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1999 LTER Network Office Annual Progress Report

Long Term Ecological Research Network

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ANNUAL PROGRESS REPORT

LONG TERM ECOLOGICAL RESEARCH
NETWORK OFFICE

1999 ANNUAL PROGRESS REPORT

SUMMARIZING ACCOMPLISHMENTS OF
THE LTER NETWORK OFFICE DURING
THE THIRD YEAR
OF COOPERATIVE AGREEMENT
DEB-9634135

ANNUAL PROGRESS REPORT

INTRODUCTION

The third year of the Cooperative Agreement establishing the Long Term Ecological Research (LTER) Network Office (NET) at the University of New Mexico ended on March 14, 2000. All activities proposed for the third year of the Cooperative Agreement were completed on schedule. A summary of noteworthy accomplishments during the past year is given below followed by descriptions of specific progress made in the seven major areas of responsibility of the Network Office.

- The Network Office entered into an agreement with the San Diego Supercomputer Center, the National Center for Ecological Analysis and Synthesis, and the University of Kansas to form the Partnership for Biodiversity Informatics (PBI). This Partnership will seek to advance the field of informatics as it relates to biodiversity and ecology.
- The Network Office continued to develop the collaborative relationship with the San Diego Supercomputer Center (SDSC) and the National Partnership for Advanced Computational Infrastructure (NPACI). Two post-doctoral associates (Lixin Lu and Joe Eastman) were employed to advance the use of high-speed computing resources by LTER scientists. A parallel version of the Regional Atmospheric Modeling System (RAMS) developed at Colorado State University was ported to SDSC and is running on a parallel processor. The increased computing power available at SDSC will permit the integration of RAMS with other models developed by LTER scientists (CENTURY, ECOTONE, RAMS).
- NET, SDSC, NCEAS, and Texas Tech University developed a successful proposal to the Knowledge and Distributed Intelligence (KDI) Competition at NSF. The proposal was titled "A Knowledge Network for Biocomplexity: Building and Evaluating a Metadata-based Framework for Integrating Heterogeneous Scientific Data". The goal of this proposal is to develop improved methods of access to distributed data sets needed by ecologists. A training program aimed at graduate students is an important component of this project.
- Our KDI working group formed a partnership with a similar project based at the University of Kansas. This alliance is designed to take advantage of parallel project goals to integrate knowledge networks in ecology and systematics. Data on primary productivity and biodiversity from LTER sites and the Organization of Biological Field Stations (OBFS) will be used as a test bed for the development of knowledge networking.
- Planning for the 2000 LTER All Scientists Meeting has reached an advanced stage. This meeting will be held in conjunction with the annual meeting of the Ecological Society of America. Details can be found at <http://www.lternet.edu/network/meetings/allsci/2000/>.
- A Committee on Scientific Initiatives was formed and had its first meeting in August at the annual meeting of the Ecological Society of America in Spokane. The function of this committee is to help identify new cross-site research initiatives and facilitate their development.
- NET continued support of the Schoolyard LTER program. Sites SLTER efforts are supported through NET activities such as web site development, promotion at national meetings, and workshops

- As part of the Earth System Sciences thrust area of NPACI, scientists from NET and the University of Kansas developed a joint project to use LTER land use data, regional climate output from RAMS, and museum collections data to examine the effect of land use and climate change on biodiversity.
- A joint project was initiated between the LTER Network Office and the Visualization Lab at SDSC to provide access to advanced visualization techniques to LTER scientists. A training workshop is proposed for the All Scientists Meeting.
- The International LTER program continued to grow and now comprises a total of 19 national networks. The Network Office facilitated the initiation and development of many of these networks.
- Activities have been initiated with the Global Terrestrial Observing System (GTOS) including a demonstration project to link data sharing/validation between ILTER sites and NASA programs.

FACILITATING ELECTRONIC COMMUNICATION

One of the principal responsibilities of the Network Office is the development and maintenance of effective electronic communication among the 24 LTER sites, among ILTER sites and networks, and between the Network Office and LTER, ILTER, and other networks. The tasks associated with this activity include the maintenance of a personnel directory and e-mail aliases for scientists working at U.S. LTER sites, development and maintenance of LTER and ILTER home pages, and support of the hardware and software required for data bases and electronic communication. For example, this year we coordinated the planning and development of enhanced network connectivity for LTER field sites. As a result, 19 sites submitted supplement proposals to provide field research connectivity at a level of T-1 or better. All these services have now been migrated to the new servers purchased this year and all movements of the domain name "lternet.edu" have been completed.

Specific accomplishments during the third year of the Cooperative Agreement included:

- We coordinated the planning and development of enhanced network connectivity for LTER field sites. As a result, 19 sites submitted supplement proposals to provide field research connectivity at a level of T-1 or better. The majority of those funded have since completed their connections. Feedback from site information managers about our role in this effort was very positive.
- Recruitment of a new user-support analyst and a programmer were completed. A part-time graphic designer was recruited to maintain and upgrade NET web pages.
- NET staff continued to update databases describing LTER personnel and publications. Statistics on LTER activities were also updated on the web site.
- We continue to maintain and add new features to the LTERnet mail reflector. Key mail lists are being archived in hypermail and new security features are being added to protect against SPAM and malicious mailings.
- An informational web page, and electronic mail group, linked to a database of ecological monitoring sites and contacts, were developed to support information and data exchange between ILTER/GTOS sites and validation programs of NASA

- NET Staff facilitated the first successful collaborative videoconference meeting of the LTER Executive Committee. This cost and timesaving technology will continue to be used two of the four annual meetings.
- This year NET staff made a concerted effort to expand the personnel database to include foreign scientists active in research at sites in the International LTER network. Although there have been several hundred foreign entries in the database, the majority of them are not associated with the ILTER networks. Once the new ILTER scientists have registered their research and biome expertise and interests, we hope this will facilitate identifying potential partners and sources of data for collaborations across sites and countries. Standardized e-mail addresses through "lternet.edu" will certainly make communication easier across sites.
- NET Staff continued to develop and upgrade the LTER Web site—the nexus for LTER Network science communication. Current projects include: enhancing the basic science information component for use by the general public, school children, and their parents, with interactive digital video clips, virtual reality tours and streaming “Web Cam” images, creating a window to SLTER activities, and archiving electronic editions of Network publications.
- Coordination between LTER site personnel and associates of the Global Fiducial Program including the MITRE Corporation to collect current classified remote sensing data for future use at LTER sites.
- Activities have been initiated with the Global Terrestrial Observing System (GTOS) including a demonstration project to encourage collaborations, link data sharing/validation between ILTER sites and NASA programs.

FACILITATING SCIENTIFIC EXCHANGE

The ultimate goal of all activities of the Network Office is to help increase the quantity and quality of scientific studies performed by the U.S. LTER Network and its associated national and international partners. The principal mechanism by which the NET achieves this goal is the facilitation of scientific exchange at all levels of LTER activity. To this end, the NET is charged with the development of activities that enhance the capabilities of LTER Networks and their opportunities to interact. During the past year, the Committee on Scientific Initiatives (CoSI) was formed and met to begin development of a strategic plan to improve scientific exchange among LTER sites. The existence of such a plan will permit NET staff to prioritize the expenditure of resources among many possible projects. Some of the activities carried out during the third year of the Cooperative Agreement are described below.

Facilitating exchange within the U.S. LTER network:

- The fourth LTER All Scientists Meeting is scheduled for August 2-4, 2000 in Snowbird, Utah. The theme of this year’s meeting is “Long-term ecological research: unifying principles and global applications”. In addition to a keynote address by Dr. Rita Colwell (invited), the program for the meeting includes six plenary lectures by invited speakers, over sixty workshops, poster sessions, student seminars, and the debut of videos on the U.S. and international LTER programs. In addition, the meeting will provide time for ad hoc meetings of investigators to follow up on ideas arising from the workshops and invited presentations.

- The Network Office will coordinate and support pre-planning and follow-up meetings focused on workshops proposed for the all scientists meeting.
- The Network Office organized the committee on scientific initiatives and supported its first meeting. Bob Waide chairs the committee.
- Net staff facilitated the development of technology allowing videoconferencing by the LTER executive committee.
- A second meeting on scale process modeling was held at the sdsc. Ten participants from LTER sites developed ideas for using sdsc resources to advance LTER research. A draft report from the meeting is available at (http://www.sdsc.edu/sdsc-lter/bspm99_121099.doc)
- A meeting to enhance the integration of the social sciences in LTER research was planned by the Baltimore and Central Arizona-Phoenix sites and conducted with support from net.
- Ongoing cross-site studies of geological weathering, biodiversity, regionalization, and climatic variability were continued with support from net.
- The Network Office sponsors the participation of individual information managers to develop special projects related to the NIS. Karen Baker, UCSD (PAL) and John Porter, UVA (VCR) both spent time at the Network Office this year developing key components of the NIS – the data table of contents (DIOC) and the site description database (SITEDB).
- Personnel from NET helped organize and fund CC meetings at the Luquillo and Hubbard Brook LTER sites.
- The Network Office provided specific web-based information for sites/programs interested in the recent expansion of the LTER program to include land-margin sites.
- Net staff organized executive committee meetings in San Juan, PR, and Washington, D.C.
- Chris French and Louise Williams helped the graduate student committee organize a meeting of LTER graduate students held during the ESA meeting in Spokane. Meeting highlights included presentations by James Gosz (LTER activities), Bob Waide (Network Office update), Diane Ebert-May (Committee on Education), and Chris French (ILTER).
- Net staff regularly acquires and posts minutes from Coordinating Committee and other meetings on the LTER web page.

Facilitating exchange between the LTER network and the national scientific community:

- The Network Office conceived of and developed a series of vision statements whose purpose is to encapsulate efforts in 15 areas key to the development of future LTER science. These key areas are: disturbance and recovery, regionalization, biodiversity/productivity, climate variability, socioeconomic elements of LTER research, development of technology, climate monitoring, education, integration of graduate students, data management, publications, microbial ecology, monitoring of biodiversity, and planning environmental observatories. LTER

scientists are preparing summary statements of goals in each of these key areas to be incorporated into the LTER web page (<http://www.lternet.edu/vision/>).

- James Brunt represented NET at a meeting of the Organization of Biological Field Stations at Mountain Lake Biological Station, Virginia, where he discussed methods of developing information management systems at field stations.
- NET Staff helped organize a symposium on North American regional LTER activities held at the ESA meeting in Spokane.
- NET developed a proposal for supplemental funds to initiate training activities in data management and communications for OBFS sites. These funds will be used to recruit a scientist resident at NET to conduct these training activities. The goal of this activity is to prepare OBFS sites for participation in the National Ecological Observing Network (NEON).
- Patricia Sprott, John Vande Castle, and James Brunt organized an LTER information booth at the joint annual meeting of ESA and the American Institute of Biological Sciences (AIBS) and distributed information on LTER activities to many meeting attendees.
- Patricia Sprott organized an LTER information booth at the 2000 meeting of the American Association for the Advancement of Science and distributed information on LTER activities.
- NET facilitated the development of two videos by John Dennis Productions. The first is an informational video directed towards research at LTER sites. The second video will describe the formation of international LTER networks.
- NET organized an ad hoc committee for microbial ecology/microbial observatory efforts within LTER, coordinating information exchange and producing an online summary and white paper: (http://www.lternet.edu/research/technology/microbial_ecology/) and (http://www.lternet.edu/research/technology/microbial_ecology/lter_me_whitepaper.html)
- NET organized a new committee of representatives of all LTER sites and a meeting of this committee to discuss new technologies, and implementation strategies resulting in an on-line document (http://www.lternet.edu/research/technology/background/techcom_1999.html) detailing the recommendations.
- NET collected new site coordinate and location information for use with advance remote sensing technologies within the global fiducial program (http://www.lternet.edu/research/technology/background/global_fiducial_program.html).

Facilitating exchange between the U.S. LTER network and the international scientific community:

- We have continued to enjoy success in pursuing the international objectives laid out in the network office grant and in implementing the mission of the ILTER network. NET recruited a group of U.S. LTER scientists to act as a consultative body regarding interactions with national networks in the East Asia-Pacific Region. A similar effort for the Central and South American region is well advanced. We will continue our efforts to develop a cadre of interested us scientists to act as advisors to the growing list of countries with active or interested in LTER style research.

- During the past year, national networks were formally established in Ukraine, Switzerland, and Namibia. Substantial progress was made in network planning by scientists and sponsoring organizations in Mexico and South Africa; their networks should be formally established shortly. Promising discussions continue with key scientists in Argentina, France, Austria, Romania and Slovakia, and inquiries have been received from scientists and government officials in several other countries.
- Regional networks continued to develop in the Central European, North American, South American, and East Asian regions. NET has contributed to these developments in a number of ways: communication by e-mail, information made available through publications and the increasingly enhanced web site it maintains, but most importantly through consultative visits and attendance at meetings.
- The Network Office is acting as a clearinghouse for chapters submitted for publication in a book on biodiversity in drylands. This book is the result of a workshop held in Israel that included many LTER scientists from the U.S. and other countries.
- NET staff organized the annual meeting of the ILTER network, which was held in South Africa on August 15, 1999, in association with a South African symposium on LTER, organized by the National Research Foundation of South Africa.
- John Vande Castle and Jim Gosz made presentations regarding the status of ILTER and GTOS at the annual meeting of the ILTER network and South African symposium on LTER, and John Vande Castle also made a presentation at the latter meeting regarding LTER data and information management.
- James Gosz represented NET and the LTER network at the EMAN meeting in Toronto, Canada, in January 2000.
- NET staff helped organize a symposium/workshop on the North American Regional LTER Network at the 1999 ESA meeting in Spokane. Scientists from Canadian, Mexican, and US networks made presentations.
- In addition to this public symposium, NET also coordinated a closed working meeting of the members of the new North American regional network during the ESA meeting. Four Mexican and four Canadian scientists participated as well as several scientists from the US LTER network.
- NET assisted in organizing a group of US LTER scientists, including Bob Waide, to participate in an international workshop in Korea associated with the biennial East Asian-Pacific regional LTER meeting, and provided follow-up to help create a permanent East Asian consultative group within the US LTER network.
- NET took steps to establish a similar us advisory/collaborative group for the Latin American region.
- Chris French organized an exchange visit of LTER graduate students between the US and Japan; eight us students from seven US LTER sites, accompanied by two senior scientists, visited four research sites in Japan in June 1999 and made presentations at a bilateral workshop. Four

Japanese students then visited four US LTER sites and participated in the ESA meeting in August 1999.

- Patty Sprott hosted a visit by a staff member of the Polish LTER network, trained him in desk-top publishing techniques and helped him with the substantial task of editing the proceedings of the US-Central Europe LTER workshop held in Poland in September 1998.
- Several other activities are reported under outreach, publications and other products

ACTIVITIES ASSOCIATED WITH DEVELOPMENT OF ILTER

Paralleling the development of the U.S. LTER network, international networks have sprung up in 19 countries since 1993. The impetus for this explosive growth was a meeting of international scientists held at Estes Park, Colorado, as part of the last LTER All Scientists Meeting. It was at this meeting that the concept of a global network of networks was first presented and embraced by representatives of 16 countries. Since that time, the LTER Network Office has successfully embraced the challenge of transferring the model of long-term ecological research developed in the U.S. to other national scientific communities. Each of the countries now supporting a network of long-term research sites has adopted a version of the model pioneered by the U.S. LTER program. At present, more than 200 international LTER sites have been designated (see <http://www.ilternet.edu>).

PROMOTING INFORMATION MANAGEMENT PROTOCOLS

The LTER Network Office provides leadership to the LTER sites and the Committee on Information Management regarding the development of standard protocols for management of data and information. An Associate Director for Information Management (James Brunt) is responsible for encouraging and assisting individual sites to develop state-of-the-art information management capabilities. In addition, NET coordinates information management activities at the network level to provide value added data products to LTER scientists and the ecological community in general. Moreover, NET provides the point of contact between the LTER Network Information Managers and other agencies and networks involved in the development of national standards for data management.

- The migration of “CLIMDB”, an interactive, web-based access system to integrated climate data from all sites, to the network office is complete. This effort was accomplished through support of Robin Stubbs, a database programmer at NTL, where it was developed. Efforts are now underway to get 100% site participation in this value-added database.
- The network information management committee made further advances this year at its annual meeting in Spokane, WA. Twenty of the 21 sites were represented with Cedar Creek not represented. Additional guests included Anne Frondorf, National Biological Information Infrastructure, and Dick Olson, Oak Ridge National Laboratory, DAAC project. The committee focused attention on metadata and the future development of the NIS. The major development to come out of this meeting was the formation of a metadata working group to formalize a standards-based metadata exchange format for ecologists. The metadata exchange format is the next critical step in developing an integrated network information system and much effort will be devoted to this in the coming year.

- The LTER Network Office sponsored participation of LTER Network personnel in efforts that are helping to lay the groundwork for developing international standards for data exchange and interoperability and provided exchange of information valuable to the developing ILTER networks.
- A data management workshop was held as part of the Hungarian ILTER meeting in June 1999 in Hungary. This meeting was facilitated by Information Manager Chris Wasser (SGS) and Graduate Student Kristin Vanderbilt (AND).
- The Network Office coordinated and hosted the Information Managers Network Information System (NIS) / Metadata working group in February, 2000 to further progress on the NIS and metadata standards for ecological data.
- James Brunt participated in an NSF post-vBNS workshop at San Diego where he represented the needs of the ecological community in the areas of high performance networks and computing. His presentation there focused on the need for ubiquitous network accessibility.
- James Brunt met with Anne Frondorf, NBII director, and the people at the USGS Center for Biological Informatics in Denver. Discussion focused on the development of a partnership between NBII and LTER. Immediate action provided for the inclusion of LTER representation on the biological data standards working group. Follow-up included having Anne Frondorf attend the LTER information managers meeting in Spokane.
- USDA-FS FHM – we have entered into discussions with Chuck Liff at the Forest Health Monitoring Data Center in Las Vegas about the integration of LTER and FHM metadata. A trip was scheduled but has been postponed.

ENCOURAGING NEW TECHNOLOGIES

The LTER Network has as a prime objective the dissemination of new technologies among its sites and scientists. The Network Office provides leadership in identifying and developing new technologies through an Associate Director for Technology Development (John Vande Castle), who serves as the chair of the Committee on Technology. The Network Office fulfills its role in encouraging the use of new technologies by actively identifying novel technology and new uses for existing technology that might benefit ecologists. We serve as a test bed for new products and a clearinghouse for products whose use is facilitated by a centralized repository. The Network Office also works to develop standardized data collection techniques where appropriate.

- Tony Fountain, a post-doctoral fellow at SDSC under a sub-contract from the Network Office, represented the Network Office at a meeting on vBNS technology held in Taiwan. One purpose of the meeting was to acquaint Asian colleagues with the ways in which LTER scientists use high speed computing.
- The Network Office has conducted a series of workshops and other activities to make LTER scientists aware of technology available at SDSC. In particular, we have focused on high-speed computing, mass storage, and visualization capabilities.
- We have purchased and are implementing the use of a digital video camera, which will enhance communication by providing video on demand via the World Wide Web and CD

Rom. These edited clips will include examples of site science, field and laboratory procedures, and searchable interviews with prominent ecologists discussing relevant ecological issues.

- We have begun development of Virtual Tours technology—using the digital still camera, a wide-angle lens and graphics software, the Network Office will assist sites in acquiring a series of photos and stitching them together into a 360° image, to be made available on the Web site.
- We have submitted a supplement proposal to acquire and deploy Web Cam technology, which allow WWW users to actively view LTER field sites with remotely controlled cameras, including pan/zoom/tilt capability.
- A new technology committee was organized, and NET supported the meeting and on-line publication of results and recommendations from the committee.
- NET canvassed LTER sites regarding their use of new technologies for microbial ecological applications, and summarized the information as an online document (http://www.lternet.edu/research/technology/microbial_ecology/) and a white paper (http://www.lternet.edu/research/technology/microbial_ecology/lter_me_whitepaper.html)
- NET investigated potential applications of currently classified remote sensing data within the Global Fiducial Program and assisted sites using new remotes sensing data from the Landsat-7 satellite.
- NET coordinated information for LTER sites regarding future use of hyper spectral remote sensing data to be available from the European Space Agency's Land Surface Processes and Interactions Mission
- NET has investigated several wireless internet technologies for use by LTER sites including BSWD (Mobitex network) and CDPD (cellular digital packet data) and implemented an operational prototype CDPD system.

DEVELOPING LINKAGES WITH OTHER LONG-TERM RESEARCH PROGRAMS, SITE NETWORKS, AND SCIENCE AND TECHNOLOGY CENTERS

The Network Office acts as liaison between the 24 sites and 1200 scientists in the LTER Network and other research programs, networks, and science and technology centers. We serve to coordinate activities of the LTER Network with similar efforts being conducted by other agencies or networks. This coordination includes cross-site or cross-network studies, standardization of experiments or data management, and joint proposals for research funding. We actively seek out partnerships that allow us to amplify the effect of research conducted at LTER sites and to address research questions that cannot be investigated successfully in isolation. We conduct focused research on mechanisms to improve linkages among research programs and data repositories.

- NET represents the LTER Network in interactions with the National Partnership for Advanced Computational Infrastructure based at the University of California at San Diego. The Network Office has a sub-contract from UCSD to promote the use of the facilities of the San Diego Supercomputer Center (SDSC) by LTER scientists.
- The Network Office is involved in the development of a joint project between LTER modelers, SDSC, and the Kansas University KDI program. The purpose of this initiative is to use meso-scale climate models to examine the indirect effect of land use change on biodiversity.

Predictions on the effects of land use change on regional climate at several LTER sites will be correlated with changes in biodiversity obtained through the KDI program's interface with museum collections.

- Staff of the Network Office coordinate database information of international ecological research site information, coordinates and contact information as well as e-mail connectivity within the has a formal arrangement to handle arrangements for e-mail connectivity within the GTOS network, as it relates to ILTER coordination efforts .
- NET staff interact with members of the Oak Ridge NASA DAAC facility to encourage information exchange and coordinate information management efforts between LTER and related NASA facilities. Richard Olsen of the NASA DAAC is included in LTER data management meetings and John Vande Castle is a member of the ORNL DAAC user working/review group.
- NET staff is involved in a program at the Cooperative Monitoring Center at Sandia National Laboratory to establish a Middle Eastern LTER Network. The goal of this initiative is to develop joint Israeli-Palestinian trust and cooperation through a common environmental research program. NET identified several LTER scientists to represent the LTER Network in future interactions.
- The network office provided technical assistance to The Nature Conservancy (TNC) to develop a web site and database to support a nascent amphibian-monitoring program in Latin America. The results from a trio of workshops related to this work are available at <http://www.lternet.edu/tnc> .

PROMOTING THE RELEVANCE OF LONG-TERM RESEARCH

One of the most important activities of the Network Office is the dissemination of results obtained by LTER scientists. Scientific publications based on LTER research inform the ecological community of our accomplishments. The Network Office has the responsibility to insure that LTER research results reach other potential users of the information such as policy makers, ecosystem managers, educators, students, the media, and the general public. We fulfill this responsibility through an outreach program that utilizes print and electronic media, personal presentations, video, the World Wide Web, workshops, symposia, and other means of disseminating information. Nearly all of the activities of the Network Office could be viewed as promoting the relevance of long-term research. However, some accomplishments in particular have been directed towards promoting a greater awareness in the scientific community and the public regarding the importance of our mission. These include the following research and educational activities:

- The web page describing activities of the LTER Network was re-designed and enhanced to provide improved access to information about LTER for students and non-scientists (<http://lternet.edu>). The re-organization of the Website has created important new avenues for reaching the research community and the public through electronic publishing.
- NET staff have planned the development of a Schoolyard LTER web page that will include information about each of the SLTER sites, satellite images covering the sites, video interviews with LTER scientists, real-time video feeds of LTER experiments, and fixed video cameras at selected LTER sites. A supplemental proposal has been submitted to initiate this activity.

- The Network Office has formed a partnership with the Ecological Society of America to develop a video history of ecological research in the United States. NET staff will interview prominent ecologists and record the interviews using state-of-the-art digital video techniques. NET will develop an archive of the interviews and develop products targeted for use on the web page and in presentations.
- Interactions with OBFS have been oriented towards developing an appreciation of long-term research and the need for data management at ecological field stations.
- Facilitation of the development of videos on research at LTER and ILTER sites will provide access to a large segment of the public.
- The biannual Network Newsletter is now available on the LTER Website in its entirety.
- The LTER slide presentation, a combination of information and images explaining the LTER program, is available on the LTER web page. Through the Internet, LTER sites can easily access to slides for their own presentations.
- Jim Gosz, Patricia Sprott, and Bob Waide are participating with the Publications Committee in the development of the Oxford Press book series.
- While electronic publishing adds a new dimension to communications, the LTER Network Office continues to recognize the importance of print publishing. During the last year, NET staff continued to expand the Site Brochure series and revised the LTER brochure and the International LTER book. Together with large-format posters (available on demand to specification), and the Website, these publications create a complete picture of LTER for the greater ecological research community.

Project Training/Development

- NET staff helped organize and participated in a workshop for LTER educators to provide information and training on obtaining funds for educational activities.
- The Network Office has begun to develop a joint project with the Visualization Lab at SDSC to train LTER scientists in advanced visualization techniques.
- Tony Fountain of SDSC has provided individual instruction in the use of facilities at SDSC to LTER scientists.
- We will be developing an on line syllabus for a seminar course to be conducted at 15-30 universities in association with the KDI project. This seminar will be designed to instruct graduate students in techniques needed to collect and analyze data on the relationship between biodiversity and ecosystem processes. The seminars will also include guidance on the construction and maintenance of databases and the use of software for data accession to be developed under the KDI project. The seminars will culminate in a meeting at NCEAS to synthesize data from the individual projects.

Outreach Activities

- NET staff prepared a brochure about the ILTER network that will be made available at various meetings and site visits, and sent to the ILTER network coordinators for their promotional use.

- We began work on a new edition of the ILTER book that describes the member networks in some detail as well as some of the cross-site research efforts. chapters will be solicited from the current 20 member countries plus any new countries that join in the next few months. This will be published in time for the All Scientists meeting.
- We substantially updated the personnel data base records of non-U.S. scientists affiliated with LTER and communicated to them that the semiannual US LTER newsletter was now available on the web site. Aside from reducing mailing costs, we believe that this will increase the awareness of this group of the other activities and information available about the US LTER and ILTER networks, since they will be drawn to the web site more often
- Patty Sprott developed an exhibition of LTER activities for the AAAS Meeting in February 2000 in order to communicate the importance of LTER science within the greater research environment.
- NET continues to enhance the LTER World Wide Web site—the primary interface between LTER science and school children, teachers, policy makers, the general public, and other scientists. Recent developments include improving the interface for general science communication and the addition of interactive visualization tools such as virtual reality tours and digital video clips.
- NET Staff presented an LTER exhibit at the annual ESA meeting in Spokane. They disseminated information about LTER to students and international and national researchers
- In association with the ESA meeting, Patty Sprott represented the LTER education program at a meeting of Strategies for Ecology Education, Development and Sustainability (SEEDS) – a collaborative effort between the United Negro College Fund (UNCF), the Ecological Society of America and the Institute of Ecosystem Studies that aims to increase the number of minority students choosing to major in ecology in college.

PUBLICATIONS

Journal publications

- Waide, R. B. M.R. Willig, C. F. Steiner, G. Mittelbach, L. Gough, S. I. Dodson, G.P. Juday, and R. Parmenter. 1999. The relationship between primary productivity and species richness. *Annual Review of Ecology and Systematics* 30:257-300.

Books and other one-time publications

- ILTER Directory: We compiled the first level of information for an international directory of scientists associated with LTER networks worldwide. This involved identifying and adding the site directors for each ILTER network site to the personnel database maintained by us. We will ask each foreign network to add to this database additional scientists who are involved in research at their sites as well as additional information about the research interests of their core LTER scientists. This will make it possible to search our personnel database for foreign scientists by organism, habitat, core area, etc., which will facilitate identifying partners for cross-site research.

- Ecological Data: Design, Management, and Processing. 2000. William K. Michener and James W Brunt, editors. Methods in Ecology series. Blackwell Scientific, Ltd, London.
- Brokaw, N., S. Fraver, J. S. Grear, J. Thompson, J. K. Zimmerman, R. B. Waide, E. M. Everham III, S. P. Hubbell, R. Condit, and R. B. Foster. Disturbance and canopy structure in two tropical forests. 1999. In E. Losos, R. Condit, and J. LaFrankie (eds.). *Tropical Forest Diversity and Dynamism*. Center for Tropical Forest Science, Smithsonian Institution, Washington, D.C. In press.
- Christian, R.R., C. French, R.B. Waide, and J. Gosz. 1999. Perspectives on international long-term research. Pp. 99-105 in *Perspectives in Ecology* (A. Farina, ed.). Backhuys Publishers, Leiden.
- Edited and produced Polish workshop proceedings: "Long Term Ecological Research: Examples, Methods, Perspectives for Central Europe. Proceedings of the ILTER Regional Workshop 16-18 September 1998, Madralin, near Warsaw, Poland."
- A new hardcopy of the personnel database was produced in July 1999. This publication included revisions of the personnel database made in 1998
- LTER Network Newsletters were published in April and September 1999
- Two NET publications "Guidelines and Sample Protocol for Sampling Forest Gaps. 1992" and "Guidelines for Measurements of Woody Detritus in Forest Ecosystems. 1996" were published in electronic format
- ILTER brochure

Internet Sites

- The Education Committee activities web site at <http://www.lternet.edu/oppts/education/>
- Employment Opportunities at <http://www.lternet.edu/employ/>

OTHER PRODUCTS

- Informatics in Long Term Ecological Research and Beyond. 1999. James W Brunt. 1999 ESA Poster Session: Beyond LTER., Spokane Washington.
- Whitepaper- The Future of Bioinformatics in LTER. 1999. LTER Information Management Committee.
- Reports of technology assessments, including the report of the 1999 LTER technology committee, have been compiled and placed online for access by the LTER and general ecological community at <http://www.lternet.edu/research/technology/>.
- Site description database - as part of a collaboration with FAO GTOS and the LTER information managers committee we have developed a prototype site description database that combines features suggested by PI's with those needed to do broad-scale analyses. The database features standardized representations of locations and sub-locations at sites including geo-spatial references. (expected prototype completion date January, 2000)

- Ecoinformatics homepage – we have made public the ‘ecoinformatics’ homepage which contains resources for ecologists involved in information management. These resources include lists of relevant websites and publications including PDF documents of unavailable publications. The very successful OBFS/LTER collaboration data management volume (DIMES) is included on the site in its entirety. <http://www.lternet.edu/ecoinformatics>
- NET staff participated in the Konza Prairie site review and the various NSF panels as well as conducting reviews of proposals for DBI and FSML programs in BIO.
- Produced an informational poster describing collaborations and science associated with GTOS and the NPP Demonstration Project.
- Produced informational poster describing the development of the International LTER Network and it’s affiliated countries.
- Produced sample tee-shirts to be displayed and distributed at future meetings, creating a sense of affiliation for LTER scientists and associates.
- Information regarding remote sensing coordination, LTER site coordinates, on-line Landsat and SPOT imagery for LTER sites are also maintained as documentation at <http://www.lternet.edu/research/technology/>.
- The Network Office compiled information related to Microbial Observatory efforts within the LTER Network at http://www.lternet.edu/research/technology/microbial_ecology/.
- Web information regarding Network Office support to the Global Terrestrial Observing System (GTOS), specifically for the first Net Primary Productivity Demonstration Project (GT-NET/NPP) has been compiled at <http://www.lternet.edu/gtnet/>. This site includes access to databases developed at the Network Office to support enhanced information exchange between International Long Term Ecological Research sites and verification projects of NASA.
- A modified version of the Terrestrial Ecosystem Monitoring Sites (TEMS) Database was developed with substantial updates for support and enhance information exchange within the GT-NET/NPP project.