interpreting climate change impacts - indicators of cli-

mate change;

- climate change impacts on biodiversity - understanding of baseline processes including the impacts of extreme events and interactions with changes in land-use;
- the effects of drought on ecosystems;
- climate change interactions e.g. with land use and atmospheric deposition;
- monitoring key components of the carbon cycle.

The ECN/Macaulay Land Use Research Institute site at Sourhope in Scotland This is also the main site for an intensive programme of research (funded by NERC) on Soil Biodiversity. ECN work at Sourhope is sponsored by the Scottish Executive Rural Affairs Department .

ECN's structure and programme of standard measurements is specifically designed to encourage cross-site research. For example, ECN is:

- setting standards for measurements (Sykes and Lane 1996, Sykes, Lane and George 1999); providing a range of representative sites where there is good instrumentation and reliable environmental information for related research projects. ECN sites have been closely involved in some major UK research programmes run by the Natural Environment Research Council, including TIGER (Terrestrial Initiative in Global Environmental Research) and the Environmental Diagnostics Programme. More recently the upland-grassland site at ECN Sourhope (MLURI) has been used as the focus for a major research programme on Soil Biodiversity which aims to achieve simultaneously an understanding of biological diversity of the soil biota and the functional roles played by soil organisms in key ecological processes.
- providing data for the development or testing of models of environmental change, particularly in relation to the development of models for the early detection of change.
- providing an input from three of its sites to the GTOS demonstration project on Net Primary Productivity.

Individual sites also undertake their own research programmes which are associated with the research priorities of the host research organisation. Information on these can be found on individual web pages, accessible through www.nmw.ac.uk/ecn.

Information management

ECN has adopted an integrated approach to data management which aims for seamless transition from data collection to data dissemination and from data provider to data user. At the heart of ECN is a central database that integrates all data and meta-data collected under the programme (Lane 1997). Data from all network sites is sent to the ECN Central Co-ordination Unit where they are maintained under an Oracle relational database management system with links to the geographical information systems Arc/Info and Arc/View for spatial data handling. The procedures include specifications for data formats, reporting units and precisions, handling missing data, meta-information and data validation rules. Quality assurance procedures are built into all stages of data collection and data management, through quality controls embedded in the sampling protocols, data validation during processing, quality assessment exercises, and data quality 'flags' built into the meta-database.

Data Access Procedures

One of ECN's main objectives is to make its data available for research and information purposes. The aim is to have no more than a 6-month lag between data collection and the availability of validated data in the database for measurements sampled throughout the year. Annual data digests are published in hard-copy format but the ECN database can be directly accessed at three levels to meet different user requirements:

- General-purpose database query and retrieval methods are provided primarily for scientific users already familiar with SQL and with the ECN database structures.
- Users who require guided access to the data without prior training can examine the ECN summary database through a 'tailored interface' on the Web (http://www.nmw.ac.uk/ecn/). The interface enables users to build their own database query by selecting any combination of ECN Sites, Core Measurement variables and date ranges for instant generation of tables and graphs. Data may also be downloaded *via* E-mail for import into local software.
- ECN also provides access to 'real-time' data *via* the Web from an automatic weather station (AWS) at the Moor House/Upper Teesdale site in the north Pennines. The AWS generates a summary dataset each hour which is transmitted via a modem link to the ECN CCU, and automatically displayed as graphs and tables on ECN's Web site.

Data licensing

Summary data are freely available, either from data digests or over the Internet, without the need for a licence. Raw data are available under authorisation and licence with charges levied according to the proposed use.

Collaboration among networks

ECN forms part of an observing hierarchy within the UK that is similar to that adopted by the Global Terrestrial Observing System (GTOS)/Global Hierarchical Observing Strategy (GHOST). At the most general level within the UK is the Institute of Terrestrial Ecology's Land

References

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Journal of Environmental Management, 51 (1), 87-105.

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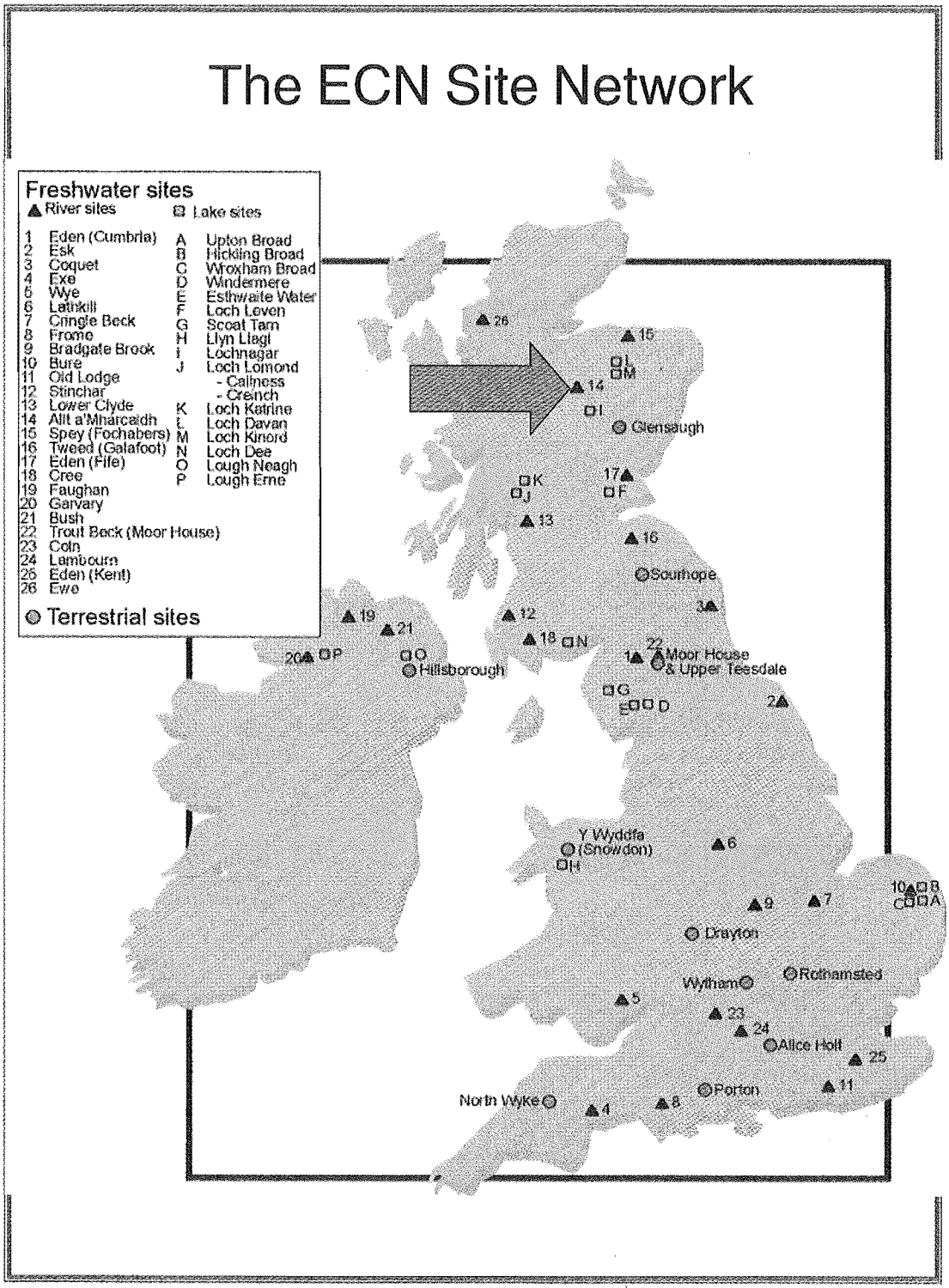
Sykes, J. M., Lane, A. M. J. & George, D.G. (1999). (eds.) *The UK Environmental Change Network: Protocols for standard measurements at freshwater sites.* ITE, Huntingdon.

Tinker, P.B. (1994). Monitoring Environmental Change through Networks. In:- Leigh, R.A. and Johnston, A.E. (Eds). Long-term Experiments in Agricultural and Ecological Sciences. pp 407-421. CAB International: Wallingford.

Cover Map of GB (Barr *et al* 1993) which gives 100% coverage based on satellite imagery circa 1990. At the next level comes detailed field recording (Countryside Surveys) in a sample of 1 km squares across GB at intervals of 6 to 10 years (Barr *et al* 1993). At the final level, ECN contributes detailed and continuous data from its network of 54 terrestrial and freshwater sites across the UK. ECN is also linked to thematic networks within the UK. These include: the Acid Waters Monitoring Network, DETR Air Quality Monitoring networks, DETR Ammonia Monitoring Network, Biological River Quality Surveys, Butterfly Monitoring Scheme, Chemical River Quality surveys, British Trust for Ornithology's Common Birds Census/Breeding Bird Survey, DETR Countryside Survey 1990/2000, Forest Health Surveys, GB Harmonized Water Monitoring Scheme, Meteorological Office Weather Stations, National Vegetation Classification, River Habitat Survey, IACR Rothamsted Insect Surveys and national soil surveys (Soil Survey and Land Research Centre (SSLRC), MLURI, DANI).

ECN is also a UK focal point for international links connected with long-term integrated monitoring and is becoming increasingly involved in international wider-scale monitoring initiatives such as the Global Terrestrial Observing System (GTOS). At a European level, ECN is involved in a project in the ENRICH programme (European Networking of Research in Global Change) - on "Networking of Long-term Integrated Monitoring in Terrestrial Systems" (NoLIMITS). NoLIMITS is preparatory action aimed at developing an implementation plan for improved networking integrated site monitoring programmes in Europe (http://nolimits.nmw.ac.uk/). It is headed by a consortium of research organisations including ECN, the Finnish Environment Institute (which administers the Integrated Monitoring Programme) and the Hungarian Academy of Sciences, and is working with the European Environment Agency, the Centre for Earth Observation project and GTOS to ensure that plans are targeted towards the requirements of the main user communities for a continental scale network.

Figure 1. Distribution map of ECN sites. The new terrestrial site in the Cairngorms is highlighted.



United Kingdom: Table of Site Information

Site name	Date	Principal biomes	Research themes	Types and lengths of data sets	Affiliation
Drayton (Site Code: T01)	Site occupied by the Ministry of Agriculture, Fisheries and Foods in 1940 in order to establish it as a Grassland Research Institute site.	Arable farmland	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Agricultural Development and Advisory Service / Ministry of Agriculture, Fisheries and Food
Glensaugh (Site Code: T02)	1954	Moorland, upland agriculture	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Macaulay Land Use Research Institute / Scottish Executive Rural Affairs Department
Hillsborough (Site Code: T03)		Agiculture and woodland.	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Department of Agriculture for Northern Ireland
Moor House-Upper Teesdale (Site Code: T04)	1952	Upland - blanket peatland, acid grassland, meadows and deciduous woodland.	Climate change, land use change, water quality, biodiversity, soils, freshwater ecology.	Standard ECN measurements (see table) plus vegetation (since 1952), climate and stream discharge (since 1960s).	Centre for Ecology and Hydrology, Natural Environment Research Council / English Nature
North Wyke (Site Code: T05)		Lowland agricultural grassland.	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Institute of Grassland and Environmental Research, Biotechnology and Biological Sciences Research Council
Rothamsted (Site Code: T06)		Lowland arable/ woodland	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Institute of Arable Crops Research, Biotechnology and Biological Sciences Research Council
Sourhope (Site Code: T07)	1954	Moorland/ upland agriculture.	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Macaulay Land Use Research Institute / Scottish Executive Rural Affairs Department
Wytham (Site Code: T08)		Woodland/arable	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Centre for Ecology and Hydrology, Natural Environment Research Council
Alice Holt (Site Code: T09)	1947	Woodland	Climate change, land use change, water quality, biodiversity, soils and forestry.	Standard ECN measurements (see table) plus meteorological data since 1949.	Forestry Commission
Porton (Site Code: T10)		Chalk grassland/woodland	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	Defence Evaluation and Research Agency / Ministry of Defence
Snowdon (Site Code: T11)		Upland grassland	Climate change, land use change, water quality, biodiversity, soils	(Standard ECN measurements - see table)	(Cyngor Cefn Gwlad Cymru - Countryside Council for Wales & Cynulliad Cenedlaethol Cymru - The National Assembly for Wales

Scientific contact	Address	Area (ha)	Location	Neareast town that would appear on a large scale map
Stuart Corbett	ADAS Drayton Alcester Road STRATFORD UPON AVON Warwickshire CV37 9RQ Tel: 01789 293057 Fax: 01789 414393 Email: Stuart_ Corbett@adas.co.uk http://www.nmw.ac.uk/ecn	c. 2km^2	1°45 W 52°12 N	Stratford-upon-Avon, Warwickshire
Dr John Milne	Macaulay Land Use Research Institute Craigiebuckler ABERDEEN AB9 2QJ Tel: 01224 318611 Fax: 01224 311556 Email: J.Milne@mluri.sari.ac.uk http://www.nmw.ac.uk/ecn	c. 10 km^2	2°30 W 56°51 N	14) Aberdeen/ 30 miles NE
Dr Roy Anderson	Dept Agriculture and Food Science Newforge Lane BELFAST BT9 5PX Northern Ireland Tel: 01232 255347 Fax: 01232 662007 Email:Roy.Anderson@dardni.gov.uk http://www.nmw.ac.uk/ecn	c. 5km^2	6°5 W 54°27 N	Belfast
John Adamson	Centre for Ecology and Hydrology Merlewood Research Station GRANGE-OVER-SANDS, Cumbria LA11 6JU Tel: 015395 32264 Fax: 015395 34705 Email: jka@ceh.ac.uk http://www.nmw.ac.uk/ecn/sites/moorh.html	c. 74 km^2	2°20 W 54°40 N	15 km south of Alston , Cumbria
Roger Smith	North Wyke Research Station North Wyke OKEHAMPTON EX20 2SB Devon Tel: 0183 782558 Fax: 0183 782139 Email: roger.smith@bbsrc.ac.uk http://www.nmw.ac.uk/ecn	c. 2.5 km^2	3°54 W 50°46 N	Okehampton, Devon
Paul Hargreaves and John Bater	Rothamsted Experimental Station HARPENDEN, Herts AL5 2JQ Tel: 01582 763133 Fax: 01582 760981 Email: paul.hargreaves@bbsrc.ac.uk john.bater@bbsrc.ac.uk http://www.nmw.ac.uk/ecn	c. 2.5 km^2	0°22 W 51°49 N	Harpenden, Hertfordshire
Dr John Milne	Macaulay Land Use Research Institute Craigiebuckler ABERDEEN AB9 2QJ Tel: 01224 318611 Fax: 01224 311556 Email: J.Milne@mluri.sari.ac.uk http://www.nmw.ac.uk/ecn	c. 11 km^2	2°15 W 55°30 N	Kelso, Roxburghshire/ 11 miles NW
Dr Michael Morecroft	University Field Laboratory Wytham OXFORD OX2 8QJ Tel: 01865 202619 Fax: 0185 202612 Email:mdm@ceh.ac.uk http://www.nmw.ac.uk/ecn	c. 11 km^2	1°20 W 51°47 N	Oxford
Sue Benham	Alice Holt Lodge Wrecclesham FARNHAM Surrey GU10 4LH Tel: 01420 22255 Fax: 0140 23653 Email: S.Benham@forestry.gov.uk http://www.nmw.ac.uk/ecn	c. 9 km^2	0°50 W 51°10' N	Farnham, Surrey
(appointment pending)	CBDE Porton, Porton Down SALISBURY Wiltshire SP4 0JQ Tel: 01980 613564 Fax: 01980 613690 http://www.nmw.ac.uk/ecn	c. 12 km^2	1°43 W 51°7 N	Salisbury, Wiltshire
Alex Turner	Countryside Council for Wales Plas Penrhos Fford Penrhos BANGOR Gwynedd LL57 2LQ Tel: 01248 370444 Fax: 01248 355782 Email: A.Turner@ccw.gov.uk http://www.nmw.ac.uk/ecn	c. 5.5 km^2	4°5 W 53°4' N	Bangor, Gwynedd

United Kingdom: Table of Site Information

Site name	Date	Principal biomes	Research themes	Types and lengths of data sets	Affiliation
~~Cairngorms~~ (Site Code: T12)		~~Moorland/ upland~~ woodland.	~~Climate change, land~~ use change, water quality, biodiversity, soils	~~(Standard ECN measurements~~ - see table)	~~Scottish Natural~~ Heritage and the Natural Environment Research Council
Eden, Cumbria (Site Code: R01)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, North West Region
Esk (Site Code: R02)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology.	(Standard ECN measurements - see table)	Environment Agency, North East Region
Coquet (Site Code: R03)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, North East Region
Exe (Site Code: R04)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, South West Region
Wye (Site Code: R05)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Welsh Region
Lathkill (Site Code: R06)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Midlands Region
Cringle (Site Code: R07)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Midlands Region
Bradgate Brook (Site Code: R09)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Midlands Region
Bure (Site Code: R10)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Anglian Region
Old Lodge (Site Code: R11)	1988	River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Acid Waters Monitoring Network
Stinchar (Site Code: R12)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, West Region
Lower Clyde (Site Code: R13)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, West Region
Allt a' Mharcaidh (Site Code: R14)	1983	River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, North Region

Scientific contact	Address	Area (ha)	Location	Neareast town that would appear on a large scale map
~~Dr Neil~~ Bayfield	~~Centre for Ecology and Hydrology~~ Banchory Research Station Hill of Brathens Glassel BANCHORY Kincardineshire AB31 4BY Tel: 01330 826300 Fax: 01330 823303 Email: nb@ceh.ac.uk http://www.nmw.ac.uk/ecn	~~c. 10 km^2~~		~~Aviemore, Highland Region~~
Mr Dave Jowett	Environment Agency Rivers House Waterside Drive Aztec West Almondsbury BRISTOL BS12 4UD Tel: 01454 624400 Fax: 01454 624409 Email: dave.jowett@environment-agency.gov.uk http://www.nmw.ac.uk/ecn		54°39N 2°37 W	Penrith, Cumbria
Mr Dave Jowett	(See above)		54°28N 0°38W	
Mr Dave Jowett	(See above)		55°21N 1°38W	
Mr Dave Jowett	(See above)		50°48N 3°31W	Exeter, Devon
Mr Dave Jowett	(See above)		51°47N 2°40W	
Mr Dave Jowett	(See above)		53°11N 1°40W	
Mr Dave Jowett	(See above)		52°50N 0°38W	
Mr Dave Jowett	(See above)		52°41N 1°14W	
Mr Dave Jowett	(See above)		52°43N 1°21E	
Don Monteith	ENSIS Environmental Change Research Centre University College London 26, Bedford Way London WC1H 0AP Tel: 0171 436 9248 Fax: 0171 380 7565 Email: dmonteit@geography.ucl.ac.uk http://www.nmw.ac.uk/ecn	catchment = 240 ha, water course length above sampling point approx 2 km	51°3N 0°5E	10 km south of East Grinstead
Dr David Pirie	Scottish Environment Protection Agency, West Region 5, Redwood Crescent, Peel Park, East Kilbride G74 5PP Tel: 01355 574200 Fax: 01355 574688 Email: Fiona.Fleming@sepa.org.uk http://www.nmw.ac.uk/ecn		55°6N 5°0W	
Dr David Pirie	(see above)		55°51N 4°14W	
Dr Roger Owen	Scottish Environment Protection Agency, North Region Greyhope House Greyhope Road ABERDEEN AB11 9RD Tel: 01224 248338 Fax: 01224 248591 Email: roger.owen@sepa.org.uk http://www.nmw.ac.uk/ecn		57°7N 3°51W	

United Kingdom: Table of Site Information

Site name	Date	Principal biomes	Research themes	Types and lengths of data sets	Affiliation
Spey (Site Code: R15)	1980	River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, North Region
Tweed (Site Code: R16)	1994	River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, East Region
Eden, Fife (Site Code: R17)	1994	River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, East Region
Cree (Site Code: R18)	1995	River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, West Region
Faughan (Site Code: R19)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Department of the Environment, Northern Ireland
Garvary (Site Code: R20)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Department of the Environment, Northern Ireland
Bush (Site Code: R21)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Department of Agriculture and Rural Development
Trout Beck (Site Code: R22)			Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Centre for Ecology and Hydrology, Natural Environment Research Council
Coln (Site Code: R23)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Thames Region
Lambourn (Site Code: R24)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Thames Region
Eden, Kent (Site Code: R25)		River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Southern Region
Ewe (Site Code: R26)	1999	River	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, North Region
Upton Broad (Site Code: L01)		Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Anglian Region
Hickling Broad (Site Code: L02)		Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Anglian Region

Scientific contact	Address	Area (ha)	Location	Neareast town that would appear on a large scale map
Dr Roger Owen	(see above)		57°37N 3°6W	
Mr Brian Clelland	Scottish Environment Protection Agency, East Region1 South Street PERTH PH2 8NJ Tel: 01738 627989 Fax: 01738 630997 Email: Brian.Clelland@sepa.org.uk http://www.nmw.ac.uk	160 km	55°36N 2°46W	Edinburgh, 45 km north west.
Mr Brian Clelland	(see above)	49 km	56°20N 2°56W	St Andrews, 10 km to the east.
Dr David Rendall	Scottish Environment Protection Agency, West Region Rivers House Irongray Road Dumfries DG2 0JE Tel: 01387 720502 Fax: 01387 721154 Email: David.Rendall@sepa.org.uk http://www.nmw.ac.uk		54°57N 4°28W	
Ms Carol Majury	Department of the Environment, Northern Ireland Environment and Heritage Service Calvert House 23 Castle Place BELFAST BT1 1FY Tel: 01232 254824 Fax: 01232 254761 Email: carol.majury@doeni.gov.uk http://www.nmw.ac.uk		55°01N 7°15W	Derry, County Londonderry
Ms Carol Majury	(see above)		54°31N 7°59W	Enniskillen, County Fermanagh
Dr Bob Foy	Agricultural and Environmental Science Divison Department of Agriculture and Rural Development Newforge Lane BELFAST BT9 5PX Tel: 44 (0) 2890 255512 Fax: 44 (0) 2890 382244 Email:Bob.Foy@dardni.gov.uk http://www.nmw.ac.uk		55°12N 6°31W	
Mr John Adamson	Institute of Terrestrial Ecology Merlewood Research Station Windermere Road Grange-over-Sands Cumbria LA11 6JU Tel: 015395 32264 Fax: 015395 34705 Email: jka@ite.ac.uk http://www.nmw.ac.uk/ecn		54°42N 2°22W	
Mr Dave Jowett	Environment Agency Rivers HouseWaterside Drive Aztec West Almondsbury BRISTOL BS12 4UD Tel: 01454 624400 Fax: 01454 624409 Email: dave.jowett@environment-agency.gov.uk http://www.nmw.ac.uk/ecn		51°41N 1°42W	
Mr Dave Jowett	(see above)		51°25N 1°21W	
Mr Dave Jowett	(see above)		51°10N 0°10E	
Dr Roger Owen	Scottish Environment Protection Agency, North Region Greyhope House Greyhope Road ABERDEEN AB11 9RD Tel: 01224 248338 Fax: 01224 248591 Email: roger.owen@sepa.org.uk http://www.nmw.ac.uk/ecn		57°45N 5°36W	
Mr Dave Jowett	Environment Agency Rivers House Waterside Drive Aztec West Almondsbury BRISTOL BS12 4UD Tel: 01454 624400 Fax: 01454 624409 Email: dave.jowett@environment-agency.gov.uk http://www.nmw.ac.uk/ecn		52°40N 1°32E	
Mr Dave Jowett	(see above)		52°44N 1°35E	

United Kingdom: Table of Site Information

Site name	Date	Principal biomes	Research themes	Types and lengths of data sets	Affiliation
Wroxham Broad (Site Code: L03)		Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Environment Agency, Anglian Region
Windermere (Site Code: L04)	1929	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	Standard ECN measurements (see table) plus temperature (since 1947), oxygen (1968), chlorophyll a (1964), algae (1945), pH (1984), lake level (1952)	Centre for Ecology and Hydrology, Natural Environment Research Council
Esthwaite (Site Code: L05)	1929	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	Standard ECN measurements (see table) plus temperature (from 1947), oxygen (1967), chlorophyll a (1964), algae (1945), pH (1984)	Centre for Ecology and Hydrology, Natural Environment Research Council
Loch Leven (Site Code: L06)		Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Centre for Ecology and Hydrology, Natural Environment Research Council
Scoat Tarn (Site Code: L07)	1988	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Acid Waters Monitoring Network
Llyn Llagi (Site Code: L08)	1988	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Acid Waters Monitoring Network
Lochnagar (Site Code: L09)	1988	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Acid Waters Monitoring Network
Loch Lomond (Site Code: L10)		Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, West Region
Loch Katrine (Site Code: L12)	1994	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, West Region
Loch Davan (Site Code: L13)	1980	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, North Region
Loch Kinord (Site Code: L14)	1980	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, North Region
Loch Dee (Site Code: L15)	1980	Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Scottish Environment Protection Agency, West Region
Lough Neagh (Site Code: L16)		Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Department of Agriculture and Rural Development
Lough Erne (Site Code: L17)		Lake	Climate change, land use change, water quality, biodiversity, freshwater ecology	(Standard ECN measurements - see table)	Department of Agriculture and Rural Development

Scientific contact	Address	Area (ha)	Location	Neareast town that would appear on a large scale map
Mr Dave Jowett	(see above)		52°41N 1°25E	
Dr Glen George	Centre for Ecology and Hydrology The Ferry House Far Sawrey Ambleside LA220LP Tel: 015394 42468 Fax: 015394 46914 Email: dgg@ife.ac.uk http://www.nmw.ac.uk/ecn	14.7 km^2	54°24N 2°57W	
Dr Glen George	(see above)	1.0 km^2	54°22N 2°59W	Kendal
Dr Linda May	Centre for Ecology and Hydrology Edinburgh Research Station Bush Estate Penicuik Midlothian EH26 0QB Tel: 0131 445 4343 Fax: 0131 445 3943 Email: lmay@ife.ac.uk http://www.nmw.ac.uk/ecn		56°12N 3°23W	
Don Monteith	ENSIS Environmental Change Research Centre University College London 26, Bedford Way London WC1H 0AP Tel: 0171 436 9248 Fax: 0171 380 7565 Email: dmonteit@geography.ucl.ac.uk http://www.nmw.ac.uk/ecn	lake 5.2 ha catchment (excl. lake) 95 ha	54°29N 3°18W	10 km east of Gosforth
Don Monteith	(see above)	lake 5.7 ha catchment (excl. lake) 157 ha	53°1N 4°1W	10 km east of Beddgelert
Don Monteith	(see above)	9.8 ha catchment (excl. lake) 91.9 ha	56°58N 3°14W	15 km southwest of Ballater
Dr David Pirie	Scottish Environment Protection Agency, West Region 5, Redwood Crescent, Peel Park, East Kilbride G74 5PP Tel: 01355 574200 Fax: 01355 574688 Email: Fiona.Fleming@sepa.org.uk http://www.nmw.ac.uk/ecn		56°13N 4°41W	
Mr Brian Clelland	Scottish Environment Protection Agency, East Region 1 South Street PERTH PH2 8NJ Tel: 01738 627989 Fax: 01738 630997 Email: Brian.Clelland@sepa.org.uk http://www.nmw.ac.uk/ecn	14 km^2	56°14N 4°26W	Stirling - 35 km to south east
Dr Roger Owen	Scottish Environment Protection Agency, North Region Greyhope House Greyhope Road ABERDEEN AB11 9RD Tel: 01224 248338 Fax: 01224 248591 Email:roger.owen@sepa.org.uk http://www.nmw.ac.uk/ecn		57°6N 2°55W	
Dr Roger Owen	(see above)		57°5N 2°55W	
Dr David Rendall	Scottish Environment Protection Agency, West RegionRivers HouseIrongray Road Dumfries DG2 0JE Tel: 01387 720502 Fax: 01387 721154 Email: David.Rendall@sepa.org.uk http://www.nmw.ac.uk/ecn		55°5N 4°23W	
Dr Bob Foy	Agricultural and Environmental Science Divison Department of Agriculture and Rural Development Newforge Lane BELFAST BT9 5PX Tel: 44 (0) 2890 255512 Fax: 44 (0) 2890 382244 Email:Bob.Foy@dardni.gov.uk http://www.nmw.ac.uk & http://www.afsni.ac.uk/Research/eutrophication.htm		54°37N 6°24W	
Dr Bob Foy	(see above)		54°29N 7°51W	

The Brazilian Long Term Ecological Research Program: present status and perspectives for the new decade

F.A. R. Barbosa[1], G. A. B. da Fonseca[1,2], R. B. Cavalcanti[3] and M. T. da Fonseca[2]

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[2]Conservation International-Brazil-Av. Antonio Abrão Caram, 820/302 - 31275-000 Belo Horizonte-MG-Brazil ;
[3] University of Brasília-Department of Zoology-Asa Norte - 70910-919 Brasília, DF, Brazil

Brazil is arguably the richest country on Earth in biological diversity. The sheer size of the nation, with five highly diverse biomes (Amazonia, Cerrado, Atlantic Forest, Caatinga and the Wetlands (Pantanal), ranging from semi-arid ecosystems to evergreen tropical rain forests, all conspire to make Brazil the top megadiversity countries, possessing c. 10-20% of the total number of known species on Earth. On the other hand, the threats to the integrity of Brazil's biodiversity do not cease to grow, a dangerous trend given the poor level of knowledge available on the composition, processes and dynamics of its native ecosystems. Given that the investigation of critically-important ecological phenomena, relevant to the use and conservation of biological resources, demands not only descriptive studies but also monitoring of long-term trends, research agencies, universities and government institutions have proposed the establishment of a long-term Ecological Research Program for Brazil, borrowing from the experience of LTER initiatives in other countries and regions.

Network history

The dynamics leading to the creation of the Brazilian LTER were facilitated by a recent initiative within CNPq, represented by the Integrated Ecology Program (IEP), that is boosting ecological research and higher level training of investigators on a more systemic basis, under a specific budget line provided by the federal government. Using a similar approach, the IEP will be concentrating on a common research agenda, composed of five priority themes, and will serve as a support base for the nascent LTER program

The Brazilian LTER consists of an integrated and commonly agreed research agenda, the execution of which concentrated on a network of selected sites representing the various major ecosystems of the country, starting in areas which already host a significant number of programs of ecological investigation, as well as maintain adequate on-the-ground research facilities. It is necessary to recognize the important role played by the North American LTER program, now on its 17th year of activity, and sponsored to a large extent by the United States National Science Foundation (NSF), in the development of the Brazilian LTER network. Under the leadership of James Gosz and his colleagues, several preparatory meetings were held to familiarize Brazilian scientists on the experience, goals and strategies of the LTER approach to ecological investigation.

A coordinating committee put together by the Brazilian National Research Council (CNPq) identified several criteria to be used in the process of site selection to be conducted using, as baseline, a large number of candidate areas distributed throughout the major Brazilian biomes. In addition to the obvious choice of sites with a minimum amount of background studies, adequate field facilities, as well as ongoing, well funded, research programs, including national and international collaborative working links, ideally the network should build a representation component in its general design, meaning a large enough scope of sites to deal with regional and local ecosystem diversity. Unfortunately, this latter criterion is the most difficult to comply with, since the research capacity of the country is heavily concentrated on a limited number of regions, particularly in the southeast. Therefore, it was felt that this has to be seen as a longer-term goal, and the budding LTER should take a more conservative approach to its early phase, focusing on a small number of well-developed sites. Moreover, it was decided that a "bonus point" would be given to sites that were part of the Brazilian protected areas system, meaning they would provide a good level of security for the hosting of long-term research activities.

After an elaborate process of consultation with the scientific community, through several meetings of the committee, together with four larger workshops that took place in Puerto Rico, Panama and Costa Rica, culminating with a final event in Foz do Iguaçu, Brazil, a list of candidate sites was compiled, covering virtually all major Brazilian biomes. The site proposals were accompanied by information of the general ecological setting, past studies and ongoing research programs. From this list a special committee organized by the National Research Council (CNPq) selected 9 sites to initiate the program: one in the Amazon region (two core areas), one in the wetlands of central Brazil (two core areas), one in the cerrados/savannas of central Brazil, two in the southeast, and three in the southern region, including a coastal area and managed forests.

A set of 7 other sites were also selected considering the expansion of the network and the inclusion of important areas for the country (e. g. Caatinga, flooded forests) not selected in the first phase.

Network management

The Brazilian LTER Program (B-LTER) constitutes a collaborative effort among scientists and students working in distinct areas all over the country. A coordinating committee formed by 3 scientists and 2 representatives of the National Research Council is responsible for conducting the major policies for the network. Each research site has a coordinator responsible for the research activities at the site level as well as to make the applications for the planned activities. At present the chairperson of the program is Professor Francisco Barbosa, who is also the coordinator of the State Park of Rio Doce/Caratinga Biological Station site, within the biggest remnant of the Atlantic Forest in the State of Minas Gerais.

The program counts with a special line of support coming from the National Research Council (CNPq). At present, CNPq is providing annually US$1,000,000.00 to support research activities among the selected sites, a modest amount considering the existing infrastructure and needs of each site. Financial support shall also come from other governmental agencies to be disbursed on a competitive basis in order to guaranteeing the program for the next 10 years. Additional financial support is an urgent need of the program together with partnerships to maintain research activities. A recent agreement, under discussion, in order to combine research interests between the Center for Applied Biodiversity Studies-CABS of Conservation International (CI) and the Brazilian LTER program is an example. Furthermore, tentative to develop joint research are under consideration, involving existing programs such as

DIVERSITAS, LBA, and others.

The Brazilian program focuses on a common research agenda: (a) Conservation of biodiversity, (b) Pattern and control of primary and secondary productivity, (c) Population dynamics and organization of communities and ecosystems, (d) Nutrient dynamics; and (e) Effects of natural and human disturbance.

Partnerships

Notwithstanding the central coordinating role of the National Research Council-CNPq as the major government agency funding B-LTER Program, it is strongly recognized that additional partnerships need to be established, particularly with other national (Ministry for the Environment, Ministry of Education, Funding Agency for Studies and Projects - Finep) and international agencies and institutions already active in a number of the proposed sites throughout Brazil. A long-term programmatic integration of the Brazilian initiative with those of other countries and regions (e.g., US-LTER, Latin American LTER, among others) will also be pursued, together with the attraction of selected research groups in key countries with a strong tradition in the priority research lines envisioned in the B-LTER.

As referred previously, an agreement between the Center for Applied Biodiversity Studies (CABS) of Conservation International-Washington, DC and CNPq is under discussion and hopefully shall bring technical and financial support to some of the research sites in Brazil. Such cooperation will allow for the intensification of biodiversity assessments, particularly in forested areas, for which a proposed research protocol started to be envisaged during the workshop "Assessing & Monitoring the Status of Biodiversity in Tropical Forest Habitats", held in Washington, DC in April 1999. Furthermore, an exchange program of visiting scientists is under discussion from which cross-sites research activities are hopped to be scheduled in the near future.

Special activities

Some of the sites within the B-LTER have been conducting activities aiming at local communities, among which environmental education programs deserve special attention. The activities conducted with local fishermen within Mamirauá Sustainable Development Reserve (still not included within this first set of sites) and those conducted with the join participation of schools and organized groups of some of the municipalities at the surroundings of the Rio Doce State Park (site number 4) are encouraging examples of public outreaches.

Site-level information

A network web site URL was created at the Institute of Biological Sciences of the Federal University of Minas Gerais, and further information can be found at www.icb.ufmg.br/~peld.

More detailed information at site level are as follow

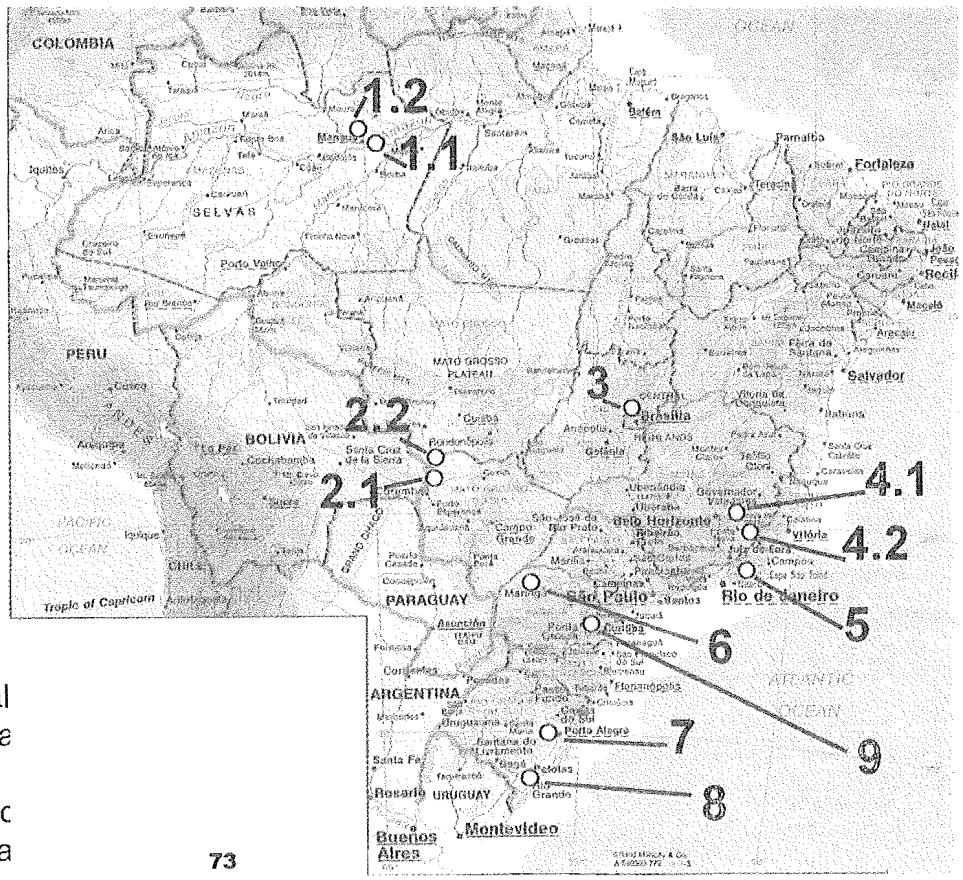
Site 1.1.Manaus

Research topics include collaborative basic studies on vegetation (New York Botanical Garden and DFID-UK); soils (IRD-ORSTOM); forest climate (UK), hydrology (USA), atmosphere (NASA), and fauna (Germany). Monitoring of climatological data for central Amazonia was initiated in 1955 and a data bank since 1970 is available. Tree phenology data tions of plants and animals; gene flow within and inter-populations; phyto-sociology and floristic assessments of forest fragments; evaluation of eco-physiological processes and impacts of deforestation; evaluation of growth/productivity of natural vegetation; nutrient cycling and decomposition; biodiversity assessments (bacteria, yeast, algae, protozoa, rotifers, microcrustaceans benthos and fishes; arthropods and mammals); up-dating and organization of socioeconomic data set; development of socioeconomic indices; environmental education with local schools, industries and municipalities.

International collaborations: Balaton Limnological Institute and University of Veszprem (Hungary); GTZ (Germany); US Fish and Wildlife Service.

Infrastructure: lodging, classroom with slide and overhead projectors, laboratory facilities, forest tracks, boats, telephone/fax. Internet facilities are under installation.

Brazil LTER Sites



1.1 Manaus
1.2 Biological Dynamics of Forest Fragments
2.1 Base de Estudos do Pantanal (wetlands)
2.2 Nhumirim Research Station
3 IBGE Ecological Reserve
4.1 Rio Doce State Park
4.2 Caratinga Biological Station
5 Restinga de Jurubatiba National
6 Flooded areas of the upper Para
7 Taim Hydrological System
8 Patos Lagoon Estuary and adjac
9 Ecosilbivras (seven experimenta

Site 4.2. Caratinga Biological Station

Research topics: ecology and behavior of Brachyteles arachnoides hypoxanthus the biggest primate of South America; studies of other mammals (Felis geoffroyi, F. yaguaoundi) have also initiated.

Infrastructure: lodging and tracks.

Site 5. National Park Restinga de Jurubatiba

Research topics: Plankton ecology; Phytosociology and eco-physiology of restinga vegetation; insect population dynamics; fish ecology; environmental education program involving local schools and industries.

International collaborations: Institut fur Gewaesserroekologie und Binnenfischerei (Germany); University of Lund (Sweden), University of Minnesota.

Infrastructure: lodging, classroom, small library, laboratory, internet facilities, and kitchen.

Site 6. Flooded areas of the upper Paraná river

Research topics: ecology of flooded areas and ecology of reservoirs, considering mainly: heavy metals; aquatic macrophytes; plankton, fishes, biodiversity assessments (birds, small mammals) and socioeconomic aspects of the occupation of the floodplains.

International cooperation: University of Glasgow, Texas A & M University, Mississipi State University and University of Lodz (Poland).

Infrastructure: lodging well equipped laboratories, boats including a boat-laboratory, kitchen, permanent supporting staff (pilot, fishermen, mechanics).

Site 7 Taim Hydrological System (subtropical wetlands)

The system is located in between the Atlantic ocean and Mirim lagoon, in the south of the State of Rio Grande do Sul (32(20'-33(00' S; 52(20'-52(45'W), with an area of 2254 km2.

Furthermore, this system includes the Taim Ecological Station with an area of 33,935 ha containing wetlands/swamps, sand beaches, dunes, lakes and forest fragments.

Research topics: hydrology/hydrodynamics; plankton, benthon and aquatic macrophytes; environmental education.

Infrastructure: lodging, boats

Site 8. Patos Lagoon Estuary and Adjacent Coast

Research topics: Circulation of estuarine and coastal waters; remote sensing and GIS methods in coastal environments; suspended matter dynamics; meteorological and physico-chemical factors and phytoplankton composition and biomass to monitor eutrophication; effect of UV radiation on selection and production of phytoplankton and on microbial degradation of POM and detritus production; population dynamics of coastal plants; effect of biological interactions and environmental stress on structure and function of intertidal plant communities; ecology of fish eggs and larvae; ecology of benthic invertebrates; structure and vegetation ecology of southern Brazilian coastal foredune; experimental restoration of coastal foredune vegetation.

International cooperation: University of Maryland, Scripps Institution of Oceanography, Brow University, University of South Carolina, NASA, South Atlantic Climate Change Consortium (IAI-NSF/CRN), Canadian Center of Remote Sensing, University of East Anglia, UK, University of Copenhagen, Universität Kiel, Germany, Intergovernmental Oceanographic Commission COI, France, Lund University, Sweden, University of Kalmahr, Sweden, Universidad de la Republica, Uruguay, Instituto Nacional da Pesca, Uruguay, Universidad Nacional de Mar del Plata, Argentina

Site 9. Ecosilvibras (Sustainable Management and Conservation of forest ecosystems.

The ECOSILVIBRAS research site is composed of seven Ecological Research Plots, as follow: São João do Triunfo Experimental Station (25o 41'S; 50o 9'W), Reata Farm (20 o 20'S; 46 o 40'W), São Francisco de Paula National Forest (29 o 23'S; 50 o 23'W), Experimental area at Jari project (00o 55'S; 52 o 20'W), Gralha Azul Farm (25 o 43'S; 49 o 12'W), Araucaria State Park (26 o 17'S; 51 o 20'W), and São Francisco Farm (25 o 45'S; 49 o 05'W).

The seven experimental plots comprise various forest ecosystems (alluvial Araucaria subtropical forest, mountain Araucaria subtropical forest, hill dense tropical rain forest, plateau dense tropical rain forest, seasonal subtropical semi-deciduous forest, and transitional ecosystems (mixed forest plantations).

• Research topics: forest photo-interpretation, remote sensing and pho-

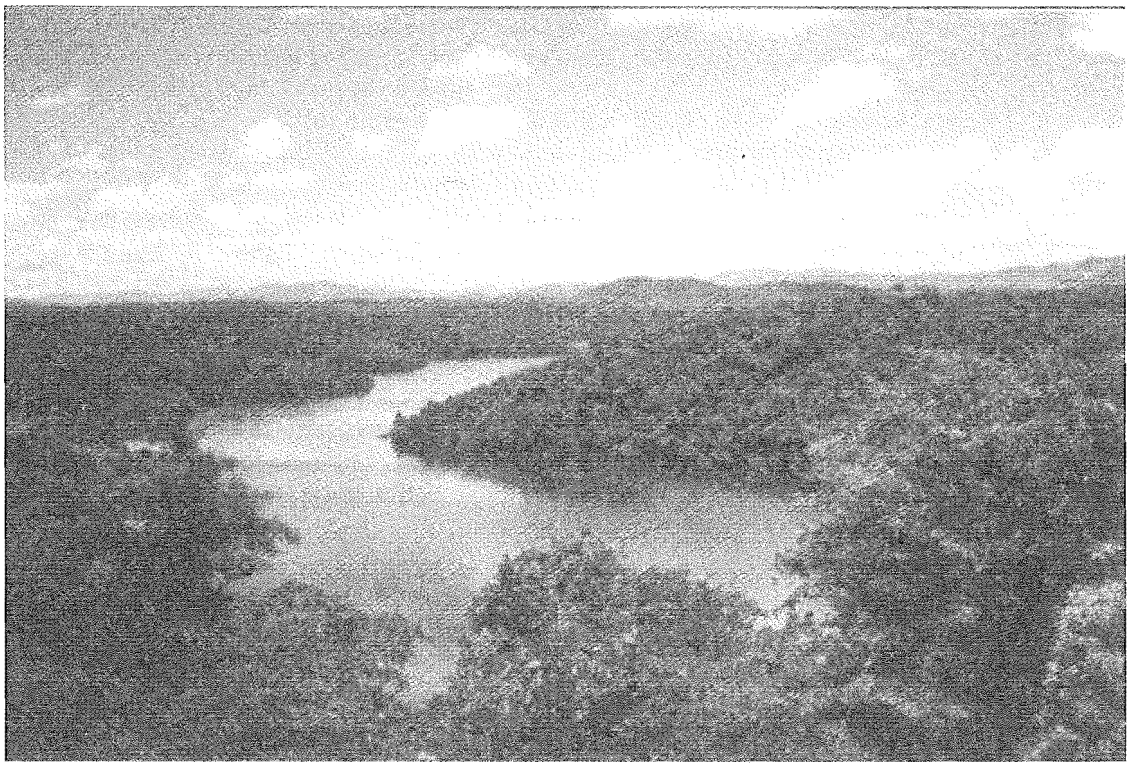
Brazil: Table of Site Information

Site Name	Date	Principal biomes	Research themes
1.1. Manaus (INPA's forest reserves) with 3 core areas	1962	Lowland evergreen forest; Riverine forest; Tall heath forest	Plant biomass/growth; nutrient cycling; plant and animal diversity; soil hydrology and chemistry
1.2. Areas of the project Biological Dynamics of Forest Fragments	1979	Forest fragments surrounded by pasture/secondary growth	Effects of logging and fragmentation on forest diversity and processes; regeneration;
2.1. Base de Estudos doPantanal (Wetlands):	1992	Cerrados/ Wetlands	Hydrologic dynamics; hydrology; population/community ecology
2.2 Nhumirim Research Station	1985	Cerrados/Wetlands	Management/monitoring of wildlife populations; impact of pastureland;
3. IBGE Ecological Reserve	1986	Cerrados (savannas)	Biological diversity of grasslands; fire impacts
4.1. State Park of Rio Doce	1977	Atlantic forest; lakes/swamps; rivers/streams; Eucalyptus plantations	Biodiversity assessment (genetic, population and community levels); socio-economic aspects; environmental education
4.2. Caratinga Biological Station	1983	Atlantic forest	Ecology/behaviour of Primates, mainly Muriqui Brachytelis arachnoides; phytosociology assessments
5. National Park Restinga de Jurubatiba	1995	Coastal Atlantic Forest; restingas; mangroves	Phytosociology; plant population; dynamics of insects; plankton ecology; fish communities;
6. Flooded areas of the upper Paraná river	1990	Paraná river Main stream; tributaries;lakes	Plankton, benthon, fish and macrophytes
7.Taim Hydrological System.	1996	Wetlands/swamps; dunes, sand beaches, lakes, grassland, forest	Hydrology/hydrodynamics plankton, benthon and macrophytes; environmental education
8. Patos Lagoon Estuary and Adjacent Coast	1973	Estuary; coastal waters	Water circulation; plankton and fish studies; coastal plants population dynamics
9. Ecosilvibras (7 exper. plots)	1990	Subtropical forests/mixed planted forests	Pollution monitoring; water availability; biodiversity assessments

tographic mono-restitution; continuous monitoring of precipitation, temperature, humidity, wind, light condition; pollution monitoring of SO2, NH3, smog index; identification and description of rock outcrops and geological mapping; and use occupation; primary and secondary productivity; nutrient dynamics; litter composition; logging effects; forest regeneration.

Infrastructure: the project counts on the existing laboratory facilities of the Institutions involved in the project (Federal University of Paraná, Federal University of Santa Maria, and Catholic State University of Paraná).

Dom Helvécio lake at the Rio Doce State Park, Minas Gerais, Brazil



Affiliation	Scientific contact	Address	Area (ha)	Location	Travel distance
Instituto Nacional de Pesquisas da Amazonia-INPA	Flávio Luizão	P.O. box 478 69011-970 Manaus-AM	31,500	3°05' S; 60° 00'W	25 Km from Manaus-AM
INPA/IBAMA/Smithsonian Institution	Heraldo Vasconcelos	P.O. Box 478 69011-970 Manaus-AM	3,500	2°30'S; 60° 00'W	100 Km from Manaus
Universidade Federal do Mato Grosso do Sul	Masao Ueternabaro	P.O. Box 649 70070-900 Campo Grande-MS	25	19°34'S; 57°01'W	130 Km from Corumbá
Empresa Brasileira de Pesquisas Agropecuárias	Guilherme Mourão	P. O. Box 109 79320-900 Corumbá-MS	4,310	18°59'S 56°39'W	150 Km from Corumbá-
IBGE/Universidade de Brasília	Carlos Klink	P.O. Box 04631 70919-970 Brasília, DF.	1350	15°56'S; 47°53'W	20 Km from Brasília, DF.
State Forest Institute/Universidade Federal de Minas Gerais	Francisco Barbosa	P.O. Box 486 30161-970 Belo Horizonte-MG	36,000	19°48'S; 42°28'W	35 Km from Ipatinga;
Fundação Biodiversitas/Universidade Federal de Minas Gerais	Gustavo Fonseca; Eduardo M. Veado	P. O 82 36950-000 Ipanema-MG	890	19°50'S; 41°50'W	54 Km from Caratinga-MG
Universidade Federal do Rio de Janeiro-Dept. of Ecology	Francisco Esteves	Dept of Ecology, Ilha do Fundão 21941-540 Rio Janeiro	11,000	22° 19'S; 41° 44'W	8 Km from Macaé-RJ
Universidade Estadual de Maringá-Nupélia	Angelo Antonio Agostinho	Av.Colombo, 5790 - 87020-900 - Maringá – PR	526,752	22° 45' S; 53° 30' W	170 Km from Maringá-RJ
Universidade Federal do Rio Grande do Sul-Instituto de Pesquisas Hidrológicas (IPH)	David Marques	IPH-UFRGS P. O. Box 15029 91501-970 Porto Alegre-RS	225,400	32°20'S; 52°20'W	115 Km from Rio Grande-RS
Depto. Oceanografia Universidade Federal do Rio Grande -	Ulrich Seeliger	Av. Italia km 8 - 96201-900 RioGrandeRS	150,000	32° 2'S; 52° 10'W	At Rio Grande
Catholic University of Paraná,	Sylvio Pellico Netto	Pellico@rla01.puc.br	32	25°41'S; 50°9'W	130 Km from Curitiba

Costa Rica
Long Term Ecological Research Program

Jorge A. Jimenez
Director, Costa Rica
Organization for Tropical Studies

The Costa Rican Network for Long Term Ecological Research was established in January 1998, with the support of the Ministry of Science and Technology. The Network was initiated with the participation of four academic institutions: Organization for Tropical Studies, University of Costa Rica, Tropical Science Center and National University. These institutions have selected five field sites as the founding sites. The network is administered by a Coordinating Committee with representatives of each site within the network.

The Costa Rican LTER Network was originated as an inititative of the involved academic institutions, with the political support of the government. Currently in its formative stage, the network is working toward consolidation through meetings with administrative authorities within each institution and involvement of researchers associated with this effort. The network is about to establish a web server with specific information about the sites.

Description of Program

The Costa Rican Network is currently composed of five sites: a) The Marine Research Station at Punta Morales, operated by the National University; b) The Biological Reserve Alberto Ml. Brenes at San Ramón, operated by the University of Costa Rica; c) The Cloud Forest Reserve Monteverde, operated by the Tropical Science Center; d) The La Selva Biological Station, operated by the Organization for Tropical Studies; and e) The Las Cruces Biological Station, also operated by the Organization for Tropical Studies.

The network has taken advantage of the experience of the Organization for Tropical Studies in the area of data management at field stations. A recently developed system for making datasets and metadata available on the web is being incorporated at each site. This highly flexible system has a search engine that browses through unstructured and structured text, numeric tabular datasets and relational datasets.

The network is also well along in the establishment of minimum standards for metadata generated at each site.

While continuing work on the definition of core areas, the sites are reaching a common ground on climatic data, site specific collections and permanent plot data.

The ECMAR-UNA is a scientific and technological station that, due to the quality of its infrastructure,allows the execution of research, teaching, extension, and productive activities related to the scientific, technological, social and economic development of the coastal, marine zone, and adjacent terrestrial areas.

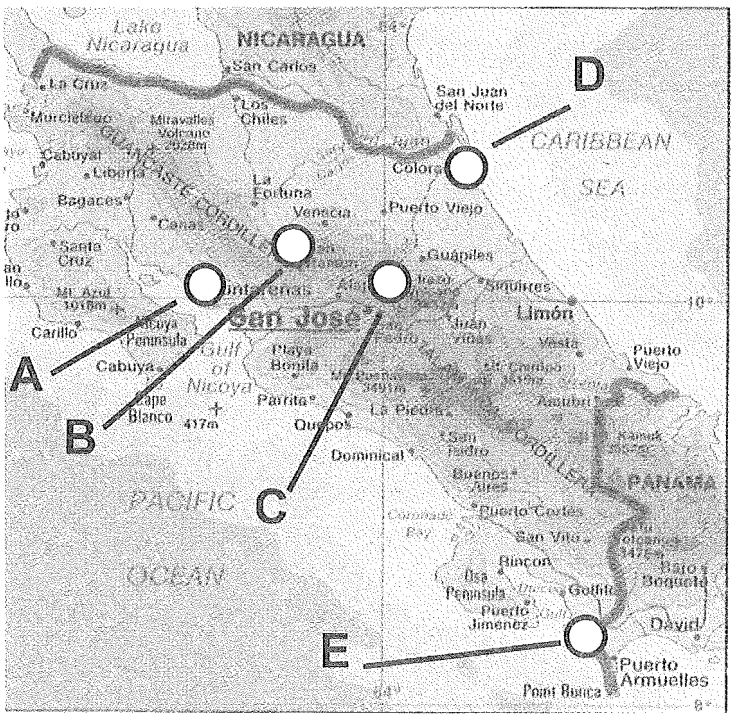
The ECMAR-UNA is located at Punta Morales in Costa Rica, Central America. It can be accessed by the Interamerican Highway. The ECMAR-UNA is 135 km from the country's capital city of San José, and it is located 120 km to the northwest of the Santamaria International Airport. It can also be reached by a small boat in a 40 minutes trip from the port of Puntarenas.

ECMAR-UNA is located in the Gulf of Nicoya, the Costa Rican most important estuarine zone, it is surrounded by mangroves, and suffers the effects of dense human population. Close to the Station are the fishing towns of Chomes, Costa de Pajaros, Chira, and Puntarenas. About 5,000 fishermen live there, and 15,000 people are dependant to the natural resources utilization.

Thematics that could be developed in the ecmar-una include: Biodiversity studies, marine, coastal and continental; Management of marine, coastal and continental resources; Ecotourism; Social and economic impact, including anthropology, economy of the coastal zone, and food availability; Distribution of physical and human resources; and rural, adult, environmental and ecological education.

THE ECMAR-UNA Objectives are to: (1) Provide infrastructure for execution of projects and activities in the field of Coastal, Marine Sciences and Tropical Ecology, which have been approved by national and international institutions, and; (2) Facilitate the vinculation between institutions and organized groups which are interested on the integral development of the coastal, marine zone and adjacent areas.

Pacheco, O. 1998. Integración de los actores e integralidad de las acciones en las políticas de desarrollo para la Región del Golfo de Nicoya. UNICIENCIA 15-16 (1) 119 - 129.



Costa Rica LTER Sites

A. Punta Morales

B. Brenes Biological Reserve

C. Reserve Monteverde

D. La Selva

E. Las Cruces

Costa Rica: Table of Site Information

Site name	Date esablished	Principal biomes	Research themes	Types and Lengths of data sets
National Marine and Coastal Research Station (ECMAR-UNA) at Punt Morales, Puntrenas	1982	Mangrove forests, esturaries, tidal flats, dry forests.	Zooplankton and phytoplankton monitoring, macrobenthos structure in intertidal mudflats, fish communities analysis, dynamic and structure of mangroves and dry forests, biology and culture of shellfish, ecology of aquatic and dry forests birds, solar energy applications.	The station was opened in 1982. Originally built and administered by the National Council on Science and Technology, this station was later handled over the National University. It has being one of the main research sites for marine and estuarine studies, tropical ecology and social aspects of fisheries communities, both for national and international researchers, Besides biological inventories and data on population and community dynamics, the site has long term data on tidal activity.
Biological Reserve Alberto Ml. Brenes at San Ramón	1975	Soil ecology, altitudinal distribution of plant species, plant taxonomy and population ecology of plants.		This reserve was created in 1975 and since then has been administered by the University of Costa Rica. As one of the few protected areas within the premontane belt, the site has atracted researchers mainly from Costa Rica, Germany and the US. The site has received considerable support from the Volkswagen Foundation in Germany. Nearly 100 research projects have been conducted at this station. Type of data collected: Long term data from permanent plots, metereologial data, species inventories and phenological data are available from this site.
Cloud Forest Reserve Monteverde	1972	Wet premontane forest, wet montane forest, and rainy premontane forest are the main life zones. Within them, dwarf forest, forested swamps, rain forest are abundant. Endemism is high in the area, with a high diversity of epiphytes.	Nutrient cycling in epiphytes; amphibian population decline; avian ecology; butterfly migration; global change impact on forest dynamics; forest regeneration; precipitation data.	The reserve was established in 1972 by the Tropical Science Center as a reaction to the fast deforestation process in the region. A gradual expansion of the Reserve area has been achieved with the support of a wide range of institutions and individuals. This is a very well studied area that has attracted a large number of researchers over the past 30 years.
La Selva Biological Station	1954	Tropical wet forest and tropical premontane wet forest, rain forest.	Forest dynamics; long-term permanent plots; carbon budgets and fluxes in the forest; nutrient dynamics; native species trials; stream ecology; agroecological research; avian ecology.	La Selva was originally established in 1954 by Dr. Leslie Holdridge as a farm dedicated to experimentation on mixed plantations for the improvement of natural resources management. It was purchased in 1968 by the Organization for Tropical Studies and declared a private biological reserve and station. Since then it has become one of the most important sites in the world for research on tropical rain forests. More than 240 scientific papers are published yearly out of the research conducted at the site.
Las Cruces Biological Station		This station is home to the Wilson Botanical Garden featuring beautifully diverse plantings of tropical and subtropical ornamentals, representatives of unusual plant families and rare and endangered plants from Costa Rica and elsewhere. Particularly well represented are ferns, aroids, bromeliads, gingers, heliconias, marantas, and palms. More than 1,000 genera in 212 plant families can be seen along trails that wind around palm-covered hillsides, through agave and lily beds, under rain forest canopy, through banana and heliconia groves, or to strategic overlooks on the rolling grounds. This station also includes approximately 240 ha of premontane/montane forests adjacent to the garden.	Horticultural research; forest fragmentation analysis; forest regeneration; butterfly ecology.	The Las Cruces Station originally began as the Las Cruces Tropical Botanical Garden. In 1962 Robert and Catherine Wilson purchased an abandoned pastureland and through years of dedicated effort transformed it into an impressive garden. The Wilsons added adjacent forested properties and chose to treat them as a biological reserve. In 1973 the Garden became the property of the Organization for Tropical Studies, which later bought adjacent forested properties to take the station to its present condition. The area has GIS coverage, metereological data, phenoligal data and horticultural/botanical databases. Information Management remains variable among the sites. Some sites have in-house data managers while for others this task remains part of the administrative duties.

Key References

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Costa Rica: Table of Site Information

Affiliation/ownership	Site manager/key contact	Address	Area extent in hectares	Location	Travel distance and direction to nearest town
University of Costa Rica	Dora Ingrid Rivera	Estación Nacional de Ciencias Marino Costeras (ECMAR-UNA) Carretera Muelle de la Liga de la Caña Punta Morales, Puntarenas, Costa Rica, AC Tel/Fax: (506) 661-2394 drivera@una.ac.cr Facultad de Ciencias Exactas y Naturales Apartado 86 - 3000, Heredia, Costa Rica, América Central Tel: (506) 277-3313. Fax: (506) 277-3485 ecmar@una.ac.cr	327 ha	10°N, 85°W, 2 m	
University of Costa Rica	Rodolfo Ortiz	Universidad de Costa Rica Sede de Occidente, rortizv@cariari.ucr.ac.cr, phone Tel: (506) 445-5533	7,800 ha	10°13'N, 85°37'W, 850, 1500 m	50 km NE of San Ramón city on the Continental Divide.
Tropical Science Center	Robert Carlson	P.O. Box 55-5655 Monteverde, Punta Arenas Phone: (506) 645-5122 Fax 645 5034 montever@cct.or.cr	10,500 ha	10°18'N, 84°47'W, 700-1800 m	About 40km west of the Inter-American Highway.
Organization for Tropical Studies	Dr. Robert Matlock	La Selva Biological Station, Organization for Tropical Studies, Puerto Viejo de Sarapiqui, Centroamerica Costa Rica US: Interlink 341, P.O. Box 02-5635, Miami, FL 33152, USA, Costa Rica: Apartado 676-2050, San Pedro, Costa Rica, Tel.: (506) 766-6565 Fax: (506) 766-6535 rmatlock@sloth.ots.ac.cr	1600 ha	37-130 m	
Organization for Tropical Studies	Luis Diego Gómez	Estacion Las Cruces & Wilson Botanic Garden Organization for Tropical Studies, Inc. P.O.Box 73-8257 Coto Brus, Costa Rica ldgomez@hortus.ots.ac.cr Fax: (506) 773-3665 Tel: (506) 773-4004	235 ha	8° 47' 28" N, 82° 57' 26" W; 1,120-1,385m;	6 km south of San Vito de Java

camarón blanco *Penaeus spp* en el Golfo de Nicoya, Costa Rica. UNICIENCIA 15-16 (1) 131-138.

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Phillips, P.C. 1893. Diel and monthly variation in abundance, diversity and composition of littoral fish populations in the Gulf of Nicoya, Costa Rica. Rev. Biol. Trop. 31(2)297-306.

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Vargas, M. 1998. Estimación de parámetros biológico-pesqueros para el pargo mancha *Lutjanus guttatus* en el Golfo de Nicoya, Costa Rica. UNICIENCIA 15-16 (1) 79-84.

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The Venezuelan Long Term Ecological Research Network

Wilfredo Franco
Chair of the Venezuelan LTER Network Coordinating Committee

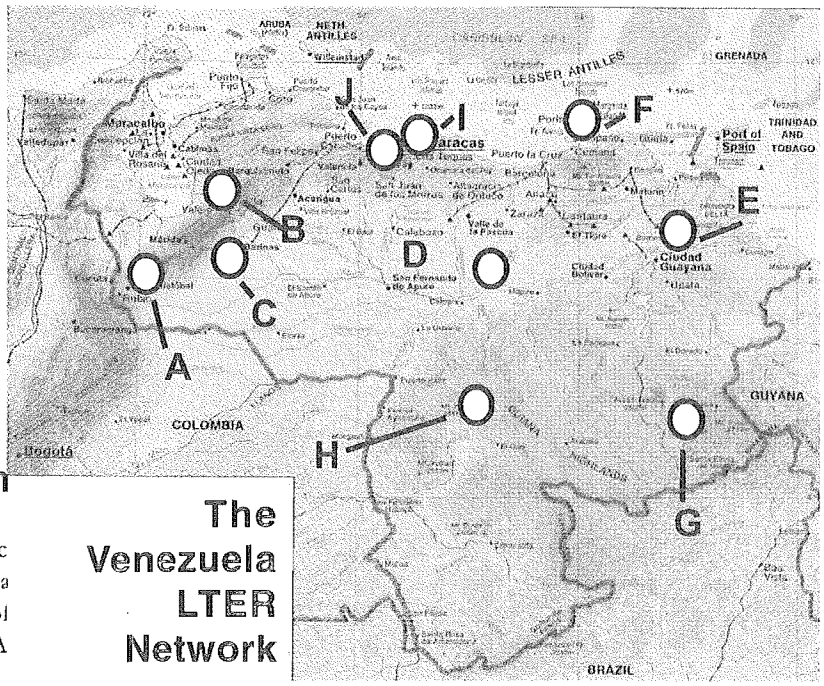
Armando Torres-Lezama
Research Institute for Forest Development (INDEFOR), Facultad de Ciencias Forestales y Ambientales, Universidad de Los Andes, Mérida, Venezuela. Email:torres@ing.ula.ve. Tel:+58.74.401507.

Venezuela is divided in three quite different regions : a) the coastal and mountain region which comprises one third of the surface but supports 90% of the population; b) the very flat alluvial region of the Orinoco Llanos which comprises about 20% of the country ; and c) the Guayana-Amazonas region which is the southern half of the country and is still very sparsely populated. This territorial and economical distribution determines a wide demand for long term ecological research, which varies from the study of the environmental impact of the industrial and urban development in the North to the inventory of the still quite unknown biological diversity in the southern half of the country.

The Venezuelan government, through the National Council for Scientific and Technological Research (CONICIT) and encouraged by the success of the US LTER Network, decided in 1996 to establish and support the Venezuelan Long-Term Ecological Research (LTER) Network in cooperation with scientific institutions throughout the country.

In December 1996, CONICIT created the Commission for the LTER Network, which carried on a review process of 14 potential sites, of which ten were selected using the following criteria: 1) scientific background and commitment to long term ecological research and cooperation; 2)existing capabilities in facilities and personal; 3)biogeographical setting; and 4) current and potential long term ecological research.

The Venezuelan LTER Network was established 29 September 1997. The representatives from each Venezuela LTER Network site met at CONICIT on 30 September to initiate its collaborative activities. A second workshop was conducted in March 1998 in Mérida with the support of CONICIT, Fundacite-Mérida (Regional Science Foundation)and the Universidad de Los Andes. It addressed important decisions regarding network organization, including proposals to develop a Network Office and a project for the strengthening of all the stations and their connectivity. The current Network organization has a Coordinating Committee comprised of two scientists from each station and headed by a chair, an Executive Committtee comprised of the Chair and three regional Coordinators, and an Advisory Council of independent scientists.



The Venezuela LTER Network

In June 1998, Venezuela hosted the 4th Latin American LTER Conference, with the objective of discussing the concepts, structure and function, of the national LTER networks in accordance with regional and countries particularities. Additionally, we meeting initiated the development of a Latin American LTER Pilot Project. The meeting included extensive discussions of data management needs and resources in the region. This Conference was an integrated effort of CONICIT, the National Science Foundation and the US-LTER Network Office, the CNPq (Brazil), the Humboldt Institute for Biodiversity (Colombia) and other Latin American Institutions.

As a follow-up activity of the 4th Latin American LTER Conference and the 2nd National workshop, a third national workshop was held in February 2000 at El Merey Center for Forestry Research with the support of CVG-Proforca, CONICIT, Universidad de Los Andes, Universidad Central de Venezuela and Fundación La Salle. Dr. Armando Torres Lezama was elected as director of the CONICIT project for the strengthening of the network. Similarly, Dr. Magdiel Ablan was elected as the director of the CONICIT connectivity project.

At the current level of the network development, each station is still carrying on its own research program. Efforts must be made to promote a common research program and to initiate interactions among stations. At the second national workshop in March 1998, the main objective of the Network were defined as: 1) to study long term ecological changes in some key biomes of the country; 2) to understand ecological processes in selected ecosystems; 3) to provide ecological information relevant to sustainable development; and 4) to contribute to ecological regional and global monitoring initiatives. Similarly, the following common core areas were established: a) primary productivity and biogechemical cycles; b)evaluation of biological diversity; c) population dynamics; d) environmental impact of human activities; e) alternatives to improve productivity through

Venezuela: Table of Site Information

Site name	Date established as a research site	Principal biomes	Research themes	Types and lengths of data sets
Center for Highland Studies (CETA)	1988	Cloud montane forest.	Highland watershed evaluation and management, Andean national parks management, biodiversity conservation and management, agroecology, socioeconomics and cultural aspects, land-use pattern, environmental impact.	The researchers collect data mainly on species composition, climate, and soils of different types of vegetation, and additionally on the results of experimentation in order to improve agricultural productivity.
Bocono Center for Ecological Studies	1980	Riparian forest, dry woodlands.	Highland watershed management soil and water resources, land-use patterns, hydrological models, soil fertility, cultural aspects, Bocono river sustainable development.	Hydrological parameters, climate, soil, vegetation and land use in the Bocono river region.
Caparo Experimental Station	1970	Seasonal evergreen forest.	Biodiversity conservation and management, natural forest management, tropical forest dynamics, forest ecological features, sustainable development, agroforestry and forestry plantation.	Species composition, tree growth and phenology in natural forest and forestry, wildlife, plantation, plant-animal relationships, agroforestry experimentation, soil-water-plant relationships, remote sensing. More than 30 years of continuous research activities.
La Iguana Agroecological Research Station	1979	Seasonal savanna.	Tropical grassland ecology, dry savanna productivity, cattle ranching, bovine nutrition experimentation.	
El Merey Center for Forestry Research	1988	Dry savanna, riparian forest.	Caribbean pine plantation management, silvicultural management, pine genetics improvement, agroforestry, Savanna conservation, riparian forest ecology, environmental impact, sustainable development,	Caribbean pine genetics, tree growth, plant phenology, pine pathology, silvicultural treatments, management, climate, soils, water quality, natural vegetation, wildlife.
EDIMAR Margarita's Marine Research Station – La Salle Foundation	1957	Mangroves, sea-grass beds, coral reefs.	Fisheries resources evaluation, marine ecology, environmental impact, marine geology, sedimentology, aquaculture, food quality control, fisheries product processing, oceanography, fish biology.	Fish population, water environment parameters.
Parupa Scientific Station (ECP)	1993	Treeless savannas, riparian forest, montane forest, shrublands and broad leaf meadows.	Atmosphere-biosphere interactions (contributes to LBA project), global change, fire ecology, community dynamics, environmental impact, Indigenous uses of land and changes due to human activities, reproductive biology, biodiversity, agricultural sustainable systems, restoration ecology	Climate, soils and vegetation, and human impact
Amazonas Experimental Station		Tropical rain forest.	Amazonian biological diversity, agricultural sustainable development, agrobiodiversity, fish ecology, fish biodiversity, forest biodiversity, indigenous technologies.	The station has one of the largest collections of river fishes in the country.
Arboretum – IBE Experimental Station	1975	Premontane deciduous secondary forest.	Plant ecophysiology, taxonomy, reproductive biology, animal-plant interactions, birds behavior, urban ecology.	
Arboretum – "Dr.Alberto Fernández-Yépez", Rancho Grande Biological Station.	1966	Tropical mountains ecosystems, cloud forest.	Ecosystems dynamics, vegetation evolution, natural resources inventory, agriculture monitoring, waste management, protected areas management.	Vegetation, soils, fauna. More than 30 years of continuous research activities.

ecosystem management; and f)global changes. All the stations have educational and public outreach activities.

Stations infrastructure varies greatly. Here we refer to EDIMAR, the oldest one. This is a well equipped research station, which carries on advanced oceanographic projects in cooperation with national, United States and European institutions. The station is the coordinator of the Cariaco project (NSF-CONICIT), which is interested in examining the budget of total CO2 upwelled with deep, nutrient rich water relative to annual export of organic carbon from surface waters. It has also participated in the CARICOMP project (COMAR/UNESCO) since 1980, which attempts to determine the variation in the productivity of coastal marine ecosystems. The station has an important museum dedicated to marine ecology.

Affiliation/ownership	Site manager/keycontact	Address	Area extent in hectares	Location, elevation	Travel distance and direction to nearest town
Non-government organization (NGO), supported by the local government, the Regional Council for Research, and eight other organizations.	Norberto Rebolledo	CETA Calle Bolívar entre Carrera 4 y 5 El Cobre, Estado Tachira Venezuela. norberto@funtha.gov.ve. Telefax: +58-77-97069		8°03'N, 72°02'W, 2000 m	40 km northeast of San Cristobal City.
Universidad de Los Andès, CONICIT and the local government.	José Arturo Bastidas	Centro de Ecologia Bocono. Bocono-Estado Trujillo Venezuela. cebocono@cantv.net.. Tel. +58-72-521531. Fax:+58-72-521142		9°15'N; 70° 15'W, 1500 m	80 km southeast of Trujillo City.
Faculty of Forest and Environmental Sciences of the Universidad de Los Andes in cooperation with the Ministry for Environment and Natural Resources (MARN).	Luis E. Rodríguez P.	INDEFOR Facultad de Ciencias Forestales y Ambientales Universidad de Los Andes, Merida-Venezuela torres@ing.ula.ve Telefax : +58-74-401580 Tel. +58-74-401581	7,000 ha	7° 25'N; 71° 07' W, 100 m	200 km southwest of Barinas City.
Universidad Simón Rodriguez	Pablo Herrera	Estacion La Iguana Universidad Simon Rodriguez Apdo. Postal 47-925. Caracas C .D. 1041-A. Venezuela	3000 ha	8° 25'N; 65° 25' W, 100 m	172 km southeast of Valle de La Pascua.
Government Forestry Company CVG-PROFORCA	Gerente de Investigación, CVG-PROFORCA	Centro Empresarial Ferrocasa, torre A, piso 6 calle Caicara cruce con carrera El Miamo Puerto Ordaz Estado Bolívar. Apartado postal 071 proforca@telcel.net.ve Tel:+58-87-91694/86-237508/86-238387. Fax:+58-86-613403/233971	560,000 ha	8° 35' N; 62° 50' W, 50 m	60 km south of Temblador.
La Salle Foundation, an outstanding NGO dedicated to education and research	Ramón Valera	EDIMAR Fundación La Salle Apartado 144 Porlamar 6301 A. Nueva Esparta,Venezuela. edimar_biomarina@interc Tel. +58-95-98051/98236 Fax:+58-95-98061		10°54'N; 64°07'W, sea level	
Autoridad Gran Sabana of the Corporación Venezolana de Guayana (CVG); cooperative agreements with INPARQUES, FUNDACITE-Guayana and UNEG (local university)	Gabriel Picón Nava	CVG-Autoridad Gran Sabana Estacion Cientifica Parupa Centro Comercial Altavista, Torre A Ciudad Guayana, Puerto Ordaz, Estado Bolivar-Venezuela. gpicon@canaima.uneg.edu.ve Tel: 58-86-661636, 661879, 603829 Fax: 58-86-612574.	Much of Canaima national park (3,000,000 ha)	5° 40' 30"N; 61°32'35"W, 1,200 m	150 km south of El Dorado and 500 km south of Puerto Ordaz.
Governmental Fund for Agricultural Research (FONAIAP)	Frank Torres	Estación Experimental Amazonas-FONAIAP via Samariapo Puerto Ayacucho estado amazonas Venezuela Tel. +58-48-833311, 833155, 833996		5° 40'N; 67° 37' W, 200 m	Puerto Ayachucho
Instituto de Biología Experimental (IBE) of the Universidad Central de Venezuela	Dr. Luis Levin	Apartado 47106 Caracas, 1041-A Venezuela. llevin@reacciun.ve Tel. +58.2.7510111 Fax: +58.2.7535897	4 ha	This urban station is located in Caracas, the capital of the country	Caracas
Faculty of Agronomy of the Universidad Central de Venezuela in association with the Ministry for Environment and Natural Resources (MARN)	Alfonso Cardozo	Estación Rancho Grande Facultad de Agronomía Universidad Central de Venezuela Maracay, Estado Aragua Venezuela torres@agr.ucv.ve	107.000 ha	10°21'08"N; 67°41'02"W, 1100 m	Approximately 15 km from Maracay City.

THE NEXT STEPS

The recently initiated Venezuelan LTER Network is still working on the following initiatives: 1. Reinforcement plan for each station: to improve the capabilities of the stations through the cooperation between CONICIT and the station holder institutions; 2. Connection program between the stations. All the stations should be interconnected via internet for access to information and data; 3. Creation of databases for each station, including a directory of researchers and projects. 4. Discussion on the concepts, structure and functioning of the LTER Network according to the needs of the country; and 5. Creation of the Network Office.

Network web site URL:
http://cesimo.ing.ula/LA-ECO-RED/ECORED/
National Network chairperson and e-mail address: Dr. Wilfredo Franco, sede@telcel.net.ve
Year network joined LTER network: 1997

Uruguay LTER Network

Carlos M. Martínez and Daniel Conde
Facultad de Ciencias, University of the Republic
Iguá 4225, 11400 Montevideo, Uruguay

The participation of Uruguay in the ILTER Program is recent. After a first planning meeting held at Montevideo in December 1997, two working groups were established: the Information Management Group and the Research Group, both composed of representatives of different institutions involved in long-term ecological research. This report summarizes the status of the program, the description of the proposed sites, and updated information concerning the activities.

Description of program, objectives, and core areas

The IELDU (Investigaciones Ecológicas de Larga Duración - Uruguay) has defined the following general objectives and core areas.

The core areas for research across sites are:

- Pattern and control of primary production,
- Spatial and temporal distribution of populations selected to represent trophic structure,
- Pattern and control of organic matter accumulation in surface layers and sediments,
- Patterns of inorganic inputs and movements of nutrients through soils, groundwater and surface waters,
- Patterns and frequency of site disturbance, and
- Biodiversity

The criteria for site selection were:

- biome representation
- inter-institutional relationships
- ecosystem services
- ecosystem monitoring value

Additionally, the existence of protected areas, the possibility to include coastal areas, and the presence of research teams were also considered.

Site characteristics

The IELDU Program in Uruguay has defined a site (Coastal Lagoons System) constituted by the Atlantic coastal lagoons, and the associated coastal areas and islands. As the specific research activities are regulated by different institutions, the IELDU Program focuses its activities in the promotion of monitoring work, helping in the establishment of databases, and the implementation of appropriate technology for information conservation and exchange. Three main sub-sites were proposed:

Sub site 1 (name/location/infrastructure): José Ignacio, Garzón and Rocha Wetlands. PROBIDES Regional Station (2 laboratories, accommodation, computer facilities); Puerto de los Botes Station, (Faculty of Sciences) 1 laboratory, sampling equipment to measure limnological variables, a permanent meteorological station.

Sub site 2 (name/location/infrastructure): Laguna Negra. PROBIDES Regional Station, Biological Station of Potrerillo, San Miguel and Santa Teresa National Parks

Sub-site 3 (name/location/infrastructure): Laguna de Castillos. Laguna de Castillos Natural Refuge, Forestry Reserve, and two Base Station (Ministry of Livestock, Agriculture and Fisheries).

Laguna de Rocha (Rocha Lagoon) aerial view, and Atlantic Ocean.

* Principal contact/Institution: Dr. Carlos M. Martínez, Marine and Atmospherics Sciences Program, Faculty of Sciences, University of the Republic. E-mail: carmar@glaucus.fcien.edu.uy.
* Latitude, longitude, elevation, size: 33(30' - 38(00' S and 53(28'-54(52' W; 10 - 200m, approximately 400000 ha
* General description/ principal biome and main communities: Oceanic coast and islands, Sand dunes, Coastal Lagoons, Wetlands, Thorn shrubs, Coastal forest, Hilly forest, Flooding forest, Ombú forest, Deciduous forest, Grassland, Palm brake, Plantation (forestry and rice), Range management.
* Legal situation: Biosphere Reserve "Bañados del Este"; including Lagoons National Park, Potrerillo Biological Station, Reserve and Protected Areas of San Miguel and Santa Teresa, Islas Costeras National Park, Natural Monument of Dunas and Atlantic Coast, Cabo Polonio and Aguas Dulces Forest Reserves, Fauna Refuge of Laguna de Castillos.
* Research topics: Definition of ecosystems with value for ecological monitoring; Land-stream interactions; Long-term monitoring of main ecosystems; Biodiversity and ecosystem function; Patterns of land cover changes; Bird migration monitoring; Lagoon biogeochemistry; Long-term monitoring of interface natural-productive systems; Forest hydrology and management; Distribution of animal population.
* History of site/type of data: Ombú forest dynamic; Other natural forests, litterfall production, entomological fauna, fungi; Forestry systems, mycorrhizal associations; Forestry management; Fauna monitoring; Sea lion population dynamics (Ministry of Livestock, Agriculture and Fisheries, since 1942 and Faculty of Sciences); Fish population dynamics and fishing management (National Institute of Fisheries - PROBIDES, 1985); Vegetation composition (Botanical Garden of Montevideo, 1986); Primary production in Coastal Lagoons (Faculty of Sciences, 1988); Organic pollution in Laguna de Rocha (Faculty of Sciences, 1991); Productivity of flooding forest (Faculty of Sciences, 1992); Maps of geology, geomorphology, soils, vegetation, aerial photography (PROBIDES, 1993); Structure and function of Coastal Forest, Vegetation cover changes, above and belowground biomass, nutrient cycling (Faculty of Sciences - PROBIDES, 1997).
* Infrastructure: PROBIDES Regional Station (2 laboratories, accommodation, computer facilities); Puerto de los Botes Station, (Faculty of Sciences) 1 laboratory, sampling equipment to measure limnological variables.
* Interintitutional relationships: PROBIDES, University of the Republic, Governmental Environmental Secretary, National Institute of Fisheries, MaB-Unesco Program, Municipal Government; Ministry of Livestock, Agriculture and Fisheries, Botanical Garden of Montevideo; Ministry of Transport and Public Works.

Information management

A Working Group on Information Management and Interconnectivity is in charge of the communications between research teams, the preparation of databases and the technical assistance. A web site is under operation (http://glaucus.fcien.edu.uy/pcmya/ieldu). A IELDU Information Node was established, related with a general Information Node (Glaucus Program: http://glaucus.fcien.edu.uy/pcmya/glaucus/). A presentation was made at a Workshop held in the PROBIDES station, focusing the main aspects of ecological monitoring. The Section of Limnology of the Faculty of Sciences maintains a meteorological station in the area, and the data will be accessed through the IELD Information node. A first version of a database of documents (scientific papers, reports and publications) was completed, and a search engine is being implemented in the web page.

Atlantic coastal lagoons of Uruguay (Landsat image)

Cross-site Research

The proposed sites are establishing common research plans for some specific objectives. As an example, vegetation cover change, biogeochemistry and ecosystem response to climatic fluctuations, including climate change. Particular interest is devoted to primary productivity, and the assessment of ecosystem health based on biogeochemical indicators, using the LOICZ methodology.

Application of LTER Research

The IELDU Program objectives are devoted to the establishment of the scientific basis for Natural Resources Management. From this, the structure of the initiative privilegiate the inter-institutional work, in order to integrate scientists, technicians and decisions makers. A second important application is to promote and develop educational activities at different levels, particularly the Master Degree Program in Environmental Sciences of the Faculty of Sciences. A recent proposal for integrated management of the area covered by PROBIDES is under consideration, and the impact of scientific research is one of the key factors for a better understanding of the time and space scales involved. In this direction, a more environmental, rather than exclusively ecological, approach is being developed, in order to include the socioeconomic system. The database under development is also dedicated to facilitate the access to data and information products relevant to specific management issues, and taking into consideration participatory methodologies for the evaluation of decision scenarios.

Partnerships

Up to date, several institutions participate in the planning process: Faculty of Sciences, through different laboratories; Secretary of Environment; PROBIDES; National Institute of Fisheries; MaB-UNESCO Program; Municipal Governments; Ministry of Livestock, Agriculture and Fisheries; Botanical Garden of Montevideo; Ministry of Transport and Public Works; Antarctic Institute of Uruguay.

Collaboration among networks

It has been decided the development of a special collaborative effort with the Latin-American ILTER network, and the established research networks related with Global Change and ecological research. Actually, inter-site research between Brazil and Uruguay is under consideration. This coordination effort is based on the current relationships between the participant institutions, especially from the University, with colleagues of Brazil and Argentina. From this, and the existing framework of cooperation between the universities of the region, the University of the Republic is playing a relevant role.

Uruguay LTER

A. Wetlands
B. Laguna Negra
C. Laguna de Castillos

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Network Management

The Steering Committee of the IELDU Program is located at the Faculty of Sciences. The addresses for each Working Group are:

Comité IELDU - Research Working Group
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North American LTER Region

James R Gosz
Chair, U.S. LTER Network
Principal Investigator, Sevilleta LTER

A further development in ILTER has been the formation of Regional LTER Networks that can focus on environmental issues common to neighboring countries, facilitate exchanges of scientists/students, and study scales of research appropriate to the region. The North American Region consists of Canada, Mexico, and the United States, three countries accounting for a very large land mass and a tremendous range of environmental conditions. Some of the most pristine habitats in the world exist on this continent as well as some of the most significantly altered environments through human occupation and use. The habitats cover most of the biomes of the world ranging from extreme desert to tropical forest, sea level to mountain environments over 4000 m, and many levels of human occupation, land use, resource management and anthropogenic effects. Fortunately there are current and potential long-term research sites in Canada, Mexico and the United States that are located in many of these situations and can provide the important studies needed to evaluate the complexity and dynamic nature of these ecosystems.

The LTER Network in the United States started in 1980 and the Network for Canada was formed in 1994 through the involvement of the Ecological Monitoring and Assessment Network (EMAN). Mexico is actively pursuing the development of a formal LTER Network (MEXLTER) by developing an agreement with the National Council of Science and Technology. EMAN is a network of people working at long-term, multidisciplinary research and monitoring sites located over all of Canada with the objective of understanding which changes are occurring in the ecosystems and why. The fundamental philosophy of MEXLTER is to address ecological research at large temporal and spatial scales in a fashion that has not been generally practiced in Mexico and create a legacy of well-designed and documented experiments and observations for future generations. The U.S. Network also has the philosophy of understanding general ecological phenomena at longer temporal and larger spatial scales, creating a legacy of experiments and observations, conducting major synthetic and theoretical efforts, and providing information for the identification and solution of societal problems.

In November 1998, at a meeting in Guadalajara, Mexico, the principals from the LTER efforts in the three countries agreed to form the North American LTER Regional Network. The first formal meeting of the North American Region occurred in August 1999 as a Special Session during the annual meeting of the Ecological Society of America. This Special Session at ESA was designed to identify research programs in the countries, characteristics of sites involved in the networks, and, most importantly, the regional scale questions that could be addressed through this network. Holding this meeting in conjunction with the annual ESA meeting was intended to open the process to discussion by the broader ecological community as well as identifying the research opportunities present in these sites and countries.

The Special Session program is recorded here for future reference.

James Gosz, "Introduction, ILTER overview and Regional LTER Network activities"

Gerardo Ceballos, "The Mexican Long-term ecological reserve network proposal"

Hague Vaughan, "The Canadian Ecological Monitoring and Assessment Network (EMAN): Its Evolution, Design and Policy Linkages"

Mark Harmon, "Crossing Borders: Continental-Scale Patterns of Decomposition"

David Lightfoot, "A Cross-site Experiment on faunal community control of vegetation at U.S. LTER sites (Sevilleta, Jornada) and Mapimi Biosphere Reserve (Mexico) "

K.E. Webster, P.A. Soranno, S.B. Baines, C.J. Bowser, T.K. Kratz, J.J.Magnuson, P.J. Dillon, P. Campbell, E.J. Fee, and R.E. Hecky, "Structuring Features of Lake Districts in Wisconsin and Ontario: Geomorphic and Landscape Controls on Lake Responses to Drought"

Jim Vose, "Comparative Analyses of Hydrologic Processes in Watersheds in Western Mexico and the Southeastern United States"

David Foster, Diego Perez Salicrup, and Deborah Lawrence, "Regional Analysis of Forest Ecosystem Response to Disturbance: Comparing Temperate and Tropical Landscapes"

Manuel Maass, " Long-term nutrient cycling in a dry forest of western Mexico"

Enrique Jardel, " Long term research on human impacts in subtropical montane forests"

Rodrigo Medellin, "Long-term ecological research in the tropical rain forest of the Chajul Biological station, Chiapas"

Lucina Hernandez and Miguel Equihua, "Long-term ecological studies in desert habitats of the Mapimi biosphere reserve, Durango"

Cliff Drysdale, "Kejimkujik National Park, Nova Scotia: An EMAN case study site"

Adam Fenech, "Linking EMAN case study sites and dispersed networks to provide an early warning capability"

Brian Craig, "Public Participation in EMAN: Using volunteers and linking with associated programs such as the UNESCO MAB"

A second session, limited to LTER scientists from the three countries, was held to propose future actions. Key discussions centered on developing a strategy for implementing cross-site research in North America and the relative roles of case study sites and dispersed networks to develop a coordinated approach to environmental monitoring and assessment. There was agreement to participate in a number of "demonstration projects" initiated by the Global Terrestrial Observation System (GTOS) and DIVERSITAS. Primary interest was expressed for involvement in the Net Primary Productivity project involving validation of MODIS imagery, a North American decomposition and soil biodiversity experiment, validation of imagery for forest and other land cover in the Global Observation of Forest Cover (GOFC), and the Terrestrial Carbon Observation (TCO) initiative. There also was special interest in "Developing the International Aspects of a North American Graduate Training Program" and areas of special need for collaboration and training in Mexico. Those efforts were developed further during 2000.

The second meeting of the North American Regional LTER Network was to be held in conjunction with the annual ILTER Network meeting in Utah, U.S. in 2000. In 2002, the ILTER Network meeting is planned for Whitehorse, Canada, which will provide an excellent opportunity for Mexican and American scientists to visit Canadian sites.

Canada's Ecological Monitoring and Assessment Network (EMAN)

From coast to coast to coast, the Canadian environment is being subjected to a variety of stresses and continuous change in the physical and chemical characteristics of our atmosphere. How these changes will alter the biological components of ecosystems is a major concern to Canadians, because large parts of our economy are based on the sustainable use of our fisheries, forestry and agricultural resources.

While some of the stressors and changes are due to natural processes, many are the result of collective human behaviour. The effects of human-induced changes can be reduced or eliminated by appropriate pollution control and resource management policies. Environmental issues have become more scientifically complex and the appropriate control programs can be costly and socially disruptive, so it is necessary to provide all Canadians with more comprehensive and reliable scientific information than has been needed when dealing with less complicated problems in the past. This requires long-term, multi-disciplinary studies at individual sites plus the ability to compose data from sites in different locations.

The Canadian Environmental Protection Act, 1997, gives the authority for Environment Canada to "establish, operate, and maintain a system for monitoring environmental quality". In addition, the Act allows for Environment Canada to conduct a wide range of research and study on pollution prevention and ecological effects of contaminants, leading to the formulation of plans for pollution prevention and/or pollution abatement. These studies may be carried out in cooperation with a wide range of partners including other Governmental organizations within Canada, foreign Governments and Aboriginal people. The information gathered from monitoring may be published in a number of forms including periodic reports on the state of the Canadian environment.

Further to the Act, many of the international conventions and protocols, to which Canada is a party, also call for the conduct of monitoring and periodic assessments of environmental condition.

Understanding how ecosystems are changing and developing the scientific information required by decision-makers, are beyond the resources and abilities of any single Department or agency. Consequently, it is necessary to develop partnerships within all components of the Canadian and International environmental science community. This is necessary to maximize the quality of the science and the efficiency of conducting the work at a time of economic restraint.

It is against this backdrop of meeting the environmental challenges that Environment Canada has enhanced its coordinating capabilities to promote and assist in mobilizing a collective Canadian scientific effort. This program has four overall objectives:

1. To provide a national perspective on how the health of Canadian ecosystems are being affected by the multitude of stresses on the environment; 2. an early warning system that identifies new ecosystem changes as they emerge; 3. To provide consistent nation-wide, scientifically defensible rationales and information related to the success of, or need for, controls and other resource management initiatives; 4. To evaluate and report to Canadians on the effectiveness of these policies.

The following list illustrates some of the ecological stresses that are occurring.

* The atmospheric concentration of carbon dioxide has been increasing exponentially for the last hundred years and this seems certain to continue into the foreseeable future.
* Ultra-violet B radiation is increasing as a result of stratospheric ozone depletion, and even under the most optimistic international control scenarios, it is believed that ozone depletion will increase for the next five years and the ozone layer will not be back to normal conditions until some time after the year 2020.
* Large areas of Canada are subjected to increased deposition of nitrogen from burning of fossil fuels and agricultural activities.
* Parts of eastern Canada also receive high levels of sulphate deposition, and the combination of sulphate and nitrogen results in acid rain falling on acid sensitive soils from Ontario eastward to Newfoundland.
* Increasing land-use changes by humans in resource extraction and human settlement
* the elevated levels of methylmercury (MeHg) in fish and the subsequent risks these concentrations pose to human and environmental health.

EMAN is a network of people from a multitude of agencies and communities working at long-term, multidisciplinary environmental research and monitoring sites located across Canada, with the objective of understanding what changes are occurring in the ecosystems and why. It is coupled strongly to the work of other environmental monitoring networks and to the EMAN Observation Programs which are community monitoring initiatives designed for the public to monitor their local environment. The Network is building on existing sites which have been established over the years for a number of reasons. For example, the Last Mountain Lake site was established in 1887 as a National Wildlife Area. The Experimental Lakes Area in Ontario was set up in the 1960s to conduct whole lake manipulation experiments on the causes of lake eutrophication. Studies at Kejimkujik National Park, also began in the 60s, looking at nutrient processes in surface waters and in the mid 1970s, the Ontario Ministry of Housing established the Research Centre at Dorset to study the effects of cottage development on lakes. Many other new sites have been established across the country to look at a variety of research questions and environmental factors. As new issues have emerged, other sites, for example, Turkey Lakes in Ontario and Duschenay in Quebec, were established in response to the need for more information on acid rain.

As of the end of 1999, about 100 case study sites are included in the EMAN Network. Each site is characterized by long-term studies, although not all sites have a full suite of multidisciplinary activities. EMAN's products are based on interjurisdictional and interdisciplinary collaborations to produce integrated information about ecosystems. Study sites within the same ecozone are grouped into Ecological Science Cooperatives so that all work undertaken can contribute to understanding what is changing in the ecozone and why. Environment Canada is the coordinating partner for the network.

Details of the site locations and other relevant information can be found on the Website at http://www.cciw.ca/eman/ or by contacting the EMAN Coordinating Office at (905) 336-4414.

The Mexican Long-term Ecological Research Network

Gerardo Ceballos, Manuel Maass, Miguel Equihua, Armando Equihua, Rodrigo Medellín, Lucina Hernández, Enrique Jardel, and Ricardo Ayala.

The participation by Mexico in the International Long-term Ecological Research Network is very important for several reasons. Mexico supports high levels of species and ecosystem diversity, representing a major fraction of the earth's biota (McNeely et al., 1989). It is imperative that the country understands and protects this heritage, because the combination of extended rural poverty, low technical support, distorted development patterns, socioeconomic disparity, and high population growth, have led to accelerated processes of environmental degradation and resource depletion (Challenger, 1998; INE, 1995). Additionally, Mexico is affected by ecological processes that operate at continental scales, such as the El Niño Southern Oscillation, that occur infrequently and can only be understood through large-scale collaborative efforts. Finally, the proximity of Mexico to a well-established network of long-term studies creates the opportunity for scientific cooperation and development of human resources.

In order to implement the proposed Mexican LTER (MEXLTER) we have organized a committee to structure the network (Ceballos et al., 1998). Presently, the committee has finished the proposal and is working with the government to define long-term funding mechanisms.

The objectives of the MEXLTER are the following ones:

1. Establishment of a network of sites to allow Mexican scientists to address in an interdisciplinary way ecological issues on broad spatial and temporal scales. A corollary is to understand the role of biological diversity in ecosystem processes and in the provision of services to the biosphere, including humans.

2. The creation of a legacy of well-designed and documented experi-

Site name	Date	Principal biomes	Research themes	Types and lengths of data sets
Chamela-Cuixmala Biosphere Reserve, Jalisco coast, Western Mexico	1971	Tropical dry deciduous forests, mangroves, and wetlands	Ecosystems (forest structure, hidrology, biogeochemistry, productivity), vertebrates, invertebrates, resources management, conservation biology, ecological monitoring	Basic climatic data (25 y), micro meteorologic data (6 y), runoff (17 y), throughfall (10 y), litterfall (20 y), standing litter (17 y), stem diameter increment (10 y), land use change (20 y), LAI (3 y), nutrient budgets (6 y), sediment yield (8 y). Small mammal populations (12 y).
Chajul Tropical Biology Station, Montes Azules Biosphere Reserve, Chiapas	1986	Rainforest, riparian forest, riverine and lake ecosystems	Successional processes, ecosystem productivity, nutrient cycles, human activities, mammal community and population ecology, seed dispersal, plant-animal interactions.	
Site name: Mapimi biosphere reserve, located in the Mapimi Bolson area, in the vertex formed by the Mexican states of Chihuahua, Coahuila and Durango	1978	Chihuahuan desert, desert scrubland, desert, salt shrublands.	Inventories, monitoring, weather, hydrology, vegetation, endangered species, populations, human systems, rangelands	
Zoquiapan Experimental Station, located in the state of Mexico, in central Mexico.	1972	Temperate coniferous forest	Inventories, monitoring, weather, hydrology, vegetation, endangered species, pests and forest diseases, fire, populations, productivity	Weather data set (from 1976). Flora and fauna (1974). Seed orchard (1987). Tree productivity (1976). Forest pests (1980).
Sierra de Manantlán Biosphere Reserve, located in the states of Jalisco and Colima, in western Mexico	1986	Subtropical mountain forests (pine-oak forests, cloud forests, tropical dry and subhumid forests), river ecosystems, and traditional agroecosystems	Biodiversity, inventories, forest ecology, restoration, landscape ecology, watershed management, wildlife ecology, agrarian dynamics, resources management	Inventories Lists of vascular plants and vertebrates, with distribution and habitat data (1977). Meteorological monitoring (1986). Geographical Information System at regional (1:250,000), reserve (1:100,000), and parcel (1:10,000 to 1:50,000) scales with information from 1971 to date. Permanent vegetation plots (succession and stand dynamics). Biodiversity studies in Las Joyas Research Station with data ranges from 5 to 10 years. Hidrology and water quality monitoring of the Ayuquila River (4 years). Biological, geographical and socioeconomic databases are integrated in the Sierra de Manantlán Regional Information System

ments and observations for future generations of society.

At present we are in the process of formally establishing the MEXLTER working in an agreement with the National Council of Science and Technology to obtain the funding for setting the network office and the initial network sites.

Network Management

The implementation of the LTER program in Mexico will require a coordinating mechanism that provides support for the establishment and funding of the research sites. The achievement of the common goals of the network will require centralization of certain processes such as training, network communication, and planning of meetings. In addition, by centralizing other elements such as acquisition of equipment and software, we anticipate improving efficiency and reducing cost. The basic structure for the coordination and operation of the Network consists of an Executive Committee, an Advisory Board, a Network Coordinator and a Coordinator for each Site. Management of the LTER Network will be by an Executive Group with representatives of each of the participating sites. To insure the success of development and implementation of the MEXLTER network several standards will be followed. The complexity of present-day environmental processes and problems, and the philosophy of the MEXLTER network to conduct ecological research on these issues, requires that all participating sites must use similar state of the art conceptual and technical tools, such as networking, data base management, geographic information systems, and modeling.

Partnerships

MEXLTER will work cooperatively with the National Council of Science and Technology (CONACyT), the National Commission on Biodiversity (CONABIO), and the Secretary of the Environment, Natural Resources and Fisheries (SEMARNAP). Other partnerships will be developed with other government, academic institutions, and NGO's.

Collaboration of MEXLTER with the regional networks will be accomplished through regular regional conferences. Presently, the MEXLTER is actively involved with both the North American and Latin American regional networks. Collaboration with the global network will be through Internet and specific meetings.

Research

Seven core subjects, that address the most relevant functional and structural features of ecosystems, and the most pressing environmental issues for human welfare, will define the basic theoretical framework for the research carried out at the MEXLTER sites. The core areas are: 1) Patterns and control of ecosystem primary productivity; (2) Patterns and control of water, carbon and nutrients dynamics in ecosystems; (3) The role of biodiversity in the structure and functioning of ecosystem; (4) Patterns and frequency of ecosystem disturbance; (5) Effect of climate change on the structure and functioning of ecosystems; (6) Interactions at the interface level between managed and natural ecosystems; (7) Defining criteria for ecosystem management and conservation.

The MEXLTER program has been designed to encompass terrestrial and aquatic ecosystems, including managed ones. At a national level should allow comparisons within and across biomes. At an international level, it should make possible comparison within and across biomes in different geographical areas. Therefore, the network should have representation of the major biomes within the country.

All sites will be subject to continuous performance evaluation carried

Affiliation/ownership	Site manager/key contact	Area extent in hectares	Location/ elevation	Travel distance to nearest town
Universidad Nacional Autónoma de México (UNAM). Fundación Ecológica de Cuixmala A.C.	Ricardo Ayala, Site Manager, Estación de Biología Chamela, UNAM. (chamela@mail.ibiologia.unam.mx) Gerardo Ceballos, Research Scientist, Instituto de Ecología, UNAM. (gceballo@miranda.ecologia.unam.mx) Manuel Maass, Research Scientist, Instituto de Ecología, UNAM. (maass@oikos.unam.mx) Efrén Campos, Site Manager, Fundación Ecológica de Cuixmala A.C.	. Area: 13,141 hectares.	19°22'4"-19°35'29"N, 104°56'23"-105°3'36"W,0-350 m	Manzanillo (Colima) is one and a half hour to the south. Puerto Vallarta (Jalisco) is 2 hours to the north.
Ministry of the Environment. Universidad Nacional Autónoma de México.	Rodrigo A. Medellín, Research Scientist, Instituto de Ecología, UNAM (medellin@miranda.ecologia.unam.mx) Rodolfo Dirzo, Research Scientist, Instituto de Ecología, UNAM (urania@miranda.ecologia.unam.mx).	331,200 hectares	16o 07" N, 90o 56" W; 120 m asl.	Chajul is about 80 km (2.5 hours) east of the city of Comitán, Chiapas
Instituto de Ecologia A.C., Xalapa.	Miguel Equihua, Research Scientist, Instituto de Ecologia A.C., Xalapa (equihuam@ecologia.edu.mx) Lucina Hernández Research Scientist, Centro Regional Durango, Instituto de Ecologia A.C., Xalapa (lucina@sequia.edu.mx)	172,000 ha	26°11´-27°00´N, 103°23´104°07´W, 1100-1680 m.	
Universidad Autónoma Chapingo	Armando Equihua, Research scientist, Colegio de Posgraduados, Chapingo (equihuaa@colpos.colpos.mx).	1626 ha	190 12` 30``-190. 20`00``N, 980 42`30``-980 30` 00``W, 3300-3700m.	56 km from Mexico City (Mexico- Puebla Highway).
Universidad de Guadalajara (Instituto Manantlán de Ecología y Conservación de la Biodiversidad, IMECBIO) and Secretary of Environment, Natural Resources and Fisheries (SEMARNAP).	Sergio H. Graf, Site Manager, SEMARNAP. Luis E. Rivera-Cervantes, Enrique J. Jardel (ejardel@fisher.autlan.udg.mx) Luis I. Íñiguez (liniguez@cucsur.udg.mx) Eduardo Santana C., IMECBIO.	139,500 hectares.	19°25' - 19° 45' N, 103°45' - 104°30' W, 350 - 2860 m	56 km from Mexico City (Mexico- Puebla Highway

independently by peer reviewing. The minimum criteria for a site to be eligible for the Mexican LTER are: 1) critical scientific mass, 2) commitment to sharing of the resulting data and its long-term management, 3) participation of a Higher Level Institution, and evidence of its commitment, 4) institutional longevity or security of site for the future, 6) adequate infrastructure and logistics, and 7) existing knowledge base (availability of long-term databases).

The sites currently included in the MEXLTER network are protected areas where academic institutions have worked with a long-term commitment for research and conservation. These sites include tropical rain and dry forests, subtropical mountain forests, desert scrub lands, and coastal ecosystems (Blanco et al., 1982; Ceballos et al., 1999; Halffter, 1981; Jardel et al., 1996).

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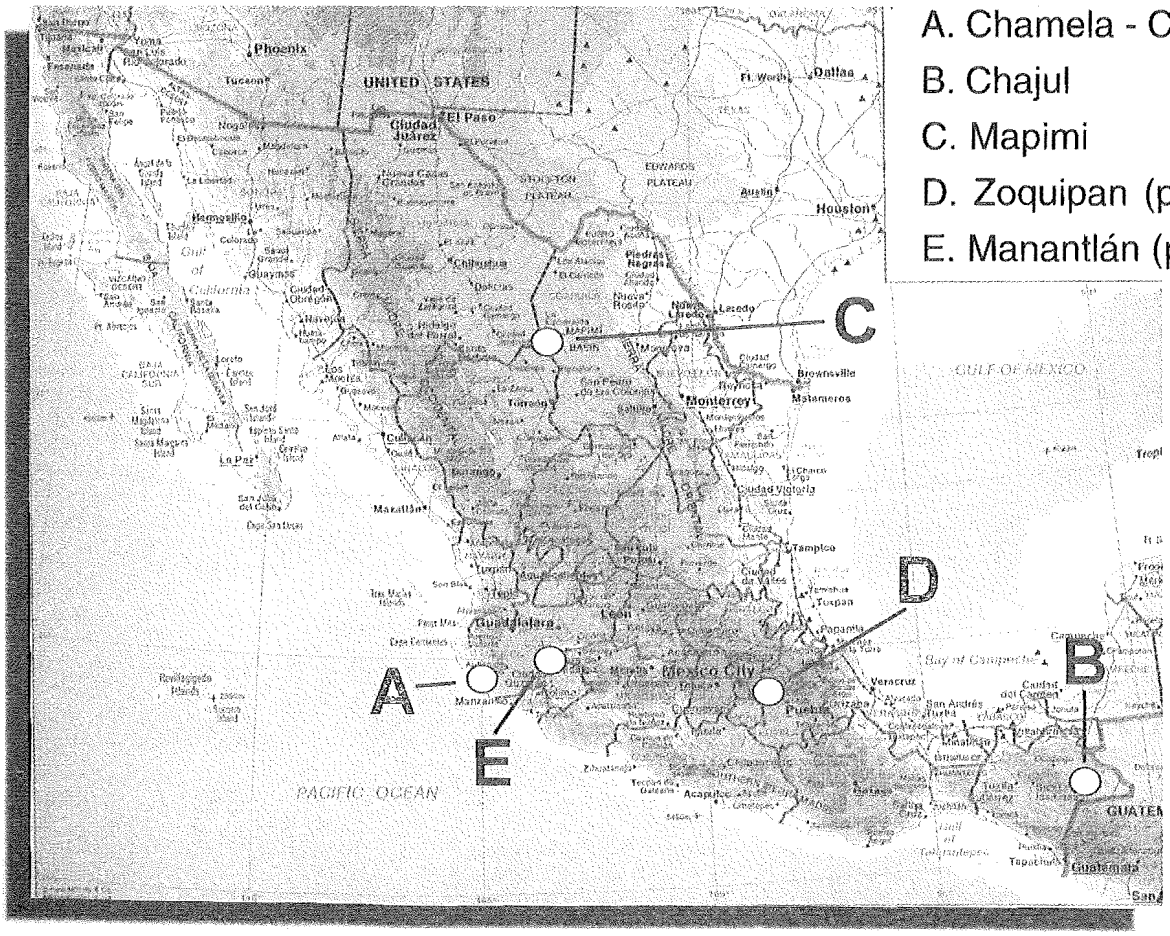
Mexico LTER Sites



The U.S. Long Term Ecological Research Network

Status of the U.S. Long Term
Ecological Research Network

Robert B. Waide, Executive Director LTER Network Office

he network of sites dedicated to long-term ecological research in the United States has grown steadily since it was formed in 1980. In addition to adding individual sites, the focus of the network has shifted from a concentration on individual site research to a broader synthetic viewpoint. As funding for the program has increased, expectations of results have shifted to include not only individual researcher, single-site products but also cross-site, network-wide, and international collaborative studies. The goal of these latter studies is to search out general ecological principles that apply to many ecosystems at many different scales. Comparative and synthetic approaches have become the norm in the U.S. LTER Network.

History of the Network

The concept of long-term ecological research sites dedicated to collaborative research was developed during a series of three workshops sponsored by the National Science Foundation (NSF) from 1977 to 1979. At these workshops, the philosophy of collaborative research was developed and a centralized working hypothesis approach to collaboration proposed. Five core areas of research were defined to orient long-term ecological research projects toward question/hypothesis formulation and resolution. The five core research areas common to all LTER sites are:

- Pattern and control of primary production
- Spatial and temporal distribution of populations selected to represent trophic structure
- Pattern and control of organic matter accumulation in surface layers and sediments
- Patterns of inorganic inputs and movements of nutrients through soils, groundwater and surface waters
- Patterns and frequency of site disturbances

In 1979, NSF announced a call for proposals for pilot projects in long-term ecological research with goals of 1) initiating the collection of comparative data at a network of sites representing major biotic regions of North America, and 2) evaluating the scientific, technical and managerial problems associated with such long-term comparative research. The first request for LTER proposals resulted in the selection and funding of an initial set of six sites:

H.J. Andrews Experimental Forest, Oregon
Coweeta Hydrologic Laboratory, North Carolina
Konza Prairie Research Natural Area, Kansas
Niwot Ridge/Green Lakes Valley, Colorado
North Inlet Marsh, South Carolina
North Temperate Lakes, Wisconsin

Competitions in 1980 and 1987 added 10 additional sites:

Arctic Tundra, northern slope of Alaska
Bonanza Creek Experimental Forest, Alaska
Cedar Creek Natural History Area, Minnesota
Central Plains Experimental Range (now called Shortgrass Steppe), Colorado
Hubbard Brook Experimental Forest, New Hampshire
Illinois Rivers, Illinois
Jornada Basin, New Mexico
W.K. Kellogg Biological Station, Michigan
Okefenokee, Georgia
Virginia Coast Reserve, Virginia

In 1988, two sites withdrew (Illinois Rivers and Okefenokee) and three new sites were added:

Harvard Forest, Massachusetts
Luquillo Experimental Forest, Puerto Rico
Sevilleta National Wildlife Refuge, New Mexico

Palmer Station and McMurdo Dry Valleys, two sites in Antartica, were selected through competitions in 1990 and 1992 by the NSF Divisions of Polar Programs and Environmental Biology.

The North Inlet site withdrew from the program in 1993 TThe selection of two new sites in 1997(Baltimore and Central Arizona-Phoenix) marked the first extension of the LTER program into urban ecosystems.

In 1998, the NSF made the decision to incorporate the Land-Margin Ecosystem Research program into the LTER Network. Four new sites representing coastal ecosystems were added to the Network, bringing the total number of sites to 24:

Plum Island Estuary, Massachusetts
Georgia Coastal Ecosystems, Georgia
Santa Barbara Coastal Ecosystem, California
Florida Coastal Everglades, Florida.

At the same time that the Network was expanding its scope, the National Science Foundation initiated efforts to broaden participation in LTER research. The purpose of these efforts included a desire to involve additional investigators at satellite research sites, an interest in attracting scientists working at landscape and regional scales, and a need to apply results from LTER research to the solution of societal problems. Trial efforts to expand the studies conducted at individual sites were implemented at the Coweeta and North Temperate Lake sites by inviting the participation of social scientists and by expanding the geographical scale of the research. More recently, this trend has been carried further by the inclusion of the two new urban sites in the LTER Network.

Description of program and objectives

The U.S. LTER Network comprises sites chosen competitively on the basis of research excellence, quality and duration of existing data sets, and strength of the commitment to long-term research and site security. The 24 sites that constitute the network at present represent a wide variety of research emphases and approaches. Over 1000 scientists and students are involved in long-term research projects throughout the network of sites. As part of their commitment to the LTER program, each site conducts a series of measurements and experiments directed towards the understanding of the five core areas as well as studies addressing ecological issues specific to the site. The most common scientific approaches include observation, experimentation, comparative analysis, retrospective study, and modeling, although emphases differ among sites.

The mission of the LTER Network as it is now formulated is to conduct and nurture ecological research by:

• Understanding general ecological phenomena that occur over longer temporal and spatial scales;
• Creating a legacy of well-designed and documented long-term experiments and observations for the use of future generations;
• Conducting major synthetic and theoretical efforts; and
• Providing information for the identification and solution of societal problems.

The LTER Network comprises a broad array of ecosystems ranging from tropical rain forest in Puerto Rico to polar desert oases at McMurdo Station, Antarctica (see table[RW1]). Collectively, the sites in the LTER Network provide opportunities to contrast marine, coastal, and continental regions, the full range of climatic gradients existing in North America, and aquatic and terrestrial habitats in a range of ecosystem types. All sites are sufficiently large to incorporate moderate to large landscape mosaics, and most sites include human-manipulated as well as natural ecosystems. The majority of sites embody considerable within-site variability in habitats and ecosystem processes and attempt to characterize this variability in the context of broad regional gradients covering hundreds of kilometers.

Information Management

The development of comparable data sets within the LTER Network has been facilitated by an active group of information management professionals representing the sites. Approaches have ranged from standardization of equipment and methodology for commonly collected data (such as climate measurements) to efforts to develop tools to access and analyze jointly data sets existing in a distributed environment. The LTER Network Information System (NIS) sets standards in information management sufficient to achieve network-wide data integration. The goal of the NIS is to facilitate seamless data exchange and synthesis within the LTER Network and to make data collected at LTER sites available to scientists worldwide. This goal is accomplished through the use of the latest advance in World Wide Web database interfaces, which provide access to network-wide data sets through a single point of entry.[RW2]

The development of several interactive database prototypes demonstrates the capabilities of the Network Information System. These prototypes include network-wide databases containing information on climate, personnel, publications, and site characteristics as well as a catalogue of data being collected at LTER sites. Development of these prototypes will facilitate the interoperability of site databases and provide techniques to extend the information system as future data modules and sites are added. In addition, information management staff from the LTER Network Office is actively cooperating with several national agency/interagency efforts to assure interoperability between the LTER Network and the greater scientific community.

Cross-site Initiatives

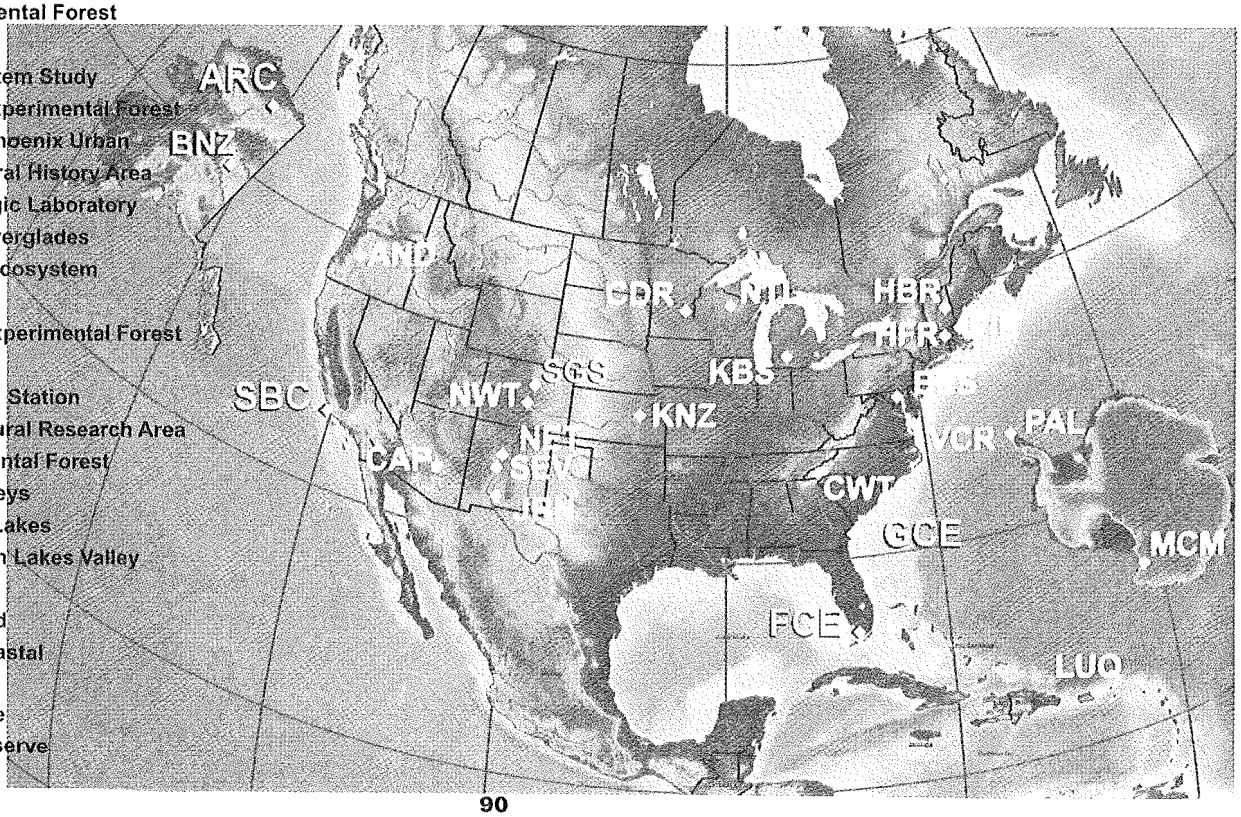
In 1994, NSF announced a special competition for cross-site comparisons and synthesis at LTER and non-LTER sites in response to the 10-year review of the LTER Program. Nine awards ranging from $109,353 to $200,000 were given for comparative research within the U.S. LTER Network, between LTER and non-LTER sites in the U.S., and with sites in Ireland, Scotland, Costa Rica, Argentina and Russia. In 1995, a second special competition for cross-site comparisons and synthesis was conducted, with thirteen awards ranging from $150,000 to $200,000 given. A third competition was conducted in 2000. These competitions have stimulated cross-site interactions both within the LTER Network and between the Network and other sites. At present, eleven different cross-site studies, ranging from a study of the relationship between net primary productivity and biodiversity to the development of standard soil methodologies for use at LTER sites, have involved the majority of sites in the Network. In addition, each individual site has developed its own collaborative studies with other research programs within and outside of the LTER Network.

Management of the Network

The U.S. LTER Network is lead by a Coordinating Committee comprising representatives of all 24 sites. This group meets twice a year to plan

The U.S. LTER Network

AND	Andrews Experimental Forest
ARC	Arctic Tundra
BES	Baltimore Ecosystem Study
BNZ	Bonanza Creek Experimental Forest
CAP	Central Arizona-Phoenix Urban
CDR	Cedar Creek Natural History Area
CWT	Coweeta Hydrologic Laboratory
FCE	Florida Coastal Everglades
GCE	Georgia Coastal Ecosystem
HFR	Harvard Forest
HBR	Hubbard Brook Experimental Forest
JRN	Jornada Basin
KBS	Kellogg Biological Station
KNZ	Konza Prairie Natural Research Area
LUQ	Luquillo Experimental Forest
MCM	McMurdo Dry Valleys
NTL	North Temperate Lakes
NWT	Niwot Ridge-Green Lakes Valley
PAL	Palmer Station
PLM	Plum Island Sound
SBC	Santa Barbara Coastal
SEV	Sevilleta
SGS	Shortgrass Steppe
VCR	Virginia Coast Reserve
NET	Network Office



LTER activities under the guidance of a chairman (presently Dr. James R. Gosz), who is selected by a vote of the Coordinating Committee. The Executive Committee, with six members selected by the Coordinating Committee, meets four times a year and is empowered to act on behalf of the LTER Network in routine matters. Representatives of the National Science Foundation are invited to these meetings to discuss LTER program development and direction.

Seven standing committees help to coordinate specific LTER activities: collection and synthesis of climate data, education, publications, information management, graduate student participation, scientific initiatives, and technology development. The members of these committees are drawn from the LTER community at large. The activities of the standing committees include the development of network-wide policies and initiatives, preparation of proposals for funding to support these initiatives, and interactions with private and public institutions as well as other segments of the U.S. scientific community.

In 1983, NSF established the LTER Network Office at Oregon State University under the direction of the LTER Coordinating Committee Chair and the LTER Coordinating and Executive Committees. The goals of the Network Office are:

- to facilitate communication among the LTER sites and between the LTER Program and other scientific communities
- to support the planning and conduct of collaborative research efforts, including provision of some technical support services
- to facilitate intersite scientific activities
- to provide a focal point and collective representation of the LTER Network in its external relationships
- to develop linkages with other relevant long-term research programs, site networks, and science and technology centers.

In 1989, the coordination grant was moved to the University of Washington, in the College of Forest Resources. In 1996, NSF announced an open competition for the LTER Network Office cooperative agreement. The University of New Mexico was awarded the cooperative agreement, and the Network Office moved there in 1997. Current staff includes an Executive Director, two Associate Directors for Information Management and Technology Development, and specialists in the fields of publishing, network management, computer programming, and database management. Responsibilities of the Network Office include facilitating cross site research synthesis, coordinating the acquisition of satellite imagery for all sites, developing and maintaining network-wide databases, preparing publications describing site and network accomplishments, maintaining the LTER site on the World Wide Web, organizing All-Scientists, Coordinating Committee, and Executive Committee meetings, and leading in the development of the International LTER program.

Application of LTER Research

Education

A primary goal of the LTER Network is to provide a wide range of educational opportunities for students at participating institutions. Many undergraduate and graduate students are supported directly from LTER awards each year and others use LTER facilities and equipment in support of their research programs. Most LTER sites participate in NSF's Research Experience for Undergraduates program, which provides opportunities for students at both LTER and non-LTER institutions to work with LTER scientists. In addition, the LTER Network, through its association with other networks worldwide, provides opportunities for the international interchange of students and faculty. Prime examples of this kind of opportunity are the interchanges of students from Asian and U.S LTER sites organized in 1997 and 1998.

The Committee on Education has initiated an intensive effort to integrate science and education using the LTER Network. The goals of the Schoolyard LTER Program include K-12 teacher enhancement programs at LTER sites, development of data collection and experimentation sites on or near school grounds, development of educational materials for experiential learning, facilitation of the use of the Internet to input and share data at schools, and development of funding for participation of students and educators in LTER programs.

Research

The LTER program has demonstrated high scientific productivity during the 18 years of its existence (Risser 1993[RW3]). Specific examples of exemplary early findings are described by Franklin et al. (1990[RW4]). A complete bibliography of LTER research publications is available at http://www.lternet.edu. The LTER Network has initiated publication of two series of books, one synthesizing research results at individual sites and the other describing cross-site comparisons of ecological processes.

The LTER Network has made important contributions to the application of ecological research to the resolution of important societal problems. For example, research on forest and stream ecosystems at three LTER sites - H.J. Andrews Experimental Forest in Oregon, Hubbard Brook Experimental Forest in New Hampshire, and Coweeta Hydrologic Laboratory in North Carolina - has been used extensively in the formulation of emerging forest research management policies in the United States (Franklin 1992). Experiments conducted at the Cedar Creek Natural History Area have contributed to a better understanding of the importance of biodiversity in maintaining ecosystem processes. The availability of long-term records of rodent population dynamics at the Sevilleta National Wildlife Refuge allowed a rapid identification of the vector of hantavirus during a recent outbreak in the Southwest. Archived tissue specimens associated with the field records allowed a retrospective analysis of the distribution of virus in rodent populations. A predictive model associates viral outbreaks with specific weather conditions including El Niño-Southern Oscillation phenomena.

Partnerships

A strong relationship has developed between the LTER Program and the USDA Forest Service. Five LTER sites are located on land managed by the Forest Service, and several other sites benefit from cooperation with Forest Service units. The Forest Service contributes the use of facilities and the participation of scientists in research programs at many LTER sites. In addition, LTER programs on Forest Service land are the beneficiaries of funds allocated directly to cooperating USDA scientists.

The LTER Network continues to develop interactions with associated programs such as NASA's Mission to Planet Earth. These interactions have included continued support for state-of-the-art instrumentation including sun photometer deployment and data processing for six LTER sites as well as acting as a contact point for LTER sites with NASA's associated "AERONET" program. Both of these projects have been integrated with planned LTER modeling activities. Interaction with the NASA Oak Ridge Distributed Active Archive Center has enhanced other LTER/NASA collaboration, in particular the LTER Information Management group

The LTER program has benefited from studies of soil properties at several sites in cooperation with the Soil Conservation Service (SCS). Soil scientists associated with SCS have worked with LTER scientists to develop soil maps and descriptions at several LTER sites.

Personnel from the LTER Network Office are actively cooperating with several national agency/interagency efforts to assure interoperability between the LTER Network and the greater scientific community. Two important efforts this year were the advancement of the NBII metamaker project and the U.S. National Committee for CODATA.

Through a collaboration with the San Diego Supercomputer Center (University of California-San Diego) and the National Center for Ecological Analysis and Synthesis (University of California-Santa Barbara),

United States: Table of Site Information

Site name	Date	Principal biomes	Reseaerch themes	Types and lengths of data sets
H.J. Andrews Experimental Forest (AND)	Site established 1980; Forest established 1948	Temperate coniferous forest. Douglas-fir/western hemlock/western red cedar; true fir and mountain hemlock; streams.	Successional changes in ecosystems; forest-stream interactions; population dynamics of forest stands; patterns and rates of decomposition; disturbance regimes in forest landscapes.	Watershed data collection began 1952; meteorlogical data colletion began 1958.
Arctic Tundra, Toolik Lake LTER (ARC)	Site established 1987	Arctic tundra, lakes, streams. Tussock tundra; heath tundra; riverine willows; oligotrophic lakes; headwater streams.	Movement of nutrients from land to stream to lake; changes due to anthropogenic influences; controls of ecological processes by nutrients and by predation.	Data since 1975.
Bonanza Creek Experimental Forest (BNZ)	Site established 1987	Taiga. Areas of boreal forest including permafrost-free uplands and permafrost-dominated north slopes and lowlands; floodplain seres.	Successional processes associated with wildfire and floodplains; facilitative and competitive interactions among plant species throughout succession; plant-mediated changes in resource and energy availability for decomposers; herbivorous control of plant species composition; hydrologic regime and stream ecology.	Tree-ring data since 1900; litterfall since mid-1960s; climate data since 1917.
Baltimore Ecosystem Study (BES)		Eastern deciduous forest/ Suburban Agriculture fringe, urban parks, residential and commercial patches, riparian and stream habitats.	Patch dynamics of built, social, biological, and hydrological components of the metropolitan area; feedback's between social, economic, and ecological components of an urban ecosystem; effect of infrastructure and development on fluxes of nutrients, energy, and water in upland, stream, and coastal regions of metropolitan Baltimore.	

the LTER Network is developing a knowledge network to link different sources of ecological information. This knowledge network will be used by ecologists to discover, retrieve, integrate, interpret, and analyze heterogeneous information from distributed sources.

Collaboration among Networks

Since the first exploratory discussions associated with the 1993 All Scientists' meeting in Colorado, efforts by U.S. LTER scientists have led to the adoption or consideration of the U.S. LTER network model in many other countries. NSF funding has enabled U.S. scientists to visit countries where there is demonstrated interest in LTER and has facilitated the development of national (see chapters in this volume) and regional (North American, Latin American, East Asia/Pacific, Central European, middle Eastern, African) networks.

Affiliation/Ownership	Principal investigator/ address	Area extent in hectares	Location	Nearest town
Oregon State University; USDA Forest Service, Pacific Northwest Research Station	Mark E. Harmon Department of Forest Science Oregon State University Corvallis, OR 97331-7501 503/750-7333 mHarmon@LTERnet.edu Arthur McKee Department of Forest Science Oregon State University Corvallis, OR 97331-7501 503/750-7350 aMcKee@LTERnet.edu Frederick J. Swanson USDA Forest Service Pacific Northwest Station 3200 SW Jefferson Way Corvallis, OR 97331 503/750-7355 fSwanson@LTERnet.edu	6,400 ha	N 44.2, W 122.2	Blue River, Oregon
The Ecosystem Center, Marine Biological Laboratory; Universities of Alaska, Massachusetts, Minnesota, Cincinnati, and Kansas; Clarkson University	John E. Hobbie Marine Biological Laboratory The Ecosystems Center Woods Hole, MA 02543 508/548-3705, ext. 473 jHobbie@LTERnet.edu Gaius R. Shaver Marine Biological Laboratory The Ecosystems Center Woods Hole, MA 02543 508/548-3705, ext. 492 gShaver@LTERnet.edu	150 ha	N 68.6, W 149.6	Brooks Range, Alaska
University of Alaska; Institute of Northern Forestry, USDA Forest Service, Pacific Northwest Research Station	Stuart Chapin University of California-Berkeley Department of Integrative Biology Berkeley, CA 94720 510/642-6000, 510/642-1003 fchapin@LTERnet.edu Mark W. Oswood Institute of Arctic Biology Department of Biology & Wildlife University of Alaska Fairbanks Fairbanks, AK 99775 907/474-7972 mOswood@LTERnet.edu John Yarie Forest Soils Laboratory School of Agriculture and Land Resource Management University of Alaska Fairbanks Fairbanks, AK 99775-0740 907/474-5650 jYarie@LTERnet.edu	10600 ha	N 64.8, W 148.0	Fairbanks, Alaska
Institute of Ecosystem Studies; USDA Forest Service, Johns Hopkins University; University of Maryland; Baltimore County and College Park; University of North Carolina; Parks and People Foundation; US Geological Survey; Yale University	Steward Pickett Institute of Ecosystem Studies Box AB Millbrook, NY 12545-0129 Phone: (914) 677-5343 FAX: (914) 677-5976 PickettS@ecostudies.org	Approx. 17,150 ha	N39.1, W –76.3	Baltimore, Maryland

As a result of the international meeting in 1993, an International LTER (ILTER) Network was formed with a mission to facilitate international cooperation among scientists engaged in long-term ecological research. The main objectives are to:

- Promote and enhance understanding of long term ecological phenomena across national and regional boundaries;
- Facilitate interaction among participating scientists across sites and disciplines;
- Promote comparability of observations and experiments, the integration of research and monitoring and encourage data exchange;
- Enhance training and education;
- Contribute to the scientific basis for ecosystem management and improve predictive modeling at larger spatial and temporal scales.

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United States: Table of Site Information

Site name	Date	Principal biomes	Reseaerch themes	Types and lengths of data sets
Central Arizona – Phoenix LTER (CAP)		Sonoran Desert scrub. Urban parks, residential, interior remnant desert patches, commercial and industrial patches, urban fringe, regulated river and floodplain (dry), effluent-dominated river.	Interactions of ecological and socio-economic systems in an urban environment; influence of land use change on ecological patterns and processes; movement of nutrients through highly manipulated, urban flowpaths; interactions of introduced and native species in urban environment; millenium- and century-scale geomorphic change in landforms and interaction with engineered landscapes.	
Cedar Creek Natural History Area (CDR)	Site established 1982; Natural History Area est. 1940	Eastern deciduous forest and tallgrass prairie. Old fields; oak savanna and forest, conifer bog; lakes; pine forest; wetland marsh and carr.	Successional dynamics; primary productivity and disturbance patterns; nutrient budgets and cycles; climatic variation and the wetland/upland boundary; plant-herbivore dynamics.	
Coweeta Hydrologic Laboratory (CWT)	Site established 1980; hydrology research established 1933	Eastern deciduous forest. Hardwood forests and white pine plantations.	Long-term dynamics of forest ecosystems including forest disturbance and stress along an environmental gradient; stream ecosystems along an environmental gradient; and the riparian zone as a regulator of terrestrial-aquatic linkages.	Streamflow gauging since 1939; chemistry data since 1968.
Florida Coastal Everglades (FCE)	Site established 2000	Freshwater Everglades marsh, estuarine mangrove, seagrass estuary	How regional controls (climate change, changing freshwater inflow) control population and ecosystem level dynamics in wetland-dominated coastal landscapes, with an emphasis on the oligohaline zone and taking advantage of the oligotrophic status of the entire coastal Everglades system.	Estuarine water quality data span over 10 years; canal nutrient data available for the last 20-30 years; fresh water marsh and mangrove wetland nutrient concentration flux data sor some sites that go back to 1996; primary productivity data for many fresh water and mangrove wetland sites back to 1997; soils data for most sites back to 1997-98; meteorology and hydrology for the study landscape for the last 20 –30 years; aquatic fish and in vertebrate population density data for some sites for the last 20 years and for many sites the last 5-7 years.
Georgia Coastal Ecosystem (GCE)	Site established 2000; The University of Georgia's Marine Institute was established on Sapelo Island in 1953	Coastal barrier island/marsh complex; salt marsh, estuary, intertidal sediments, surficial aquifer, oceanic sounds, oyster reefs.	Influence of river flow and groundwater discharge variability on: transport and exchange processes in salt-marshes, tidal creeks, and the surficial aquifer; sediment/ground water nutrient dynamics; salt marsh productivity and trophic structure; bacterial and fungal diversity and productivity; invertebrate population dynamics.	Published research from the Marine Institute dates back to 1955. The Marine Institute has climatological dating back to 1957 and water quality data dating back to circa. 1985-1990 (first five years are of lower quality). Various PIs associated with the LTER have datasets on a variety of topics dating back several years. We have yet to begin copying any of these data to the LTER database.
Harvard Forest (HFR)	Site established 1988	Eastern deciduous forest. Hardwood-white-pine-hemlock forest; spruce swamp forest; conifer plantations.	Long-term climate change, disturbance history and vegetation dynamics; comparison of community, population, and plant architectural responses to human and natural disturbance; forest-atmosphere trace gas fluxes; organic matter accumulation, decomposition and mineralization; element cycling, fine root dynamics and forest microbiology.	Data collected since 1907.

Affiliation/Ownership	Principal investigator/ address	Area extent in hectares	Location	Nearest town
Arizona State University (Main and West)	Nancy Grimm Arizona State University Department of Zoology Box 871501 Tempe, AZ 85287-1501 602/965-4735 ngrimm@LTERnet.edu Charles L. Redman Arizona State University Center for Environmental Studies Tempe, AZ 85287-3211 602/965-2975 charles.redman@LTERnet.edu		N33.5, W –11.2	PhoenixArizona
University of Minnesota	Peter Reich University of Minnesota Forest Resources 115 Green Hall St. Paul, MN 55108 612/624-4270 pReich@LTERnet.edu G. David Tilman University of Minnesota Department of Ecology, Evolution and Behavior 100 Ecology Building, 1987 Upper Buford Circle St. Paul, MN 55108-6097 612/625-5743 dTilman@LTERnet.edu	2,200 ha	N 45.4, W 93.2	Minneapolis, Minnesota
University of Georgia; USDA Forest Service, Southeastern Forest Experiment Station	David C. Coleman Research Professor Institute of Ecology Ecology Annex University of Georgia Athens, GA 30602-2360 Phone: (706) 542-2309 FAX: (706) 542-2423 *DColeman@LTERnet.edu*	2,185 ha	N 35.0, W 83.5	Otto, North Carolina
Florida International University	Daniel L. Childers Address Southeast Environmental Research Center, Florida International University, Miami, FL 33199; http://www.fiu.edu/~serc/ childers@fiu.edu	606,688 ha	25 N, 80 W	Miami, Florida
University of Georgia, University of Georgia Marine Institute, Skidaway Institute of Oceanography, Georgia Institute of Technology, Indiana University Bloomington	Timothy Hollibaugh aquadoc@uga.edu Steven C Pennings University of Georgia Marine Science Institute Sapelo Island, GA 31327 912 485 2293 scpenn@peachnet.campuscwix.net	7264 ha	31.4 N, -81.3 W	Darien, GA (small town within study region), Brunswick, GA (medium town just south of study region) and Savannah, GA (medium-large town 30 miles north of study region).
Harvard University; Universities of New Hampshire and Massachusetts; The Ecosystem Center, Marine Biological Laboratory	David R. Foster Harvard University Harvard Forest Petersham, MA 01366 508/724-3302 dFoster@LTERnet.edu	1,200 ha	N 42.5, W 72.2	Petersham, Massachusetts

United States: Table of Site Information

Site name	Date	Principal biomes	Reseaerch themes	Types and lengths of data sets
Hubbard Brook Experimental Forest (HBR)	Site established 1987; Experimental Forest est. 1955.	Eastern deciduous forest. Northern hardwood forests in various developmental stages, spruce-fir forests; streams and lakes.	Vegetation structure and production; dynamics of detritus in terrestrial and aquatic ecosystems; atmosphere-terrestrial-aquatic ecosystem linkages; heterotroph population dynamics; effects of human activities on ecosystems.	Hydrology data since late 1950s; biogeochemistry since 1963.
Jornada Basin (JRN)	Site established 1981	Hot desert. Playa, piedmont, and swale; bajada, basin, mountain and swale shrubland; mesquite dunes.	Desertification; primary production; animal-induced soil disturbances; direct and indirect consumer effects; vertebrate and invertebrate population dynamics; effects of grazing; biodiversity and ecosystem function; small mammal effects on soil and vegetation heterogeneity; soil microbial processes; surface hydrology; trace gas emissions from soils; eolian processes.	
Kellogg Biological Station (KBS)	Site established 1987	Row-crop agriculture. Conventional and organic-based corn-soybean-wheat cultivation; perennial biomass cultivation; native successional communities.	Ecological interactions underlying the productivity and environmental impact of production-level cropping systems; patterns, causes, and consequences of microbial, plant, and insect diversity in agricultural landscapes; gene transfer, community dynamics, biogeochemical fluxes.	Several decades of weather data available.
Konza Prairie Research (KNZ)	Site established 1980	Tallgrass prairie. Gallery forest; prairie stream.	Effects of fire, grazing and climatic variability on ecological patterns and processes in tallgrass prairie ecosystems, use of remotely sensed data and geographic information systems to evaluate grassland structure and dynamics.	Weather data since 1895; bird census data since 1971; aboveground NPP since 1975.

Based on the recommendations of the summit's working groups, directives for the U.S. LTER participation in an International LTER (ILTER) program include the following:

- Assisting in the establishment of networks for long-term ecological research in other countries;
- Creating programs and scientist exchanges between U.S. and foreign LTER sites and networks;
- Developing and operating a communication and data sharing system among an international network of sites.

The U.S. LTER Network Office has played an important role in the development and activities of the ILTER Network. From the 1993 International Summit to the present, the Network Office has provided the catalytic efforts to encourage the development of long term research in developed and developing countries, the stimulus to focus on research-intensive (research platform) sites as a fundamental way to address inter-disciplinary and integrative needs to understand complex systems, and the training/leadership required for electronic communication, networking activities and information management. The maturation of the ILTER Network has expanded and progressed to the stage where it is now important for the broader LTER and environmental science community to become actively engaged in developing research efforts that promote scientist to scientist, site to site, and network to network interactions. The Network Office remains the primary mechanism to stimulate these follow-up activities.

Among the primary strengths of the U.S. LTER Network are the quality and diversity of the research done at its individual sites. The 24 sites that make up the Network represent an enormous range of biological diversity and institutional affiliations.

Affiliation/Ownership	Principal investigator/ address	Area extent in hectares	Location	Nearest town
Yale, Cornell, and Syracuse Universities; Institute of Ecosystem Studies; USDA Forest Service, Northeastern Forest Experiment Station	Charles T. Driscoll Department of Civil and Environmental Engineering 220 Hinds Hall Syracuse University Syracuse, NY 12344 315/443-3434 cDriscoll@LTERnet.edu Timothy J. Fahey Cornell University Department of Natural Resources Fernow Hall Ithaca, NY 14853 607/255-5470 tFahey@LTERnet.edu	3,160 ha	N 43.9, W 71.8	West Thornton, New Hampshire
New Mexico State University; USDA ARS Jornada Experimental Range; Duke University, NC; NOAA, Research Triangle Park, NC; University of New Mexico; Dartmouth College, NH; Oregon Graduate Center; Texas Technological University; SUNY Buffalo, NY: University of Leicester, UK; Kings College, London, UK; EPA-EMAP, Las Vegas, NV	Laura F. Huenneke New Mexico State University Department of Biology Box 30001, Department 3AF Las Cruces, NM 88003 505/646-3933 lHuenneke@LTERnet.edu William Schlesinger Duke University Department of Botany Phytotron Building Box 90340 Durham, NC 27708-0340 919/660-7406 wSchlesinger@LTERnet.edu	78,266 ha +25,900 ha	N 32.5, W 106.8	Las Cruces, New Mexico
Michigan State University, Michigan Agricultural Experiment Station	G. Philip Robertson Michigan State University W.K. Kellogg Biological Station Hickory Corners, MI 49060-9516 616/671-2267 pRobertson@LTERnet.edu	800 ha	N 42.4, W 85.4	Hickory Corners, Michigan
Kansas State University	John M. Briggs Kansas State University Division of Biology Ackert Hall Manhattan, KS 66506-4901 913/532-6629 jBriggs@LTERnet.edu David C. Hartnett Kansas State University Division of Biology Ackert Hall Manhattan, KS 66506-4901 913/532-5925 dHartnett@LTERnet.edu	3,487 ha	N 39.1, W 94.6	Manhattan, Kansas

United States: Table of Site Information

Site name	Date	Principal biomes	Reseaerch themes	Types and lengths of data sets
Luquillo Experimental Forest (LUQ)	Site established 1988	Tropical rainforest. Tabonuco forest; palo Colorado forest; palm brake; dwarf forest and montane streams.	Patterns of ecosystem response to different patterns of disturbance; land-stream interactions; effect of management on ecosystem properties; integration of ecosystem models and geographic information systems.	Intermittent climate data since early 1960s (continuous since 1975); temperature and precipitation data since 1931.
McMurdo Dry Valleys (MCM)	Site established 1993	Polar desert oases. Glacial ponds, ice-covered lakes, seasonal streams, and arid soils.	Microbial ecosystem dynamics in arid soils, ephemeral streams, and closed basin lakes; resource and environmental controls on terrestrial, stream and lake ecosystems; material transport between aquatic and terrestrial ecosystems; ecosystem response to greater hydrologic flux driven by warming climate.	
Niwot Ridge/Green Lakes Valley (NWT)	Site established 1980	Alpine tundra. Fellfield; meadow; herbaceous and shrub tundras; cliffs and talus; glacial lakes; streams and wetlands.	Patterns and controls of nutrient cycling; trace gas dynamics, plant primary productivity and species composition; geomorphology, and paleoecology.	Longest datasets go back to 1952; area associated with the University since 1914.
North Temperate Lakes (NTL)	Site established 1981	Northern temperate lakes in glacial landscapes in urban, agricultural and forested watersheds. Oligotrophic, dystrophic and eutrophic lakes; temporary forest ponds; warm and cold streams; sphagnum-leatherleaf bog; conifer swamp; mixed deciduous and coniferous forests.	Physical, chemical and biological limnology; hydrology and geochemistry; climate forcing; producer and consumer ecology; ecology of invasions; ecosystem variability; lakescape and landscape ecology.	Some historic data sets (e.g., lake freeze and ice break-up dates) since 1852; birge and juday limnology data 1925-41; other data available.
Palmer Station (PAL)	Site established 1990	Polar marine. Coastal and open ocean pelagic communities; seabird nesting areas.	Oceanic-ice circulation and models; sea-ice dynamics; biological/physical interactions; effect of sea ice on primary production, consumer populations and apex predators; bio-optical models of primary production; spatial distribution and recruitment in consumer populations; seabird population dynamics and reproductive ecology.	

Affiliation/Ownership	Principal investigator/ address	Area extent in hectares	Location	Nearest town
Center for Energy and Environment Research, University of Puerto Rico; Institute of Tropical Forestry, USDA Forest Service, Southern Experiment Station	Ariel E. Lugo International Institute of Tropical Forestry USDA Forest Service PO Box 25000 Rio Piedras, PR 00928 (787)766-5335 X26 a_lugo@uprl.upr.clu.edu Frederick 'Fred' N. Scatena USDA Forest Service Institute of Tropical Forestry PO Box 25000 Rio Piedras, PR 00928-2500 (787) 766-5335 fscatena@fs.fed.us Jess Konrad Zimmerman Natural Science Faculty U.P.R. Río Piedras Institute for Tropical Ecosystem Studies PO Box 363682 San Juan, PR 00936-3682 (787) 767-0350 jzimmer@sunites.upr.clu.edu	11,231 ha	N 18.3, W 65.8	Near San Juan, Puerto Rico
Institute of Arctic and Alpine Research, University of Colorado, Boulder, Colorado; University of Alabama; Colorado State University; Texas Tech University; Montana State University; Desert Research Institute; Dartmouth College; U.S. Geological Survey, Water Resources Division, Portland State University; and University of Illinois at Chicago	B.W. 'Berry' Berry Lyons Byrd Polar Research Center Ohio State University 1090 Carmack Rd, Scott Hall Columbus, OH 43210-1002 614-688-3241 lyons.142@osu.edu	1,500,000 ha	S 77.0, E 162.9	McMurdo Station, Antarctica
Institute of Arctic and Alpine Research, University of Colorado	Nel Caine University of Colorado INSTAAR Campus Box 450 Boulder, CO 80309-0450 (303) 492-5053 cainen@culter.colorado.edu Timothy R. Seastedt University of Colorado INSTAAR Campus Box 450 Boulder, CO 80309-0450 (303) 492-3302 tims@culter.colorado.edu Carol A. Wessman University of Colorado CIRES Campus Box 216 Boulder, CO 80309-0216 (303) 492-1139 wessman@cses.colorado.edu	80 ha	N 40.1, W 105.6	Near Boulder, Colorado
Center for Limnology, University of Wisconsin-Madison, Wisconsin	Timothy 'Tim' K. Kratz University of Wisconsin Trout Lake Station 10810 County Highway N Boulder Junction, WI 54512-9733 (715) 356-9494 tkkratz@facstaff.wisc.edu	1000000 ha	N 46.0, W 89.7	Trout Lake Region near Boulder Junction & Madison Lakes Region near Madison, Wisconsin
University of California at Santa Barbara; University of California at San Diego; University of Hawaii; Montana State University; Old Dominion University	Raymond C. Smith University of California-Santa Barbara Institute for Computational Earth System Science ICESS/6th Floor Ellison Hall Santa Barbara, CA 93106 (805) 893-4709 ray@icess.ucsb.edu	240000 ha	S 64.7, W 64.0	Antarctic Peninsula

United States: Table of Site Information

Site name	Date	Principal biomes	Reseaerch themes	Types and lengths of data sets
Plum Island Ecosystem (PIE)		Coastal estuary.	Linkages between land and coastal waters involving organic carbon and organic nitrogen inputs to estuarine ecosystems from watersheds with various land covers and uses.	
Santa Barbara Coastal LTER (SBE)	Site established 2000; Government and university scientists have been doing research in the Santa Barbara Channel since the 1940's. Channel Islands National Park was established in 1980.	Semi-arid coastal zone/giant kelp forests, coastal mountians, coastal oceans, salt marsh, streams, chaparral.	Effects of land use on the processing and transport of nutrients and carbon to the coastal ocean. Role of runoff and oceanic forcing in structuring kelp forest communities. Controls on reef food webs by nutrients and predation.	Quarterly abundance data on phytoplankton, zooplankton, fish and birds in the Channel since 1949; annual abundance data on kelp forest plants and animals since 1980; quarterly abundance data on intertidal plants and animals since 1990; monthly / bimonthly estimates of giant kelp biomass since 1957; annual rainfall data since early 1900's; data on ocean temperature, waves, ocean color since mid 1980's
Sevilleta	Site established 1988; Wildlife refuge est. 1973; Bosque del Apache est. 1939.	Intersection of subalpine mixed-conifer forest/meadow, riparian cot- tonwood forest, dry mountainland, grassland, cold desert, hot desert. Conifer savanna; creosote bush; desert grassland; mesquite and sand dunes; Great Basin shrub and shortgrass steppes; tallgrass swales.	Landscape and organism population dynamics in a biome tension zone; semiarid watershed ecology; climate change; biospheric/ atmospheric interactions; paleobotany/ archaeology; microbial role in gas flux; landscape heterogeneity; scale effects on spatial and temporal variability.	
Shortgrass Steppe LTER (SGS)	Site established 1981	Shortgrass steppe. Floodplain; shrubland; saltmeadow.	Soil water; above- and belowground net primary production; plant population and community dynamics; effects of livestock grazing; soil organic matter accumulation and losses, soil nutrient dynamics; and ecosystem recovery from cultivation.	Grassland Biome Project began late 1960s.
Virginia Coast Reserve LTER (VCR)	Site established 1987	Coastal barrier islands. Sandy intertidal; open beach; shrub thicket; mature pine forest; salt marsh; estuary.	Holocene barrier island geology; salt marsh ecology, geology, and hydrology; ecology/evolution of insular vertebrates; primary/secondary succession; life-form modeling of succession.	Some data since 1970s; aerial photos since 1940s; weather data since late 1800s; repeated land surveys since 1852.

Affiliation/Ownership	Principal investigator/ address	Area extent in hectares	Location	Nearest town
Woods Hole Marine Biological Laboratory	Charles 'Chuck' S. Hopkinson Marine Biological Laboratory Ecosystems Center Woods Hole, MA 02543 (508) 289-7688 chopkins@mbl.edu	60000 ha	N42.4, W -70.5	Plum Island, Massachusetts
Marine Science Institute, UC Santa Barbara; Institute for Computational Earth System Science, UC Santa Barbara; Donald School of Environmental Science and Management, UC Santa Barbara; Department of Ecology, Evolution and Marine Biology, UC Santa Barbara; Department of Geography, UC Santa Barbara	Dan Reed Marine Science Institute University of California Santa Barbara Santa Barbara, CA 93106-6150 (805) 893-8363 reed@lifesci.ucsb.edu		34 N, 119 W	Santa Barbara, California
University of New Mexico; U.S. Fish and Wildlife Service	James 'Jim' R. Gosz Sevilleta LTER 167 Castetter Hall University of New Mexico Albuquerque, NM 87131-1091 (505) 277-2265 jgosz@sevilleta.unm.edu	168,690ha	N 34.3, W 106.8	Near Albuquerque, New Mexico
Colorado State University; USDA Forest Service; USDA Agricultural Research Service	Ingrid 'Indy' C. Burke Colorado State University Department of Forest Science Fort Collins, CO 80523 (970) 491-1620 indy@cnr.colostate.edu Eugene 'Gene' F. Kelly Colorado State University Department of Soil and Crop Sciences Plant Sciences Building, Room C22 Fort Collins, CO 80523 (970) 491-6881 pedoiso@lamar.colostate.edu Jack Morgan Rangeland Resources Unit Agricultural Research SErvice Ft Collins, CO morgan@lamar.colostate.edu	84,380 ha	N 40.8, W 104.8	Nunn, Colorado
University of Virginia	Linda K. Blum University of Virginia Department of Environmental Science Clark Hall Charlottesville, VA 22903 (804) 924-0560 lkb2e@virginia.edu John H. Porter Department of Environmental Sciences Clark Hall University of Virginia Charlottesville, VA 22903 (804) 924-8999 jhp7e@virginia.edu	14,000 ha	N 40.8, W 74.8	Near Oyster, Virginia

United States: Table of Site Information

Site name	Date	Principal biomes	Reseaerch themes	Types and lengths of data sets
LTER Network Office (NET)	Site established 1987		Publishing, information management, research technology, meeting coordination, satellite imagery.	

Affiliation/Ownership	Principal investigator/ address	Area extent in hectares	Location	Nearest town
University of New Mexico	James W. Brunt LTER Network Office Department of Biology University of New Mexico Albuquerque, NM 87131-1091 (505) 272-7085 jbrunt@lternet.edu John R. Vande Castle 505 272-7315 jvc@lternet.edu Robert 'Bob' B. Waide 505 272 7311 rwaide@lternet.edu		N 37.5, W 107.4	Albuquerque, New Mexico

ISRAEL: Dryland Ecosystem-management Network (DEN)

The Jewish National Fund (JNF), in cooperation with scientists from the Jacob Blaustein Institute for Desert Research of the Ben-Gurion University, from the Agricultural Research Organization - Volcani Center in Bet Dagan, and from the Soil Research Station - Ruppin Institute, Israel, initiated an ecosystem management program in 1990. The aim of the program was to develop ecosystem management of drylands that were under long-term human exploitation, based on integration of ecological understanding and application. The program concentrates on fostering development of ecological landscape management for increasing biotic productivity and diversity.

The program focuses on five questions:
1. What are the processes that control the input, retention and leakage of resources from natural and desertified arid and semi arid ecosystems?
2. What are the effects of the processes of resource flows, in natural and desertified ecosystems, on bioproductivity and biodiversity?
3. What are the consequences of biological interactions on flows of organisms and resources and landscape dynamics?
4. What are the potential management benefits in terms of bioproductivity and biodiversity of manipulations of resource flows and landscape structure?
5. What are the most efficient approaches for sustainable range management in dry lands?

In 1997, it was decided that this would be a long term program, so the sites and their program joined the international ILTER network. The chairperson of the Israeli network is Prof. Moshe Shachak (email: shachak@bgumail.bgu.ac.il). The co-chairperson is Dr. Avi Perevolotsky (avi@ias.agri.gov.il) and the site manager is Dr. Eli Zaady (zaady@bgumail.bgu.ac.il).

The program deals with three avenues; research, management and education.

The research program focuses on:
1) ecosystem composition, structure, function and processes;
2) ecosystem history and current state;
3) ecological consequences of ecosystem management;
4) biodiversity - the relationships among species, ecosystem and landscape diversity.

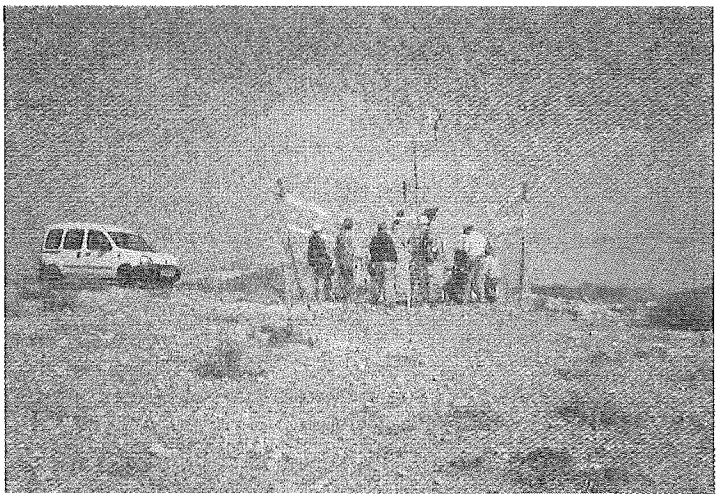
The core topics in the DEN program are the effects of natural processes and management on:
1) the spatial pattern and temporal variation of primary production.
2) the spatial and temporal distribution of populations selected to represent trophic structure and ecosystem engineering function.
3) the spatial pattern and temporal variation of organic matter.
4) water and nutrient flows.
5) patterns and frequency of disturbances.
6) spatial and temporal dynamics of functional and taxonomic diversity.

Management emphasizes restoration of areas that have undergone desertification. This had been caused by uncontrolled grazing and clear cutting of woody vegetation. The program utilizes two methods for ecosystem management of desertified areas: 1) controlled grazing and 2) formation of water enriched patches that can support relatively high biological productivity and diversity. The program studies the effects and effectiveness of both methods.

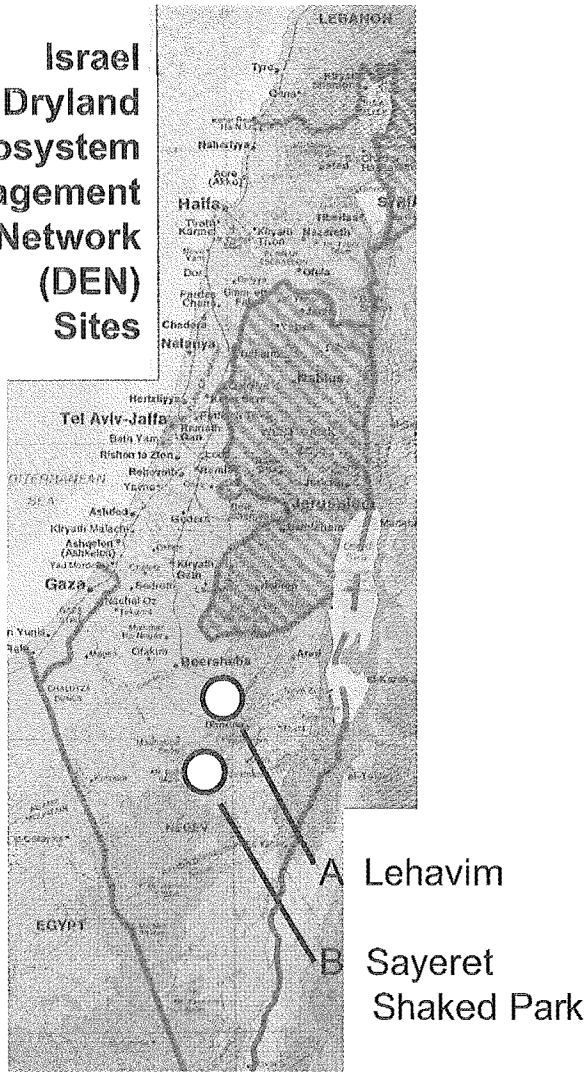
The education program is composed of a number of aspects: 1) demonstration sites where students can observe and track ongoing scientific research, 2) a number of educational plots for student projects, 3) an interactive Internet website where students can be kept up-to-date on the LTER activities and ask questions on issues that may be unclear to them.

Israel: Table of Site Information

Site Name	Date	Principal biomes	Research themes	Types and lengths of data sets
Sayeret Shaked Park	Established 1987	Semiarid desert; shrub and grass steppes, rocky and loessial watersheds, dry riverbeds, loessial plains.	Animals and ecosystem functions; Biodiversity and ecosystem function; Desertification; Disturbances; Ecosystem management; Effect of livestock grazing; Landscape dynamics; Nutrient cycling; Organic matter dynamics; Organisms as ecosystem engineers; Plant community dynamics; Remote sensing; Watershed ecology.	Changes in landscape mosaic (since 1991); Density, biomass and species diversity of annual plants in natural, disturbed and managed areas (since 1992); Dust and organic matter deposition (since 1993); Litter deposition (since 1993); Nitrogen flux (1994-97); Organic matter flow by surface runoff across the landscape (since 1991); Rainfall (since 1991); Recovery of crusted and shrub patches (since 1991); Runoff water generation and erosion from disturbed and undisturbed areas (since 1991); Seed bank dynamics (since 1995); Snail, ant and termite population dynamics (since 1995); Spectral reflectance (since 1994); and Variations in annual plant species composition due to grazing (since 1994).
Lehavim, northern	Established 1980	Semi arid desert; shrub and grass steppes, rocky and loessial watersheds, dry riverbeds, rangeland.	Animals and ecosystem functions; Biodiversity and ecosystem function; Desertification; Disturbances; Ecosystem management; Effect of grazing; Landscape dynamics; Nutrient cycling; Plant community dynamics; Primary production dynamics; Remote sensing; Spatial and temporal distribution of grazing; Watershed ecology	Changes in landscape mosaic; Density, biomass and species diversity of annual plants in grazed and ungrazed areas (since 1987); Effects of different stocking rates on plant communities (since 1987); Soil fertilization (1993-96); Herd movements (since 1999); Organic matter and soil flows by surface runoff across the landscape (since 1999); Primary production dynamics (since 1987); Rainfall and soil moisture dynamics (since 1994); Runoff water generation and erosion (since 1999); Seed bank dynamics (since 1994); Spectral reflectance; Variations in annual plant species composition due to grazing (since 1999); shrub dynamics (since 1998).



Automated weather station at the Lahavim site, installed by the Cooperative Montoring Center (CMC) of Sandia National Laboratory to facilitate climate monitoring and data exchange between Israel and Palestine. similar sites were set up in Palestine. Photo: Jim Gosz



REGIONAL COOPERATION

In cooperation with Hebron University and the Environmental Protection Authority of the Palestinian Authority and Sandia National Laboratories (SNL), two Palestinian LTER sites were established. The Palestinian sites are at Samoa, about 20 km south of Hebron and Zeef, about 10 km southeast of Hebron. The Palestinian chairperson is Dr. Akrum Tamimi, email: akrum@palNET.com . At this point, at each of the four (Israeli and Palestinian) sites, fully automated meteorological stations have been set up by SNL. The stations transmit data in real time to all ILTER sites. Two long-term research projects are in the process of being set up with the cooperation of Palestinian and Israeli scientists. One project is on the effect of effluent water and treated water on plant communities, and the other project is on the effects of grazing on productivity and diversity.

SITE CHARACTERISTICS

In the Israeli network there are at present two sites on a rainfall gradient, Sayeret Shaked Park at 200 mm average annual rainfall and Lehavim at 300 mm average annual rainfall. We plan on a third station at Sede Boqer under a rainfall regime of 100 mm average annual rainfall. For more details about the research sites, refer to the site information table.

INFORMATION MANAGEMENT

All data are stored on hard disks and on zip diskettes, accessible through a local network with several Mac and PC computers.

Affiliation/ownership	Site manager/key contact	Address	Area extent in hectares	Location	Travel distance and direction to nearest town
Mitrani Center for Desert Ecology, The Blaustein Institute For Desert Research, Ben Gurion University of the Negev	Moshe Shachak	Center for Desert Ecology, The Blaustein Institute For Desert Research, Ben Gurion University of the Negev, Sede Boqer Campus 84990 Israel shachak@bgumail.bgu.ac.il	300 ha	31°17' N, 34°37' E, 200 m	Northern Negev, Israel - 15 km west of Beer Sheva
Department of Natural Resources, Agricultural Resource Organization-Volcani Center	Avi Perevolotsky	Department of Natural Resources, Agricultural Resource Organization-Volcani Center POB 6, Bet Dagan 50250 Israel avi@ias.agri.gov.il	800 ha	31°25' N, 34°48' E, 300 - 400 m	Lehavim, northern Negev, Israel - 15 km north of Beer Sheva

NETWORK MANAGEMENT

Committee of six members, four researchers and two managers, meets bimonthly to discuss the research and its implementation.

APPLICATION OF DEN RESEARCH

The Network serves students, scientists and managers by demonstrating ecosystem structure and function and practical methods for sustainable ecosystem management for conservation and restoration.

Abbreviations: Dryland Ecosystem-management Network (DEN); International Arid Lands Consortium (IALC); Jewish National Fund (JNF)

Surface runoff plots to evaluate the influence of microbiotic crusts on water redistribution and shrub islands as water collectors at the Sayeret Shaked LTER site in Israel. Photo: Jim Gosz

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2) LEHAVIM

Ginguld, M., Perevolotsky, A. and Ungar, E.D. (1995). Managing herds and households: Managements practices and livelihood strategies of sheep-owning Bedouin households in the Negev region og Israel. Proc. of The 5th International Rangeland Congress, Salt Lake City, Utah, USA, August 23-28, 1995.

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Namibian Long Term Ecological Resesarch Network

The Namibian Long-Term Ecological Research Network (Na-LTER) was formed in August 1999 as the first national LTER network in Africa. This followed planning since 1993 in consultation with the International Long-Term Ecological Research Network (ILTER - http://www.ilternet.edu/). Na-LTER became the nineteenth member of ILTER. This document describes the characteristics of Na-LTER, as accepted at a workshop attended by 29 representatives of 16 environmental institutions on the 24th February 2000 in Windhoek.

Namibian Environment

"Namibia is one of the world's driest countries, skirted by the Namib and Kalahari Deserts and desiccated by the interplay of winds off the cold Atlantic and the hot southern African basin. It is therefore a nation with unusual and impressive habitats and species, many of them unique to the country or to the southernmost African arid zone. (...) Namibia faces significant fundamental environmental constraints which it cannot ignore. Its annual rainfall is modest and highly variable, the more so the further west one travels. This has not only shaped a range of extraordinary arid-adapted ecological communities, but has also powerfully shaped the human development options of the modern Namibia". p.4 In: Phoebe Barnard (1998) Biological diversity in Namibia: a country study. Namibian National Biodiversity Task Force.

The population of Namibia is 1.6 million in a land area of 824 000 km2 covering desert biomes, savanna, and broadleaf woodland. Annual rainfall ranges from 0 mm along the west coast of the Namib to over 700 mm in the eastern extremes of the Caprivi Strip. A relatively small research community working in government institutions, the University and Polytechnic, as well as non-government organisations, is supplemented by visiting scientists from abroad. Environmental research is dominated by implications of aridity in terms of hydrology (e.g. variability and prediction), biodiversity (e.g. endemism), tolerance of extreme conditions (e.g. hyperthermia, water balance) and socio-economics (e.g. desertification, sustainable natural resource management, knowledge transfer). Extraordinary features include one of the richest oceans of the world, strong climatic gradients from west to east and south to north, high concentrations of endemic species along the western escarpment and nearby Inselbergs, as well as high species richness of tenebrionid beetles and lichens (>200 species each) in the most arid parts of the country. Due to their scarcity, wetlands form focal points for resources in this dry country.

Na-LTER Goals and Objectives

Na-LTER endeavours to facilitate enlightened environmental management in Namibia. All Na-LTER partners have increased capacity to provide, access, understand and use long-term ecological data and information in Namibia.

The Na-LTER endeavours to: 1. Establish and have a functional Na-LTER network; 2. Identify, promote and facilitate the appropriate operation of Na-LTER sites; 3. Facilitate environmental monitoring and analyses of long-term and large-scale processes; 4. Establish, operate and maintain a comprehensive MetaDatabase; 5. Connect Na-LTER with partner networks; 6. Facilitate the transfer of LTER knowledge to resource managers, students and decision-makers; 7. Formulate funding strategies and secure funding for Na-LTER, and facilitate funding of LTER in Namibia.

The Network

The Na-LTER network comprises Namibian research institutions and individuals willing to contribute to the network's goal, purpose and objectives. The network is co-ordinated by the Na-LTER committee, a working group of the Namibian National Biodiversity Task Force (BDTF). The BDTF, housed at Directorate of Environmental Affairs, Ministry of Environment and Tourism, is a forum of government institutions, NGOs and individuals
http://www.dea.met.gov.na/Programmes/Biodiversity/Biodiversity/WorkingGroups.html.
The BDTF is co-ordinated by Dr. Phoebe Barnard (pb@dea.met.gov.na) at the Directorate of Environmental Affairs.

Secretariat

Na-LTER and Gobabeb LTER: Dr. Joh Henschel, Desert Research Foundation of Namibia, P.O.Box 20232, Windhoek, Namibia. Tel: +264-61-229855; Fax: +264-61-230172; Email: jhenschel@drfn.org.na.

Na-LTER Committee

The committee comprises Na-LTER network members willing to and capable of driving the LTER process forward in Namibia. Responsibilities of the committee include planning, drafting recommendations, developing network guidelines, organising meetings, representation and promotion nationally and internationally, identifying partners and soliciting collaboration, managing network activities (e.g. MetaDatabase), and drafting proposals for funding of such. The six current members joined the committee on a consultative basis. Committee members are:

member
position & institution
relation to LTER
own field
Dr. Joh Henschel (chair)
research co-ordinator of Desert Research Foundation of Namibia (DRFN)
jhenschel@drfn.org.na

project manager of Gobabeb LTER; management of long-term data sets; MetaDatabase co-ordination; ILTER contact
arthropods, climate, natural resource use
Dr. Chris Brown
director of Namibia Nature Foundation (NNF)
chrisbrown@nnf.org.na

administrative strategies, extension to Community Based Natural Resource Managemnt Programme (CBNRM)
ornithology, environmental & sustainable development planning & management in arid systems
Mr. Bertus Kruger
programme deputy-director of DRFN
bertusk@drfn.org.na

extensive experience with agricultural and forestry research stations, group facilitation
rangeland use, ungulates, productivity
Dr. Rob Simmons
researcher at Ministry of Environment and Tourism (MET)
harrier@iafrica.com.na

project manager of wetlands study sites, represents MET which administers Etosha Ecological Institute, data sharing policy
ornithology, wetlands
Mr. Ben Strohbach
researcher at Namibian National Botanical Research Institute (NBRI)
bens@mweb.com.na

Project manager at several field sites, agro-ecological mapping
botany
Ms. Juliane Zeidler
community programmes co-ordinator of DRFN
julianez@drfn.org.na

DRFN project manager of Namibian Programme to Combat Desertification (Napcod)
bio-indicators, arthropods, socio-economics, soils

Web Site
The web site http://www.netwise.drfn.org.na/NaLTER.html contains information on the Na-LTER network, member institutions, and field sites, as well as the Na-LTER MetaDatabase.

Membership
Sharing of environmental data with long-term perspectives (existing or potential) is the fundamental criterion of a Na-LTER member institution. Most environmental data with time and place coordinates have potential for LTER. Representation of information on (potentially) long-term data by an institution in the MetaDatabase serves as evidence of sharing.

Field Sites
The multi-tier scale approach of GTOS (Global Terrestrial Observing System) serves as guideline to identify the type of field site. The Na-LTER network includes sites with:
1. A primary ecosystem-based research and training programme (tier 2) at the Gobabeb Training and Research Centre, where LTER is conducted across the Namib Desert by the Desert Research Foundation of Namibia (Gobabeb is a designated national LTER site; http://www.iwwn.com.na/drfn/Gobabeb.html)
2. Long-term monitoring programmes (tier 3) at national park (Etosha Ecological Institute), agricultural, forestry and university research stations (Na-LTER sites to be identified by network member institutions)
3. Research projects and monitoring activities with long-term perspectives not directly affiliated to an on-site research station (tier 4), such as parks, reserves, and conservancies, weather stations, hydrological monitoring points, coastal and other wetlands, river catchments, the Eastern National Water Carrier, Inselbergs, Napcod desertification study sites, Sardep agricultural study sites, Rehoboth Acacia Forest, and Polytechnic field sites (Na-LTER sites to be identified by network member institutions)
4. Other regional or site-specific data shared through the Na-LTER network, such as socio-economic monitoring by Nepru (Namibian Economic Policy Research Unit), livestock censuses by Veterinary Services, wildlife censuses by Division of Specialist Support Services, runoff and groundwater monitoring by Department of Water Affairs (Na-LTER sites to be identified by network member institutions)

MetaDatabase
The MetaDatabase http://www.netwise.drfn.org.na/NaLTER/MetaDatabase.html is a core facility of the Na-LTER network. The MetaDatabase is managed by Netwise, a project of the Desert Research Foundation of Namibia. Netwise integrates information on environmental institutions throughout the SADC region. The MetaDatabase contains information on data relating to long-term ecological research by Na-LTER member institutions in Namibia. This enables institutions and researchers to obtain information on existing data including how it can be accessed.

Data Sharing Policy
The Na-LTER data sharing policy is that:
1. Information on data must be made available to the Metadatabase as soon as possible;
2. Assure long-term maintenance of the MetaDatabase;
3. Unrestricted data are made directly available via the internet in a MegaDatabase;
4. Other data listed in the MetaDatabase are conditionally available to users;
5. Completely restricted data are exceptional, reasons for restriction must be given, and information on the data should still be listed in the MetaDatabase;
6. Data are free of charge besides cost recovery for providing data;
7. Documentation and format of data, including method of collection and considerations for interpretation, should be user-friendly and enable others to use the data;
8. Institutions must ensure that data are available even if the investigator is transferred or dies;
9. Data is not distributed further by the recipient, except with substantial value addition+;
10. Investigators have first opportunity to publish data within a "reasonable" period of time*;
11. Data sources are adequately acknowledged;
12. Data source institutions receive copies of resulting publications.

* for post-graduate university students this encompasses the project period; for researchers, the period will be agreed upon
+ extent of value addition to constitute a difference needs to be agreed upon with the original data provider

Log-Frame

OBJECTIVE
ACTIVITIES
INDICATORS
1.
Establish and have a functional Na-LTER network
* define purpose of LTER in Namibia
* define membership criteria
* identify partners & solicit membership
* develop common vision among members
* formulate Na-LTER drivers and response variables
* define role of committee
* develop guidelines for LTER in Namibia
* workshop proceedings documented
* partners & committee meet as needed/agreed
* annual conference of network members
2.
Identify, promote and facilitate the appropriate operation of Na-LTER sites
* determine site selection criteria to guide to projects & institutions
* Namibian institutions & projects establish own long-term research sites, in synergy where possible
* the Na-LTER network serves as a source of technical expertise to assist institutions and individuals to design long-term monitoring systems and procedures as part of new programmes
* Na-LTER facilitates capacity-building at institutional LTER sites

* long-term study sites in Namibia organised along Na-LTER guidelines
* sites used by collaborators

3.
Facilitate environmental monitoring and analyses of long-term and large-scale processes
* obtain baseline data by monitoring along Na-LTER guidelines
* conduct experiments so as to continue monitoring (by-product)
* Na-LTER members assist other members with data collection, analysis and interpretation where required, feasible and practical
* identify and gain knowledge of long-term phenomena
* elucidate how short-term studies reflect long-term processes
* examine the role of episodic events
* provide data for modelling at large spatial and temporal scales
* recognise changes caused by human activities
* elucidate environmental factors that affect humans
* continuous data available
* scientific publications
* extent of collaboration between members
4.
Establish, operate and maintain a comprehensive MetaDatabase
* establish data sharing policy among network members
* design and manage an effective Metadatabase with detailed descriptions of environmental data in Namibia, how to obtain data and conditions of use
* Metadatabase with details and data from several Namibian institutions accessible on internet
5.
Connect Na-LTER with partner networks
* establish information exchange with ILTER, GTOS, SA-LTER and other developing national networks in Southern Africa
* publish Na-LTER details in media of international partners
* contribute to the establishment of a functional Southern African regional LTER network
* website describes Na-LTER network, participants and linkages
* Na-LTER sites have descriptions of projects and data on websites
* request assistance from ILTER, GTOS and SA-LTER as required
* Na-LTER publication by ILTER
* attend ILTER AGM
* Namibia features in SADC-LTER network
* partner collaborate and visit Na-LTER websites & physical sites
6.
Facilitate the transfer of LTER knowledge to resource managers, students and decision-makers
* foster mechanisms of information flow out of the network
* Na-LTER assumes an advocacy role, promoting the role and importance of LTER by disseminating information on the relevance and essential usefulness of monitoring
* use LTER as training tool for Namibian students: incorporate into field courses and capacity building
* use LTER projects as demonstration tools to further understanding of the Namibian environment
* publish in scientific, popular and policy media
* Polytech & Unam students are involved in LTER at each site (constellation)
* timely publications
7.
Formulate funding strategies and secure funding for Na-LTER, and facilitate funding of LTER in Namibia
* identify potential funding sources from development and research funding bodies or endowments
* garner support from ILTER, GTOS and collaborating international institutions and researchers for (collaborative) funding proposals
* Na-LTER network to engage in collaborative programmes where possible
* establish core funding for network functions (communications, website maintenance, meetings, promotion)
* continuous maintenance of MetaDatabase is funded
* core functions are funded
* where essential, non-institutional funding is available at LTER sites


Nuuk
(Godthab)
Ikateq
Nanortalik
Yellowknife
Rankin Inlet
Churchill
Edmonton
Calgary
Regina
Spokane
Bismarck
Minneapolis
Toronto
Ottawa
Quebec
Sydney
St. John's
Halifax
Boston
New York
Philadelphia
Washington D. C.
Raleigh
Jacksonville
Orlando
Tampa
Miami
Key West
Havana
Salem
Boise
Salt Lake City
Cheyenne
Denver
Oklahoma City
Phoenix
Dallas
Houston
San Antonio
Hermosillo
La Paz
Monterrey
Guadalajara
Mexico City
Acapulco
Guatemala
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Managua
San Jose
Caracas
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Lima
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Buenos Aires
Montevideo
Mar Del Plata
Bahia Blanca
Puerto Montt
Comodoro Rivadavia
Puerto Santa Cruz
Puerto Natales
Rio Gallegos
Port Stanley
Punta Arenas
Belem
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