A Report from the Network Office of the U.S. Long Term Ecological Research Network
for work accomplished in Year 1 of **DEB-0236154**
December 16, 2003

Introduction

The LTER Network Office (LNO) operates on a fiscal year beginning in March and ending in February. An annual report of LNO activities and accomplishments is prepared in December of each fiscal year. This report describes completed activities up to December, and projects work to be completed by February. The annual report is submitted to the National Science Foundation through the FastLane system, and modified reports are prepared for the LTER Executive Committee and the University of New Mexico in order to facilitate annual reviews of the LNO. The following document is the first of these reports to the LTER Executive Committee.

Accomplishments of the LNO are organized below into 10 categories, arranged to reflect the organization of the Scope of Work for the LNO Cooperative Agreement with the national Science Foundation. Where applicable, comments on obstacles to LNO operations are also included. This and future reports will adopt the same organization, although we solicit suggestions for additional information that might prove useful in the review process. A brief Executive Summary highlights the major accomplishments of the LNO during the past year. A complete list of LNO activities as described in the Scope of Work is given in Appendix 1, project participants are shown in Appendix 2, and organizational partners in Appendix 3.

Executive Summary

The scope and priority of activities conducted by the LTER Network Office (LNO) are closely linked to the overall objectives of the LTER Network and the tasks defined through the Cooperative Agreement between NSF and the University of New Mexico. The Scope of Work described in the Cooperative Agreement comprises ten core task areas. During the last year, the LNO has realized six major accomplishments related to our core task areas, as well as many achievements in response to specific tasks.

- We developed a draft strategic plan focusing on LNO's mission, its role in relation to other organizations, and the most effective structure for managing LNO and its relations with external entities. The plan includes 1) a mission statement, management organization chart, and defined scope of external relations; 2) mechanisms for personnel evaluation,; 3) reporting structures and mechanisms of accountability; 4) relations to NSF, UNM, and LTER leadership; 5) processes for program evaluation, priority setting, and priority implementation; 6) defined role in LTER-wide initiatives; 7) defined role in LTER-related research; and 8) assessment of the most effective structures and activities for independent advisory groups. Comments on the draft plan have been solicited from the LTER Executive Committee, National Advisory Board, and NSF. A final version will be submitted to the Coordinating Committee for their approval

at the April, 2004 meeting. The final version of the LNO Strategic Plan will be submitted to NSF as part of the Year 2 reporting requirement.

- LNO Senior Staff participated in the development of the Network Strategic Plan, including the preparation of a proposal to NSF for a planning grant to define and implement new synthesis activities as part of the LTER Decade of Synthesis. LNO staff helped develop working groups at the All Scientists Meeting to define science themes to be included in the Strategic Plan.

- The LNO took the lead in organizing, funding, and carrying out the fifth LTER All Scientists Meeting, held in Seattle, WA in September in association with the annual meeting of the Estuarine Research Federation. More than seven hundred scientists from U.S. and international LTER programs contributed to 66 working groups and nearly 400 posters. A call for proposals for follow up activities to the ASM resulted in 27 requests for support. At least 12 of these proposals will be supported by the LNO. These new working groups will provide leadership and direction for LTER cross-site and network-wide synthesis in the years to come.

- We conducted our primary responsibilities for service to LTER sites and the Network efficiently while undergoing a major reorganization of staff. Two staff members re-located and one was promoted, and all three of these positions had to be filled. Three new staff positions were funded and filled, two for the development of the Network Information System and the other to replace the promoted staff member. In the process of recruiting, we restructured our information management team to better serve the LTER community and to increase our capabilities in the field of IM technology and training. We also implemented a project team approach to core tasks and developed mechanisms for the evaluation and promotion of research faculty.

- We prepared and administered four surveys: 1) to individuals to determine needs and satisfaction with LNO services, 2) to sites for the same purpose, 3) to individuals to gauge satisfaction with the ASM, and 4) to LNO staff to assess job satisfaction. The results of these surveys will inform the annual evaluation of the LNO by the Executive Committee, the LNO and Network Strategic Plans, and planning for the 2006 All Scientists Meeting.

- We updated ILTER databases and prepared a status report in preparation for the transfer of ILTER responsibilities to the ILTER Executive Committee and the new U.S. LTER International Committee.

More detailed descriptions of accomplishments are given in the following sections.

Network Office Administration and Service Activities

The LNO provides basic services necessary for the LTER Network to function. Provision of these services supports each of the major goals of the Network by creating an efficient and effective environment in which LTER site, cross-site, and cross-Network research can be conducted. Specific tasks are identified in the Cooperative Agreement and reviewed annually by the LTER Executive Committee. Our accomplishments relative to these tasks are discussed below.

Interact with external entities

- We continued to coordinate interactions between the LTER Network and NSF, the U.S. State Department, the National Biological Information Infrastructure, other agencies, and other national and international networks. Specific activities included the organization of NSF participation in LTER meetings, conference calls, videoconferences, and the All Scientists Meeting. The LNO facilitated a mini-symposium on "Integration of Geosciences and Social Sciences into the LTER Program: Progress and Prospects" held at NSF in February and made presentations from that meeting available on the LTER web site. We continued negotiations with NBII to supply computational infrastructure for the LTER Network.
- We responded to multiple requests for information from individuals and organizations including Isle Royale National Park, Chicago Wilderness, the Acadia Institute for Teaching and Technology, the Rhode Island Natural History Survey, the International Pelagic Fisheries Research Program, the National Estuarine Research Reserve Program, the Organization for Tropical Studies, the Organization of Biological Field Stations, the York County Culture and Heritage Commission, the University of Rhode Island, and the University of Washington's School of Aquatic & Fishery Sciences.
- William Michener gave presentations related to LTER to the Advisory Committees for the Biological Sciences Directorate and the Geological Sciences Directorate at NSF, as well as the Advisory Committee for NSF's Environmental Research and Education Program which met in Santa Barbara at NCEAS. He also gave presentations at and participated in three NSF workshops related to identifying cyberinfrastructure challenges in the biological and geological sciences.

Administer funds

- We administered funds from the NSF under our Cooperative Agreement as well as funds contributed by the University of New Mexico as cost-sharing for the new Cooperative Agreement. During the past nine months, 14 separate grant accounts, 3 supplements to these grants, and 28 working group awards were managed out of the Network Office. Another 10-15 working groups will be initiated from the 2003 All Scientists Meeting.
- We administered funds for three supplements to our Cooperative Agreement for 1) the organization of the LTER All Scientists Meeting, 2) coordination and support of the ILTER Network, and 3) the African regional ILTER meeting in Botswana.
- We administered funds for separate grants for 1) a workshop on Environmental Cyber-infrastructure needs for distributed sensor networks (NSF), 2) the Knowledge Network for Biocomplexity (NSF), 3) the Spatial Data Workbench (NPACI), 4) the Resource Discovery Initiative for Field Stations (NSF), and 5) the Science Environment for Ecological Knowledge (NSF).
- We created and reconciled sub-accounts for 40 LTER cross-site working groups.

- We managed the close out of the previous Cooperative Agreement (DEB-9634135).

Prepare proposals

- We prepared two supplemental proposals for the All Scientists Meetings and support of the ILTER Network.
- We prepared competitive proposals for 1) a workshop on Environmental Cyber-infrastructure needs for distributed sensor networks (NSF), 2) the Spatial Data Workbench (NPACI), 3) improvement in LTER databases (NSF), and 4) biodiversity and ecological workflow modeling (DARPA).

Coordinate meetings

- We organized, coordinated logistics, managed finances, and helped prepare reports for the following meetings: Coordinating Committee (2), Executive Committee (4), Information Management Committee (1), IM Executive Committee/Network Information System Advisory Group (2), International LTER Coordinating Committee (1), National Advisory Board (1), All Scientists Meeting (1), SEEK Workshops (7), Research Coordination Network (RCN; 2), RCN OBFS informatics training (1), Canopy/LTER Database Workshop (1), EML Implementation Workshop (1), and Environmental Infrastructures Workshop (1). A total of 1081 participants attended these meetings.
- We organized meetings and maintained communications for four significant grants addressing global IT infrastructure (SEEK, RCN, KDI, and NPACI).
- We coordinated the 2003 All Scientists Meeting in Seattle with 711 participants, 66 working groups, three plenary sessions, and nearly 400 posters.
- James Brunt coordinated meetings for IMEXEC, IM, EML Implementation Standards, and Canopy Database Project, including conference calls and televideo conferences.

Report and communicate

- We prepared annual reports to NSF, the University of New Mexico, the LTER Executive/Coordinating Committee, and the U.S. Global Change Research Program (as required by NSF).
- We conducted three videoconferences with Henry Gholz of the NSF.
- Bob Waide visited four LTER sites (Palmer, Santa Barbara Channel, Luquillo, and North Temperate Lakes) to assess needs of sites and scientists and provide information on LNO activities.
- We prepared or edited reports and minutes from Coordinating Committee, Executive Committee, Information Management (IM) Committee, and IM Executive Committee/Network Information System Advisory Group meetings, teleconferences, and video conferences and posted these reports on the appropriate LTER web page

- We prepared and administered four surveys: 1) to individuals to determine needs and satisfaction with LNO services, 2) to sites for the same purpose, 3) to individuals to gauge satisfaction with the ASM, and 4) to LNO staff to assess job satisfaction.
- James Brunt provided quarterly reports to information managers and monthly reports to IMEXEC on the status of network office activities.
- Sonia Ortega visited five LTER sites (Luquillo, Harvard Forest, Virginia Coast, Jornada and Sevilleta) as an observer at NSF site reviews and contributed to the assessment of education activities for these sites.

Plan

- We organized and participated in multiple LNO strategic planning meetings during the year.
- We conducted a retreat of LNO staff to assess and revise strategic and tactical plans for LNO activities. (February 2004)
- We conducted bi-weekly meetings (when possible) of the Executive Director, Associate Directors, and Chair of the LTER Coordinating Committee to exchange information, review ongoing activities, and plan new initiatives.
- We conducted monthly meetings of LNO staff to exchange information and review ongoing activities.
- James Brunt conducted bi-weekly meetings of technical staff to monitor progress and coordinate tasks.
- Bill Michener conducted biweekly to monthly meetings of staff associated with the SEEK, RCN, and Cyberinfrastructure for Sensor Networking projects.
- We conducted an annual planning and assessment meeting between LNO staff and UNM administrators including the Vice-Provost for Research, the Dean of Arts and Sciences, the Chair of the Biology Department, the Director of the Museum of Southwestern Biology, and the Director of the State EPSCoR Program. (February 2004)
- James Brunt attended 16 meetings related to planning for the office relocation to campus.
- Bill Michener initiated a series of planning meetings of the Network Information System Advisory Committee that are designed to lead to a global cyberinfrastructure plan for LTER and ILTER.

Review and evaluate staff

- The Executive Director and Associate Directors conducted annual reviews of staff based on UNM norms.
- The Executive Director developed and tested a review procedure for the Associate Directors.
- The Executive Director participated in the development of promotion criteria for research faculty at the departmental and school levels.

- Recognizing the growing demands on the WWW for managing and disseminating information, we are in the process of restructuring our information management team to better serve the LTER community and to increase our capabilities in the field of IM technology and training. We have identified the need for and developed a Senior Web Designer position, and former Web Developer Marshall White has accepted this position. The Senior Web Developer will develop and maintain the most current technology for Web Site infrastructure, developing database interfaces, and training LTER sites in current WWW technology. Jeanine McGann, formerly a student intern, will fill Marshall's former position as Web Developer. The Web Developer will assist the Senior Web Designer in serving the LTER Network Office as well as sites' needs for web site content development and maintenance. A new Database Manager (Michelle Murillo; replacing Troy Maddux who has relocated) will be responsible for curation and maintenance of the LTER Network and OBFS databases, participation in the development of value-added and web-accessible databases, and providing technical assistance to site information managers among other duties,

Perform community service

- James Brunt developed the editorial guidelines, submission process, and publication website for a new peer-reviewed journal for the ecoinformatics community.
- James Brunt reviewed two chapters for a new textbook on introductory statistics by Ellison et al.
- Bob Waide reviewed a chapter for the North Temperate Lakes site volume.
- Bill Michener served on the Biological Databases and Informatics panel at NSF.
- John Vande Castle served on a Multi-User Equipment panel for BIO/DBI at NSF and on a NASA EOS panel.
- Bill Michener organized a review of biodiversity database activities for New Mexico's NSF EPSCoR Program that took place 3-4 December 2003.
- LNO senior staff reviewed manuscripts for Biotropica, Frontiers in Ecology and the Environment, Restoration Ecology, and BioScience.
- Bill Michener served as Senior Editor for Ecological Archives.
- The Executive and Associate Directors reviewed proposals for the National Science Foundation, the Environmental Protection Agency, the U.S. Department of Agriculture, and the National Aeronautics and Space Administration.
- Bob Waide and Bill Michener participated in a meeting sponsored by AIBS to plan governance structure for the National Ecological Observatory Network.
- Bob Waide served on a review panel for the environmental programs of the Smithsonian Tropical Research Institute.
- Bill Michener and Bob Waide consulted with the UNM/Mesa del Sol development project in Albuquerque.
- The Executive and Associate Directors participated in reviews for the Luquillo and Sevilleta sites.
- Sonia Ortega served on Advisory Board of Ecological Society of America (ESA) Strategies for Ecology Education, Development and Sustainability (SEEDS)

project, attended two meetings of this board, and chaired a committee to review applications for the ESA/SEEDS field trip to LTER Baltimore Ecosystem Studies site.

- Sonia Ortega served on local committee for the planning of the 30th anniversary meeting of the Society for the Advancement of Chicanos, Latinos and Native Americans in Science (SACNAS)
- Sonia Ortega served as Independent Reviewer/Advisor for Education Projects for the CR-USA Foundation.

Obstacles to LNO Operations

Since the beginning of the present Cooperative Agreement (March 1, 2003), we have made significant progress on the tasks described in Scope of Work associated with that Agreement. During that period, the LNO has endeavored to conduct its operations with as lean a staff as possible. Since March, our single Administrative Assistant, supported by one part-time hourly student, has supported the completion of the tasks listed above.

As part of the LNO Scope of Work, we conducted an accounting of time spent by senior staff on each of the 10 core activities. An analysis of time budgets revealed two key areas where improvement is needed. At our present staff levels, we are unable to provide timely information on accounts for the LNO Cooperative Agreement, external grants, and sub-accounts for meetings and working groups. Senior staff presently spends time trying to organize and understand these accounts which could be spent on other LNO and network activities. Assessment of tasks indicates that a separate accounting function should be established within the LNO to provide real-time budgetary information on all accounts and projects being managed. At present, the LNO relies on monthly budget reports from UNM, which do not include the most recent transactions and are therefore inadequate for accurate and timely planning and budget management. An additional administrative assistant dedicated to accounting would address this problem and allow other LNO staff to focus on their primary responsibilities. The annual cost of such a position would be $50K including fringe benefits and overhead.

In order to complete all service tasks scheduled for Year 1 on time, the LNO Executive and Associate Directors have had to devote more time than planned to administrative tasks, particularly regarding the management of accounts and the organization of meetings. We anticipate that the LNO workload will increase in Year 2 as activities relating to Network strategic planning, global IT infrastructure, and post-All Scientists Meeting activities mature and three new sites are added to the Network. Moreover, as recommended by the recent Site Review, the LNO is in the process of becoming a University of New Mexico center on July 1, 2004, a change that will involve additional reporting and budgetary tasks. Also on July 1, the LNO will move to new quarters on the main campus, a move that will result in a temporary increase in administrative load. At the same time, the University of New Mexico will implement a new accounting system, and the transition to this new system will also require increased administrative effort.

The LNO Strategic Planning process (Strategy 3) has identified the need for a Senior Program Manager to address these new tasks and to enable the Executive and Associate Directors to concentrate on developing initiatives in network-level synthesis, global information technology, and the Network Information System. By assuming duties such as meeting coordination, collection, maintenance and analysis of data on LTER operations, preparation of reports, oversight of administrative staff, development of operating procedures, cost and productivity analyses, proposal preparation, recruitment, and grant management, this new position will contribute significantly to the capability of the LNO to address the core objectives of the LTER Network. Annual costs associated with such a position are approximately $115K including fringe benefits and overhead.

Computational and Communication Infrastructure

The 2002 Site Review Report and NSF's response to that report acknowledged communication as critical to the LTER Network mission and have endorsed the infrastructure supported by LNO for computation and electronic communication. Our accomplishments in this area focus on increasing efficiency and accessibility of cross-site and network-wide communication.

- The @LTERnet.edu email reflector and mailing list service continues to be heavily used despite increasing limitations on file attachments and mail lists as seen by the leveling off of email volume. We have installed additional SPAM prevention and virus scanning software to make this service more useful.
- The limitations of email point to a need for more effective network based collaboration tools. We have been testing collaboration tools and portal software to find a useful platform for supporting LTER synthesis. This process has involved a lot of investigation and communication with collaboration experts and software developers.
- Databases have been tested on a monthly basis for anomalies and verification.
- Backups of databases were performed on a regular schedule, and shadow databases have been successfully restored from backups on a routine basis..
- The Local Area Network functioned with minimum unscheduled interruptions.
- We have increased security on our intranet site to provide one login/one password access to all our online resources. This also makes it easier for LTER scientists to find what they need.
- We have retooled our server room adding environmental controls. We have replaced deprecated computer equipment in use by the administrative staff.
- Server and desktop operating system patches and updates have been applied on release priority basis to reduce the risk of harmful exploits.
- Technical assistance was provided through two support portals, support@lternet.edu and webtask@lternet.edu. A tracking system is employed to monitor requests. We logged 1116 total requests during the year. Our request tracking software will be upgraded next year to provide us useful information about categories of requests and response times.
- Both sites and individual scientists were surveyed to identify needs for additional support. Results of the individual survey indicated strong support for a

centralized data repository, a centralized web entry port, and a web-based collaboration portal.

- Computer and network hardware was maintained and upgraded where necessary.
- We have brought new web and database servers online as well as new local storage.
- Historic LTER data were maintained in the remote sensing archive and new data acquired as part of the Spatial Data Workbench were added to the archive.
- We have met three times this year with mass storage consultants from Dell and have formulated and have a preliminary design for a storage area network (SAN) with entry, implementation, and growth strategies.
- A number of sites (*JRN, SGS, SEV, VCR)* have taken advantage of our outreach effort in effective web design – the 1-2 day workshop focuses on separating web design and content and attempts to get sites to refocus their efforts on content generation and away from designing and coding web sites. Several sites (SGS, SEV) and committees (Graduate Student, IM) are participating in a pilot project to redesign their web presence and take advantage of LNO virtual infrastructure services. Their experiences will be communicated to other sites and committees as results develop.
- Specific efforts were made to keep current with new technologies, primarily interests within LTER related to wireless data transmission. This field is changing rapidly, and John Vande Castle worked with a number of the LTER data managers and technicians to relay his experience and determine how other LTER sites are using the new technology. The revised LTER Technology web page (http://lternet/technology/) documents this information.
- Additional assistance was given to the Coweeta LTER site for wireless data transmission and the Sevilleta site was used to investigate data transmission ranges using a variety of wireless options, both serial data transmission and network based. John Vande Castle also installed the server and computer interface for the Sevilleta LTER site's sensor web collaboration with NASA. This work has since been passed on to Sevilleta site personnel and maintained by their staff.

Obstacles to LNO Operations

The LNO Systems Administrator is presently working at full capacity, and we envision the need for additional assistance to meet the strategic goals being set for information technology as well as an increased emphasis on internet security.

Information Management and Methods Development

The major tasks conducted by LNO staff in support of information management relate to development of metadata standards, maintenance of the LTER Network databases, development and promotion of new tools to archive and utilize geospatial data, and promotion of data standardization across sites. Continued improvements in methodology for managing LTER data are fundamental to improving the exchange of information

within the LTER Network and between the LTER Network and the rest of the scientific community. LNO provides leadership to the LTER sites and the Information Management Committee regarding the development and implementation of new techniques and protocols for management of data and information.

Promotion of metadata standards

- We organized and supported an EML implementation and best-practices workshop in June 2003. We had 12 LTER sites represented and a number of informatics partners. A preliminary report is online at: (http://intranet.lternet.edu/eml).
- We organized a local seminar on EML in December 2003 that was well attended by other UNM researchers and researchers from the Department of Interior.
- David Blankman provided consultation to individual sites on EML at the ASM 2003 and IM 2003 meetings.

Curation, maintenance, and expansion of LTER Network Databases

- The LTER Network Personnel database now contains 1810 Scientists. This up just under 300 from last year. There have been no major pushes for getting information updated in the last year so we attribute this to increases in site activity.
- The All-Site Bibliography is now being exposed through a server that is compliant with the international Z39.50 standard used by libraries and bibliographies around the world, and can be browsed by all Z39.50 clients including EndNote.
- The Site characteristics database will be online and searchable in mid-February. A number of changes in the design have been made by the IM committee since it was originally introduced and these have been implemented in this version.
- The LTER Data Table of Contents (DTOC) continues to be updated weekly from all 24 LTER sites and is searchable from the web. This will remain in effect until it is replaced late next year with the LTER metacat.
- More than 200 gb of data were added to the LTER historical data archive, which represents a 30% in archived data. The bulk of the data are new MODIS time series data added as part of the NPACI collaboration. Coordination with the related KDI project resulted in templates for the future translation of the metadata for the LTER spatial data into standardized EML metadata. The effort to convert Network Office metadata into EML compliant form will continue under the renewed funding for FY04 NPACI activities.
- Databases related to past coordination with the Global Terrestrial Observing System (GTOS) were modified as a final task in handing over coordination of the GTOS NPP Demonstration project to FAO/GTOS headquarters. More than 45 gb of obsolete data were removed after careful review from the LTER servers to free up space for other databases. This was primarily outdated raw MODIS data. Pertinent historical data comparisons, such as land cover and processed data and graphics resulting from this coordination were, however, preserved for potential

future GTOS as well as ILTER site data validation and comparison efforts. All information related to this project was made available to the GTOS coordination office in Rome.

- All LTER sites were located and mapped for classified reconnaissance data collection as part of the Global Fiducial Program. John Vande Castle visited USGS and other personnel to review classified data for proper parameters as requested by LTER site researchers as of December 15, 2003. Additional data collection during extreme events will also be reviewed, such as data obtained for east coast sites before and after Hurricane Isabel. Future efforts should be limited to routine data collection, historical data, and use of data by LTER researchers. Vande Castle provided a status report to NSF on this activity, and prepared material for a presentation by LTER PI Bruce Hayden for a talk he presented on this subject. Information related to the GLF coordination effort is available on the revised LTER GIS web pages available at: http://www.lternet.edu/technology/ltergis/index.html.
- We have completed phase 1 of the integration of the LTER network databases. Schemas have been redrawn and each database placed under a common ID structure, and original interface functionality restored – having the data under a common ID structure makes the overall resource more powerful and a more useful tool for providing the framework for the network information system.
- A substantial amount of time was devoted to upgrading and modifying web-based access to LTER spatial data. LTER Network Office web pages were revised and a new page specifically related to LTER GIS, spatial data and associated information was developed. Information related to the ad hoc LTER GIS working group is also posted on this web page: http://www.lternet.edu/technology/ltergis/index.html.
- Phase 2 of the integration of LTER Network databases will focus on increasing the ease of updates and creating the capability for sites to automate update via web services interface. Phase III will expose the database as an EML data source with a consistent API.
- ILTER databases and web pages continue to be curated. Updates related to communication continue to be made.

Data Standardization

- We have been collaborating with the Canopy Database Project to develop a cross-site study database framework. We have supported several site IM's to work with Judy Cushing in May, 2003 and again in November 2003 on this development, and results have been very useful. This provides groundwork for standardized approaches to ANPP.

Network Development, Community Outreach, and Training

Network development, community outreach and training efforts encompass an array of LTER Network Office activities that are specifically designed to have positive impacts on both LTER sites and the broader scientific community.

Network Development

- The OBFS databasing efforts continued in 2003 with the assistance of Marshall White who is restructuring the bibliography, site characteristics, and related databases to be compatible with the "parent" LTER databases. The data registry database was restructured with assistance from Matt Jones to be more user friendly (supporting on-line editing).
- Web-based access to LTER spatial data was upgraded and modified. LTER Network Office web pages were revised and a new page specifically related to LTER GIS, spatial data and associated information was developed. Information related to the ad hoc LTER GIS working group is also posted on this web page: http://www.lternet.edu/technology/ltergis/index.html.
- The OBFS web site continues to be housed at LTER and is maintained by Marshall White.
- In conjunction with the LTER CC meeting at the Kellogg LTER site, John Vande Castle assisted site personnel to install a sun photometer as part of the ongoing collaboration with the NASA AERONET sun photometer network. The sun photometer was made available after the instrument was no longer used by the flux tower associated with the NTL LTER site. Vande Castle worked with NASA collaborators to keep the instrument within the LTER Network and provide it to the KBS researchers who where interested in using it.
- Bill Michener and Deborah Estrin organized a symposium related to "Cyberinfrastructure Need for Distributed Environmental Sensor Networks" that was held at Scripps Institution of Oceanography. More than 75 ecologists, engineers, computer scientists, and representatives from environmental observatory networks (CLEANER, CUAHSI, ORION, LTER) attended the three day meeting. A variety of sensor technologies were reviewed and a comprehensive report was published (both hardcopy and web-accessible formats; http://www.LTERNET.edu/sensor_report)
- John Vande Castle interacted with the Center for Microbial Ecology related to LTER interests in the NSF funded Microbial Observatories. Most efforts during 2003 focused on interactions with NSF and LTER sites that were funded for Microbial Observatory research, which include updates to the LTER Microbial Observatory WebPages which Vande Castle maintains at http://www.lternet.edu/microbial_ecology/.
- Bill Michener organized two multidisciplinary symposia in conjunction with the LTER All Scientists' Meeting:

1. A Future Vision for Enabling Information Technologies for LTER Science.. LTER All Hands' Meeting, Seattle, WA. Funded by NSF and LTER Network Office. 21 September 2003.

2. Biological and Environmental Infrastructure: Science Needs, Infrastructure Opportunities, and Political Challenges and Realities. LTER All Hands' Meeting, Seattle, WA. Funded by NSF and LTER Network Office. 20 September 2003.

Community Outreach and Networking

- Bill Michener is meeting with OBFS personnel and participating in their strategic planning effort which involves database and cyberinfrastructure support.
- John Vande Castle attended the NBII "All Node" meeting to continue our interaction with their coordination office and nodes that interact with LTER sites. At this meeting he also made an LTER presentation related to the structure of LTER and the review process for sites and the Network Office, and discussed further potential collaboration.
- Bill Michener continued extensive interactions with network partners and building community outreach activities. In particular, he organized and participated in workshops and working group meetings with: SEEK (the Science Environment for Ecological Knowledge), PBI (Partnership for Biodiversity Informatics, which includes the National Center for Ecological Analysis and Synthesis, The University of Kansas, University of California-San Diego, and the LTER Network), NPACI (National Partnership for Advanced Computational Infrastructure), NBII (the National Biological Information Infrastructure, an affiliate of the US Geological Survey), RCN (a Research Coordination Network comprised of multiple LTER and non-LTER universities that are committed to enhancing the discovery of information resources at field stations and marine laboratories), NEON (the proposed National Ecological Observatory Network and related planning activities supported by the American Institute of Biological Sciences), and multiple NSF-sponsored workshops on building cyberinfrastructure for the environmental sciences. He also provided significant community outreach to the University of Rhode Island, the Rhode Island Natural History Survey, the International Pelagic Fisheries Research Program, the National Estuarine Research Reserve Program. As part of these outreach activities he contributed the following presentations:

2003 "Ecoinformatics: Managing Data, Rescuing Data and Changing the Scientific Culture." Keynote Address at the International Meeting of the Pelagic Fisheries Research Program. Honolulu, Hawaii; 9-11 December 2003.

2003 "Cyberinfrastructure, Distributed Environmental Sensor Networks and LTER Synthesis." Western Regional NEON Planning Meeting, Sevilleta Research Station, NM. 1-2 December 2003.

2003   "Environmental Cyberinfrastructure Needs for Distributed Sensor Networks." Biological Directorate Advisory Committee, NSF, Arlington, VA. 13 November 2003.

2003   "Seeking Informatics Solutions For Science." Biological Directorate Advisory Committee, NSF, Arlington, VA. 13 November 2003.

2003   "Cyberinfrastructure Planning for LTER Science." Biological Directorate Advisory Committee, NSF, Arlington, VA. 13 November 2003.

2003   "Environmental Cyberinfrastructure Needs for Distributed Sensor Networks." Geosciences Advisory Committee. NSF, Arlington, VA. 12 November 2003

2003   "A Future Vision for Enabling Information Technologies for Ecology and the Environmental Sciences." Building Cyberinfrastructure for the Geosciences: A Workshop and Symposium. NSF, Arlington, VA. 11 November 2003

2003   "Informatics: From Science to Solutions." Matt Jones & William Michener (joint presentation). Advisory Meeting of the Environmental Research and Education Program (NSF). Santa Barbara, CA. 23 October 2003.

2003   "Biological and Environmental Infrastructure: Science Needs, Infrastructure Opportunities, and Political Challenges and Realities." Triennial LTER All Scientists' Meeting, Seattle, WA. 19-21 September 2003 ASM.

2003   "A Future Vision for Enabling Information Technologies for LTER Science." Triennial LTER All Scientists' Meeting, Seattle, WA. 19-21 September 2003 ASM.

2003   "The Science Environment for Ecological Knowledge (SEEK): Enabling Ecology and Biodiversity Science Through Information Technology." Triennial LTER All Scientists' Meeting, Seattle, WA. 19-21 September 2003 ASM.

2003   "The Science Environment for Ecological Knowledge (SEEK) and the Resource Discovery Initiative for Field Stations." Annual meeting of the LTER Information Managers Committee. Seattle, WA. 22 September 2003.

2003   "Resource Discovery Initiative for Field Stations." Organization of Biological Field Stations Annual Meeting, Kananaskis Field Station, Canada. 11-14 September 2003.

2003   "Environmental Cyber-Infrastructure Needs for Distributed Sensor Networks: Introduction to the Symposium." Scripps Institution of Oceanography, La Jolla, CA. 12-14 August 2003.

2003   "Cyber-Infrastructure Challenges: An Ecologist's Perspective." Cyberinfrastructure Needs for the Biological Sciences: An NSF Workshop. Alexandria, VA. 13-15 July 2003.

2003   "The Science Environment for Ecological Knowledge." Biodiversity and Ecological Analysis and Modeling Meeting. Cozumel, Mexico. 6-8 August 2003.

2003 "Ecological Informatics: An LTER Perspective." Mesa del Sol Energy and Environment Center Planning Meeting, The University of New Mexico, Albuquerque, NM. 24 July 2003.

2003 "Role of Databases and Information Technology in Research Coordination Networks." Research Coordination Networks: An NSF Workshop. NSF, Arlington, VA. 12 May 2003. 2003   "The Science Environment for Ecological Knowledge (SEEK): Understanding change through information technology." Keynote Address at the Rhode Island Natural History Survey's 8th Annual Conference: Assessing Change in Rhode Island's Ecosystems. Rhodes On-the-Pawtuxet, Cranston, RI. 7 March 2003.

2003 "Metadata standardization efforts in ecology." Sixth International Open Forum on Metadata Registries, La Fonda Hotel, Santa Fe, NM. 20-24 January 2003.

- Bill Michener participated in a series of conference calls and working group meetings that were sponsored by AIBS and NSF and dealt with further refining the community vision for NEON. These efforts led to publication of the AIBS/IBRCS White Paper entitled "Rationale, Blueprint, and Expectations for the National Ecological Observatory Network."
- Bill Michener participated in and helped organize two workshops (4-6 September 2003 at the National Museum of Natural History, 10-11 November 2002 at AIBS in Washington DC) that led to publication of the IBRCS White Paper "A Plan for Developing and Governing the National Ecological Observatory Network (NEON).
- Bill Michener organized a group of informatics scientists (i.e., the OTS Informatics Committee) that held meetings at both Duke University and La Selva Biological Station. The meetings resulted in a comprehensive strategic plan for enhancing the informatics capabilities for the Organization for Tropical Studies.
- Bill Michener met with NBII and other governmental agency representatives at the Metadata Forum in Santa Fe where he presented an address on metadata and ecoinformatics.

Training (OBFS & LTER)

- LNO supported logistics for and staff participated in OBFS informatics training in November. Participants spent 2 weeks in an intensive course covering basic informatics and geographic information systems.
- Bill Michener organized an ecoinformatics training program for new faculty members that will be held 4-9 January 2004 at the Sevilleta Research Station. The course will primarily provide training for members of underrepresented groups in ecology and the environmental sciences. Sixteen US institutions will be represented in this training course.

Obstacles to LNO Operations

Staff turnover has been an obstacle to efficiency in this task area. Troy Maddux and Greg Bonito (funded by competitive grants) both re-located, and Marshall White was

promoted to Senior Web Developer. Replacement staff neede to be recruited amd trained.

Publications and Public Outreach

One of the most important activities of LNO is the dissemination of results obtained by LTER scientists. Scientific publications based on LTER research inform the ecological community of our accomplishments. The Network Strategic Plan establishes the goal of expanding the use of LTER knowledge in education, policy-making, management and public understanding of scientific issues. LNO contributes to fulfilling this goal 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.

- LNO continued to improve the content and design of LTER network web sites. (http://intranet.lternet.edu/, http://www.lternet.edu/)
- We helped sites prepare short descriptions of LTER research results to be updated on a regular basis and made these available to funding agencies, policy makers and the general public (http://www.lternet.edu/vignettes).
- Patricia Sprott, the LNO Technical Editor, attended two site reviews and met with LTER students, staff and scientists; learned about LTER site research and outreach activities; and shot panoramic images and developed Web sites to improve Site outreach potential.
- We produced articles for and edited two LTER Network Newsletters, working closely with writers from other LTER sites to assure broad, balanced coverage of research, outreach, publishing and other site activities. Patricia Sprott worked with the printer to manage production and distribution, and reformatted both issues for presentation and distribution on the Web.
- Patricia Sprott assisted the Santa Barbara Coastal LTER site with the production of their Site Brochure, including editing, layout, communication with site, managing production and distribution.
- Patricia Sprott completed editing and pre-production of International LTER Oxford University Press Synthesis volume. As support for the production of this volume, she completed final edits and communicated with authors; formatted and submitted the manuscript to OUP; communicated with OUP editors; and re-formatted figures. Sprott also consulted with the Jornada LTER site regarding their OUP synthesis volume.
- Sonia Ortega promoted participation of under-represented minorities in science through different activities such as:

    Presentations:

        Why Diversity? Invited presentation at: Women in Astronomy Conference, California Institute of Technology.

> Communicating Ecology with Diverse Audiences. Presentation at the Diversity in Ecology Luncheon. Ecological Society of America Annual Meeting.

> <u>Committee participation</u>:

> Member of Advisory Committee, Strategies for Ecology Education, Development and Sustainability (SEEDS) Program, Ecological Society of America.

> Member of the Human Resources Committee, American Institute of Biological Sciences (AIBS)

> Member of Education and Human Resources Committee- Ecological Society of America

> <u>Panel participation</u>:

> Pathways to Careers in Ecology and Environmental Sciences. Panel held at Smithsonian Institution as part of the ESA/SEEDS field trip to Baltimore LTER.

> Careers in Ecology. Panel held at the American Indian Science and Engineering Society (AISES) annual meeting.

- Patricia Sprott represented LTER at the Ecological Society of America annual meeting, which included gathering and distributing appropriate publications; operating the LTER exhibit at the meeting site; preparing and presenting a poster for Schoolyard LTER; preparing for and participating in the ESA History Committee meeting and the SEEDs program.
- Patricia Sprott gathered and edited materials for a poster for International LTER, including, consulted with scientists on the project, and produced the poster.
- We prepared materials for LTER All Scientists Meeting, including written materials for participants, web-based workshop and poster submission, an informational web site on the meeting, informational posters, and promotional materials for the meeting.
- We operated the LTER exhibit and information booth at the ASM.

Obstacles to LNO Operations

Patricia Sprott has re-located to North Carolina, where she is temporarily telecommuting while we conduct a search for her replacement. LNO Senior Staff have concluded that the responsibilities of this position should shift from an emphasis on technical editing and web page design to increased expertise in public relations. The new position, titled Public Information Representative, will include some of the duties of the Technical Editor (e.g., newsletters, brochures, media archive, representation of LTER at

professional meetings) but will also emphasize press contacts, preparation of information nuggets for NSF and other agencies, preparation of population publications, and public relations. The new position should be filled by February 1, 2004, and will directly contribute to Strategy 4 of the LNO Strategic Plan. Ms. Sprott will continue to contribute part-time to the preparation of site brochures and technical volumes during a period of transition to the new staff member.

Synthesis

One of the most important objectives of the LNO is to contribute to an efficient and effective environment in which site, cross-site, and synthetic research can be conducted. By creating such an environment, we hope to 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 LNO achieves this goal is the facilitation of scientific exchange at all levels of LTER activity. To this end, the LNO is charged with the development of activities that enhance the capabilities of LTER sites and networks and increase their opportunities to interact.

- Because of the All Scientists Meeting, no independent science theme meeting was scheduled for 2003. However, LNO staff helped to identify and organize seven thematic working groups at the ASM in consultation with the Executive and Coordinating Committees. These seven working groups addressed the following themes: biodiversity loss, extinctions and invasions, altered water and nutrient cycles, climate change, coupled human-natural ecosystems, engineered and designed ecosystems, and forecasting landscape change. The purpose of these working groups was to provide information for the development of a planning grant proposal to NSF to develop future synthetic activities in the LTER Network.
- As part of the call for proposals following the ASM, we requested submissions for a special science theme meeting to be held in conjunction with the CC meeting in Santa Barbara in April 2004. We have identified such a science theme, and we are working with the organizers to bring their ideas to fruition.
- Since there was no science theme meeting, no value-added databases were developed during the last year.
- The LNO took the lead in organizing the All Scientists Meeting held in Seattle, WA. All 24 sites were represented, and a total of 711 individuals participated in the meeting. Three plenary speakers, 66 working groups, and nearly 400 posters rounded out the meeting. Business meetings of the LTER Executive and Coordinating Committees, the International LTER Coordinating Committee, the Information Management Committee, the Education Committee, the AGTRANS project, and the LINX working group were held in association with the ASM. Details of the meeting can be found at http://www.lternet.edu/asm/2003/.

  For the first time, the ASM was held in conjunction with another disciplinary meeting, the annual meeting of the Estuarine Research Federation. Interactions between the two groups were catalyzed by a joint symposium and mixer. The 2003 meeting also incorporated two novel elements, the use of a hotel as the

meeting venue and facilitation of the meeting by professional meeting planners, the Schneider Group. Both of these innovations were successful. LNO staff wrote a supplement proposal to fund the meeting, coordinated the program, organized travel, lodging and meeting space for LTER and ILTER participants, prepared travel reimbursement for participants, coordinated activities with the meeting venues and the Estuarine Research Federation, disseminated information about the meeting, organized posters and working group abstracts and reports, and managed the accounts for the meeting.

- A call for proposals for follow up activities to the ASM resulted in 27 requests for support. LNO staff organized the call for proposals, distributed the proposals to the Executive Committee, and coordinated the review of the proposals. Sixteen proposals were approved for funding by the Executive Committee, of which sufficient funds were available in the Network Office budget to fund 12. Funds for the remaining four proposals are being sought through economies to other activities in the LNO. The Network Office was awarded only $50,000 a year for cross-site working groups, and the demand for support for synthesis is clearly greater than we can accommodate this year.

The following proposals were funded:

LTER Education Outreach Planning Meeting (McGee – LUQ)

Disturbance and Variance: Detecting Change In Terrestrial And Aquatic Ecosystems (Rusak, Fraterrigo and Turner – NTL, CWT)

Performing Network-Level Synthesis By Quantifying Ecosystem Goods And Services At LTER Sites Representing A Range Of Engineered And Designed Ecosystems (Wilson and Childers – BES and FCE)

Decline of Dominant Species Due To Invasive Pests and Pathogens: Consequences For Populations, Communities, And Ecosystems – Foster (HFR)

LTER-Based Student Research Symposium to Stimulate Cross-Site Student Lead Collaboration (Daoust and Gann, PIE and FCE)

N Deposition to Forested Ecosystems: Impacts on C Sequestration And Ecosystem Function (Sievering – NWT)

Workshop on Biogeochemistry of Dissolved Organic Matter (DOM) In Aquatic Environments of The LTER Program: Advancements Through Application Of Molecular Characterization (McKnight – NWT)

A Cross-Site Synthesis of the Long-Term Effects of Land Use History on Carbon and Water Balance (Gragson - CWT)

Species Richness in Space and Time: Follow-Up Activity to the ASM Workshop (Lauenroth - SGS)

Wireless Sensor Array Workshop Follow-Up Activities (Porter and Arzberger, VCR and SDSC/UCSD)

Distribution, abundance and dynamics of stream macroinvertebrates: Metapopulation dynamics and metacommunity structure (Gibson, Whiles and Collins – SEV and KNZ)

LTER Extreme Events Working Group [Goodin (KNZ), Brazel (CAP), Fountain (MCM), Hadley (HFR), Juday (BNZ), Kloeppel (CWT), Losleben (NWT), Lyons (MCM), Moore (SEV)]

- No meeting of the Committee on Scientific Initiatives was held in 2003.
- Waide and Michener worked closely with the Executive Committee to prepare a proposal to NSF for a planning grant to define and implement new synthesis activities as part of the LTER Decade of Synthesis. Should this grant be funded the LNO will play a central role in organizing meetings and working groups.

Obstacles to LNO Operations

The LNO requested funds to facilitate synthesis in its 2002 renewal proposal in accordance with instructions from the Coordinating Committee. Part of the request was granted ($50K), and these funds are being used to support synthesis working groups. However, the request also included annual support for a post-doc and an information manager to strengthen the annual science theme meetings, and these funds were not granted. NSF requested that the Network Office develop a leadership plan for synthesis in coordination with the Network Strategic Planning effort, and we have made substantial progress in this effort. As presently envisioned, the Network Strategic Plan will involve a lengthy planning process that will conclude in 2006 with a series of proposals. In the interim, resources to address the goals for cross-site and network-wide synthesis laid out in the LTER Decade of Synthesis are unavailable.

Network Information System Design and Development

Increasing the pace of synthesis in the next decade requires the development of an integrated information network with the capacity to discover access, interpret and process data easily across comparability and scaling barriers. Network information system (NIS) design and development encompass an array of LNO activities that are specifically designed to have positive impacts on LTER Network synthetic and informatics activities, as well as the individual LTER sites and the broader scientific community. At the behest of the Coordinating Committee, the LNO has added staff to support the development of the NIS and has focused on involving site scientists in planning for this development.

Establishing the Distributed Data Network
- We are supporting a web services development workshop at the San Diego Supercomputer Center in February 2003 to introduce sites to web services design, development, and implementation. The newly hired NIS team leader will present our revised vision of how this network will function and what the next steps will be for the LNO and the sites.
- A prototype of a metadata harvester will be completed by our NIS programmer in February 2003 - already initial tests have been made of harvesting EML metadata from sites into the LTER metacat metadata repository.

Community Collaboration and Standardization Efforts

- We organized and supported an EML implementation and best-practices workshop in June 2003. This workshop included discussions of standards for developing software around EML.
- As part of the NIS development activities, we will request additional funding to help sites with EML/NIS implementation – this request is based on the success of direct site visits from KNB technical personnel.
- We have submitted a joint proposal with a number of site informatics partners to extend the NIS development activities.
- We received a successful renewal of the NPACI Spatial Data Workbench project. This is the only NPACI Earth System Science project to be renewed for FY04. This will continue the important collaboration with SDSC and NACSE, especially related to web services and spatial data mapping. This effort will also support the initial steps to merge data of the Spatial Data Workbench and related LTER data into the SEEK processing environment.
- LNO PI's are participating in SEEK Knowledge Representation workshops that are aimed at developing these semantic modeling tools.

Promoting and Supporting Synthetic Research Collaborations

- We have completed Phase 1 of the integration of the LTER network databases. Schemas have been redrawn and each database placed under a common ID structure, and original interface functionality restored – having the data under a common ID structure makes the overall resource more powerful and a really useful tool for providing the framework for the network information system
- Phase 2 of the integration of LTER Network databases will focus on increasing the ease of updates and creating the capability for sites to automate updates via web services interface.
- Phase 3 will expose the database as an EML data source with a consistent API .

Coordination, Supervision and Reporting

- We have hired two new staff members to work on the LTER NIS that will form the core of our development team. The Network Information System Developer

will lead the team and will be part of the Network Information System Advisory Committee. Duane Costa is in the Analyst/Programmer 1 position and is in the process of developing a java harvester to populate the centralized data catalog.

- The Executive and Associate Directors participated in the activities of the NIS Advisory Committee, the Information Management Committee, and the Information Management Executive Committee.
- We organized a day long workshop at the 2003 ASM meeting addressing the planning for advanced cyberinfrastructure to support a global IT grid for LTER.

Obstacles to LNO Operations

The LTER Information Management Executive Committee wrote the LTER Executive Committee on October 14, 2003 requesting the creation of a new position in the LNO to provide technical outreach to the LTER sites and production level maintenance in the development of the LTER Network Information System. The position would provide technical assistance to the sites in EML implementation, the design and implementation of relational databases, the construction of web and GRID services as well as provide education in technical issues in both verbal and written forms. The position could also be used to provide assistance to new LTER sites at the beginning of implementing an information management system, to move network-level databases and tools for synthesis into production mode, and to provide maintenance for these components. These tasks would be an extension of efforts initiated under the KDI project, which comes to a close in February 2004.

The LNO has requested from the Information Management Committee clarification of the duties and skills required for this position. Before determining how this request should be addressed in the LNO Strategic Plan, we will consult with the LTER Executive Committee and the Network Information System Advisory Committee. We anticipate a request to NSF for this position as part of the LNO Strategic Planning effort.

International LTER

The LNO is responsible for assisting in the transition of the ILTER Network from an activity largely supported by the NSF to a broadly-based consortium of long-term networks. During this period of transition, the role of the LNO has been reduced pending a decision about the direction of the ILTER Network.

- NSF carried out an internal review of the ILTER program in 2003-2004, and the LNO contributed information when requested to do so.
- The annual ILTER meeting scheduled for Beijing was postponed because of the SARS outbreak, and an ILTER business meeting was held at the ASM instead. The LNO helped to organize and coordinate this business meeting.
- The LNO obtained supplemental funding to support an interim coordinator for ILTER activities. Dr. Alan Schroeder was recruited for this position. In addition to coordinating international participation in the ASM, he bought ILTER data

bases and web pages up to date and coordinated other ILTER activities. A detailed report on the status of ILTER has been sent to Henry Gholz under separate cover.

- Bob Waide attended the meeting of the Portuguese Ecological Society at their expense to provide information on the U.S. and International LTER programs.
- Bob Waide presented an invited paper on international LTER networks at the meeting of the British Ecological Society in Manchester. This trip was partially funded by the BES.
- Bob Waide presented an invited paper on the structure and management of research networks at the joint meeting of the Association for Tropical Biology and the British Ecological Society in Aberdeen.
- Alan Schroeder facilitated and attended a meeting of the ELTOSA group in Botswana in October.
- Jim Gosz and Bob Waide attended and presented papers at a joint meeting of the US and EU LTER networks in Motz, France, in June. This meeting was partially supported by the EU.
- The LNO partially supported a visit of South African LTER scientists to the Sevilleta and Jornada sites.

Obstacles to LNO Operations

Interim funding for the coordinator of ILTER activities has been expended, and there is presently no one designated to support the ILTER Network. Until NSF and the ILTER Executive Committee conclude their discussions regarding support for ILTER and funding is allocated, the LNO has no resources to support ILTER activities.

Education

Under the present SOW, the LNO focuses on a limited set of activities relating to the development of LTER educational activities. These include 1) participation in the development of the education strategic plan through the contributions of Sonia Ortega, an NSF employee on temporary assignment to LNO; and 2) maintenance of the Schoolyard LTER web page.

Facilitate the activities of the LTER Education Committee

- Sonia Ortega and LNO staff facilitated the activities of the LTER education committee through regular conference calls, annual meeting and education workshops. She prepared minutes of conference calls and meetings and disseminated information to LTER education representatives.
- Sonia Ortega helped several drafts of the Education Strategic Plan, and coordinated discussions of the education plan with members of LTER Education Committee, Coordinating Committee and Executive Committee for inclusion in the overall LTER Strategic Plan.
- Sonia Ortega presented a talk on Education Strategic Planning to the KBS Coordinating Committee Meeting in collaboration with Robert Bohanan (LTER

Education Committee Chair). This presentation was crucial for the follow up discussion on education at LTER by a working group of the Coordinating Committee.

- Sonia Ortega co-organized and co-chaired an education workshop at Konza LTER. This workshop had virtual participation of 16 sites. Outcomes of the workshop: draft of an LTER education handbook and updated SLTER statistics.

Support two meetings of the LTER Education Executive

- Sonia Ortega organized the annual meeting of LTER education representatives. The meeting focused on revision of strategic plan, an assessment workshop, and discussions by working groups about development of instructional materials using LTER research, follow up on education handbook and ways to increase diversity at LTER sites.
- Sonia Ortega co-organized two education workshops during the LTER All Scientists Meetings to further the goals of LTER education and to create partnerships with LTER Information Managers and members of the GLOBE project.

Maintain the SLTER web site
- The web site is maintained at http://schoolyard.lternet.edu/.
- Patricia Sprott produced a special Web site utilizing LTER research findings for use by the general public and Schoolyard LTER students. We recruited and trained a local Albuquerque high school teacher to research, write, and produce electronic images and text suitable for a general readership at the 8th grade level.

Facilitate logistics of an evaluation of the Schoolyard LTER Program

- Sonia Ortega helped to coordinate a Statement of Work and sought funding for the Assessment of Education Activities at LTER with NSF's Division of Research, Evaluation and Communication. Unfortunately, the assessment was not conducted because NSF's Biological Sciences Directorate didn't consider it appropriate at the time.

Promote participation of under-represented minorities in LTER-supported education activities

- Sonia Ortega organized an Environmental Education Teacher Workshop for the annual meeting of SACNAS (Society for the Advancement of Chicanos, Latinos and Native Americans in Science). This involved forming a 15-member team of scientists and educators to plan and conduct the workshop attended by over 200 teachers. The purpose of this off site, field-oriented session was to expose teachers to the importance of long-term field research and monitoring to teach ecological principles in the classroom. Teachers were taken to 4 sites along the Rio Grande in New Mexico including the Sevilleta LTER site. This workshop was the first of this kind ever offered at SACNAS and was described by

participating teachers as "the most meaningful experience during the SACNAS meeting"

<center>*Obstacles to LNO Operations*</center>

Sonia Ortega will return to NSF in September 2004, and the services that LNO now provides to the Education Committee will no longer be available.

Strategic Planning for the LTER Network

The Site Review Report and NSF commentaries on the report request that LNO engage in a strategic planning process in close consultation with the LTER Executive and Coordinating Committees.

- The sixth draft of the LNO Strategic Plan has been circulated to the LTER Executive Committee, the National Advisory Board, and the National Science Foundation. Comments from the Executive Committee, National Advisory Board, and NSF will be incorporated into Draft 7, which will be circulated to the LTER Coordinating Committee for additional comments. A final version will be submitted to the Coordinating Committee for their approval at the April, 2004 meeting. The final version of the LNO Strategic Plan will be submitted to NSF as part of the Year 2 reporting requirement.
- The University of New Mexico provided funds to engage an independent consulting firm through the Office of the Vice Provost for Research. Innovative Technology Partnerships was selected to facilitate the strategic planning process.
- Four-year plans and budgets for 1) further development of the information infrastructure and informatics capabilities of the LTER Network and 2) creation of high-level leadership and facilitation of future Network synthesis activities will be submitted with the final LNO Strategic Plan. These plans and budgets require close coordination with the Executive and Coordinating Committees and the Network Information System Advisory Committee.
- The LNO will become a center in the UNM system on July 1, 2004, concurrent with its move to new facilities on campus. During the past year, discussions about the optimum type of faculty appointments for LNO associate directors have taken place with the Vice Provost for Research, the Dean of Arts and Sciences, and the Chair of the Department of Biology. While some progress has been made, this issue is not completely resolved.
- Surveys prepared in consultation with Innovative Technology Partnerships have been administered to individuals and sites in the LTER Network. An analysis of the former survey has been sent to Henry Gholz under separate cover. Results from the latter survey will be presented at the Executive Committee meeting in Washington in February 2004.
- We are awaiting the results of the ILTER evaluation from the NSF. When completed, the new role of the LNO in ILTER will be incorporated into the Strategic Plan.

<center>25</center>

- The Executive and Associate Directors are involved in the development of the Network Strategic Plan. Bob Waide helped draft a proposal for a planning grant that is currently under internal review. Bill Michener and Bob Waide attended a meeting of the Executive Committee to set the parameters for this proposal. LNO staff helped develop working groups at the ASM to define science themes to be included in the Strategic Plan. LNO will continue to coordinate activities with the Executive and Coordinating Committees as the Network Strategic Plan matures.
- Jim Gosz and Bill Michener attended the Project Science Training Workshop sponsored by NSF where they learned management and planning techniques for large science projects.

Obstacles to LNO Operations

The development of the Network Strategic Plan presently has a timeline extending into 2006. However, certain elements of the LNO Strategic Plan (e.g., budgets for information technology infrastructure and leadership in synthesis) depend on the results of the Network Plan. Therefore, these elements of the LNO Plan will by necessity reflect the state of Network planning and will change as the Network Strategic Plan develops.

What research training has the project helped provide?

LTER Network Office provided informatics training for LTER information managers, representatives from field stations and marine laboratories during the past year. Specifically:

- A number of LTER sites (*JRN, SGS, SEV, VCR)* have taken advantage of our outreach effort in effective web design – the 1-2 day workshop focuses on separating web design and content and attempts to get sites to refocus their efforts on content generation and away from designing and coding web sites. Several sites (SGS, SEV) and committees (Graduate Student, IM) are participating in a pilot project to redesign their web presence and take advantage of LNO virtual infrastructure services. Their experiences will be communicated to other sites and committees as results develop.
- We organized and supported an EML implementation and best-practices workshop in June 2003. We had 12 LTER sites represented and a number of informatics partners. A preliminary report is online at: (http://intranet.lternet.edu/eml).
- We organized a local seminar on EML in December 2003 that was well attended by other UNM researchers and researchers from the Department of Interior.
- David Blankman provided consultation to individual sites on EML at the ASM 2003 and IM 2003 meetings.
- LNO supported logistics for and staff participated in OBFS informatics training in November. Participants spent 2 weeks in an intensive course covering basic informatics and geographic information systems.
- Bill Michener organized an ecoinformatics training program for new faculty members that will be held 4-9 January 2004 at the Sevilleta Research Station.

The course will primarily provide training for members of underrepresented groups in ecology and the environmental sciences. Sixteen US institutions will be represented in this training course.

What other educational and outreach activities have you undertaken?

Proposals were submitted to the Ecological Society of America for teaching ecoinformatics (one full day) and metadata management and implementation (two evening session) at the annual ESA meeting which is to be held in Portland OR in 2004. Michener has also developed a two day ecoinformatics training session that is partially supported by the United Kingdom's e-science initiative and will be taught in Scotland in May 2004.

Publications and Products

Journal publications

Andelman, S.J., C.M. Bowles, M.R. Willig, and R.B. Waide. Disentangling biocomplexity through a Distributed Knowledge Network. BioScience (in press).

Birkland, T.A. R.J. Burby, D. Conrad, H. Cortner and W.K. Michener. 2003. River ecology and flood hazard mitigation. *Natural Hazards Review* 4(1):46-54.

Boglioli, M., C. Guyer and W. Michener. In press. Mating opportunities of female gopher tortoises, *Gopherus polyphemus*. *Copeia.*

Hale, S.S., A.H. Miglarese, M.P. Bradley, T.J. Belton, L.D. Cooper, M.T. Frame, C.A. Friel, L.M. Harwell, R.E. King, W.K. Michener, D.T. Nicolson and B.G. Peterjohn. 2003. Managing troubled data: coastal data partnerships smooth data integration. *Environmental Monitoring and Assessment* 81:133-148.

Michener, W.K. In press (book review). Win-Win Ecology: How the Earth's Species Can Survive in the Midst of Human Enterprise. *Restoration Ecology*.

Books and other one time publications

Bonito, G.M. and W.K. Michener. In press. Environmental *In situ* Sensors. *Proceedings of the National Conference on Environmental Science and Technology*.

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. 2003. Disturbance and canopy structure in two tropical forests. In E. Losos, R. Condit, and J. LaFrankie (eds.).

Tropical Forest Diversity and Dynamism: Results from a Long-Term Tropical Forest Network. Center for Tropical Forest Science, Smithsonian Institution, Washington, D.C.

Estrin, D., W. Michener, G. Bonito, and the workshop participants. 2003. Environmental cyberinfrastructure needs for distributed sensor networks: A report from a National Science Foundation sponsored workshop. University of New Mexico, Albuquerque, NM. 56 pp.

Franklin, J., R. Gardner, A. Mills, W. Michener, K. Holsinger, K. Nadelhoffer, R. O'Connor, J. Goldman, J. MacMahon, and H. Swain. 2003. IBRCS White Paper: A Plan for Developing and Governing the National Ecological Observatory Network (NEON). Washington, DC: American Institute of Biological Sciences. 23 pp.

Groffman, P.M., M. Shachak, M. and R. B. Waide. (in press). Unified Framework II: Ecosystem processes: a link between species and landscape diversity. In J. Gosz, S. Pickett, A. Perevelotsky, and M. Shachak, eds. *Dryland Biodiversity*. Oxford University Press.

Holland, F., W. Michener, R.H. Beard, and J. Silvanima. 2003. National review panel report of the National Oceanic and Atmospheric Administration's Centralized Data Management Office of the National Estuarine Research Reserve System. National Estuarine Research Reserve System, Washington, DC. 5 pp.

Holsinger, K.E., and the IBRCS Working Group. 2003. IBRCS White Paper: Rationale, Blueprint, and Expectations for the National Ecological Observatory Network. Washington, DC: American Institute of Biological Sciences. 68 pp.

Jones, M., W.K. Michener, and others. 2003. Sixth workshop on the development of a National Ecological Observatory Network (NEON): Information management. Proceedings of a NSF workshop held 16-18 September 2002 at the National Center for Ecological Analysis and Synthesis, University of California Santa Barbara, Santa Barbara, CA. 21 pp.

Michener, W.K., J.W. Brunt and K.L. Vanderbilt. In press. Ecological informatics: a long-term ecological research perspective. *Proceedings of the 6th World Multiconference on Systematics, Cybernetics and Informatics*.

OTS Informatics Committee (J. Beach, R. Colwell, E. Meléndez-Colom, W. Michener, R. Morris, and J. Porter). 2003. OTS Informatics Committee (2002-2003) Report: Managing Tropical Biology Information and Knowledge Resources. Organization for Tropical Studies, Durham, North Carolina. 67 pp.

Thompson, J., N. Brokaw, J. K. Zimmerman, R. B. Waide, E. M. Everham, and D. A. Schaefer. 2003. Luquillo Forest Dynamics Plot. in E. Losos, R. Condit, and J. LaFrankie, editors. *Tropical Forest Diversity and Dynamism: Results from a Long-Term Tropical Forest Network*. Smithsonian Institution.

Web or internet sites

- www.lternet.edu – The LTER Network Office maintains the LTER homepage, a publicly accessible website about the LTER Network. This website provides information to scientists, students, educators, collaborators, agencies and the interested public about the LTER Network, its mission, goals, and research directions. In addition, information about new ground-breaking research, new publications, and new interactions can be found here.

- intranet.lternet.edu - The Network Office maintains an intranet web site separating LTER Network specific content from the information presented about LTER to the general public. A portal to all the content needed in the process of conducting the business of the LTER Network is available without additional navigation of the site. LTER network databases can be searched and updated from this page. Information about meeting dates, committee pages, and current events is available via this portal. Access is controlled by authentication for information requiring additional credentials.

- www.ecoinformatics.org – this a web presence for informatics application development projects by LTER researchers, their collaborators, and other interested parties. It provides a source code control repository as well as home for various projects including the Knowledge Network for Biocomplexity, Ecological Metadata Language, Science Environment for Ecological Knowledge, and Jalama. The site includes access to maillists and archives about these projects and is co-managed by the National Center for Ecological Analysis and Synthesis and the LTER Network Office.

- www.obfs.org – The LTER Network Office provides the web infrastructure and some of the maintenance for the Organization of Biological Field Stations web site. This includes a database of field courses available at OBFS stations that is updated each year, a personnel database, and a developing registry of OBFS datasets.

- Databits – an online newsletter about data management in LTER is twice a year, usually in April and November. Open subscription readership continues to grow as does the quality of the publication which is coordinated and hosted by the Network Office and edited by the LTER Information Managers:

  - http://intranet.lternet.edu/archives/documents/Newsletters/DataBits/03spring/

  - http://intranet.lternet.edu/archives/documents/Newsletters/DataBits/03fall/

- www.LTERNET.edu/sensor_report contains the NSF-funded workshop report that focuses on senor networking (i.e., Estrin, D., W. Michener, G. Bonito, and the workshop participants. 2003. Environmental cyberinfrastructure needs for distributed sensor networks: A report from a National Science Foundation sponsored workshop. University of New Mexico, Albuquerque, NM. 56 pp.).

Other specific products (Database, collections, software, inventions, etc)

- All-site Bibliography (asbib) – The LTER all-site bibliography is online and available for searching via the sidebar of http://intranet.lternet.edu – this database is undergoing changes as part of the integration of LTER network databases associated with this cooperative agreement. As part of this work we have exposed the existing bibliography as a Z39.50 compliant server. Which means that scientists can now search the bibliography via Z39.50 compatible clients. We specifically mapped this server to the EndNote generic type to make it more useful as a connection client tool in EndNote.
- Site characteristics and research locations database (sitedb) – this database has undergone many design changes in the last couple of years and is now being implemented as part of the network database integration project. A prototype database should be available for continued population by the sites on March 1, 2004. This database combines features suggested by PI's with those needed to do broad-scale analyses with those need to provide timely information via the web. The database features standardized representations of locations and sub-locations at sites including geo-spatial references.
- Personnel directory – The LTER personnel directory has recently undergone a number of design changes as part of the integration of network databases project. In addition to making it easier to maintain we have made the information more broadly useful to other parts of the information system. This database is searchable from the sidebar of http://intranet.lternet.edu/ .
- Data catalog (DTOC) – The LTER data table of contents continues to be updated weekly and provides searchable links to metadata and data at LTER site information systems. This database is searchable via the sidebar of http://intranet.lternet.edu/ .

Contributions

Development of your own discipline

By coordinating cross-site activities of the LTER Network, the Network Office contributes directly to development of partnerships and collaboratories in ecological science. We provide leadership in the field of ecology, especially in critical areas involving the development of knowledge networks. Moreover, we provide expertise and leadership in the development of new kinds of networks (e.g., NEON, CLEANER) and new initiatives for existing networks. By emphasizing interdisciplinary and cross-site research activities, we advance our understanding of complex systems, including human-driven systems. Specifically, we are working with the LTER Executive Committee to develop an approach by which the LTER Network can address grand challenges in ecology. The partnership we have formed with SDSC, NCEAS, and the University of Kansas directly promotes the integration of the fields of systematics and ecology. The Network Office has played a key role in defining the importance of informatics in ecology and in disseminating knowledge about informatics throughout the ecological

community. We have provided leadership in the important areas of data sharing, connectivity, and the acquisition and implementation of new technologies.

Development of other disciplines of science and engineering

Our participation in the KDI and SEEK projects jointly with SDSC and NCEAS contributes to the field of computer science and informatics. Network development, research in computer science, ecological research concerning biocomplexity, and educational activities are purposefully linked in these proposals. Both of these projects provide test beds for integrating multidisciplinary, multi-scale data for addressing critical environmental questions. The efficient discovery of new ecological insights from these systems will provide validation of the informatics approaches being tested. Similarly, advances in computer science research involving probabilistic testing of hypotheses will guide ecological research and accelerate progress in understanding complex phenomena in general. The governance and information management models developed under the LTER program have relevance for networks in other disciplines (e.g., CLEANER).

Education and development of human resources

The LTER educational activities facilitated by the Network Office include development of web-based information on ecology for use by K-12 students, support of Schoolyard LTER sites at secondary schools, assistance to undergraduates and graduate students in identifying educational and research opportunities, organization of international student exchanges, facilitation of the activities of the LTER Graduate Student Committee, and the development of proposals aimed at the integration of education at all levels into LTER research programs. In the long-term, the LNO is working with the LTER Executive and Education Committees to define a strategic plan for integrating education and research seamlessly across all educational levels.

Physical, institutional, and information resources for science and technology

The technical and information resources developed and maintained by the LTER Network Office are available for use by the 1800 scientists of the LTER Network as well as the ecological community in general. The Long-Term Ecological Research Network Office occupies a 2,700 square-foot suite comprising seven offices, two computer laboratories, and a 15-person conference room in the University of New Mexico Science and Technology Park at 801 University Ave. This space is ideally positioned to support the working groups and research proposed. Moreover, the LTER Network Office facility has a 100-200 person fully wired and wireless modern conference facility. This facility can be separated into two independent spaces with sliding soundproof partitions providing space, whiteboards, and projection facilities for two working groups. In addition we have access to two additional 20-person conference rooms and a 200-seat auditorium adjacent to our facility. The 15-person conference room is equipped with a Polycom VU FX – 4-port IP video conferencing hub. This equipment is portable and can be easily relocated in any of the working group conference facilities described above. In

addition, we have a Polycom single port VU video conferencing unit that can be easily moved or shipped around as necessary to support this activity.

We are developing a dedicated modern computer training facility that will compliment the above facilities and will be under complete control of the program – this is unheard of in most institutions where computer classrooms are always shared and usually under control of a centralized scheduling system. The University of New Mexico (including ARI money from NSF) is renovating a building in the center of campus that will house the LTER program and the Museum of Southwestern Biology including two related NSF Knowledge Networking projects. A 1000 square foot classroom has been included in the project, with an expected completion date of summer 2004.

In addition, the Albuquerque High-Performance Computing Center (AHPCC) on campus has a node on the ACCESS grid network. The ACCESS conference room is available to us as well as the AHPCC computing facilities.

Sevilleta Research Station and Conference Facility

The UNM Department of Biology maintains a unique facility to support research 55 miles south of the UNM campus in a scenic section of the 200,000 hectare Sevilleta National Wildlife Refuge near the Rio Grande River. This facility can house 48 people and has full conference facilities including two large conference rooms with multi-media projection systems, a library, computer center, computer teaching lab, institutional kitchen, office space, and additionally includes quiet work-enhancing isolation complete with resident wildlife. The station is fully interconnected via fiber optics and has wired and wireless Ethernet in all facilities including bedrooms. The station is connected to the Internet via a point-to-point T-1 that connects directly to the Internet II router and the UNM gigabit backbone. This creates an environment conducive to productivity via the combined effects of solitude and connectivity. Participants can take a hike with their wireless enabled laptop or seek any number of secluded refugia around the compound. This facility is available for scheduling of proposed workgroup activities and is very supportive of this type of research effort.

Computing Facilities to Support Research

The LTER Network Office houses computer facilities for the LTER Network Information System Infrastructure: The backbone of the network information system is the network office data center. The center has scalable servers and enhanced network bandwidth to better serve the LTER and ecological community. Two Sun E-450 Enterprise servers (4-300mhz UltraSPARC cpu's, 1gb memory, 20gb local disk, tape backup including Benchmark DLT7 tape robot and DDS3- 12/24 gb, redundant power supplies and uninterruptible power) and 4 Dell Poweredge servers (2-2.4Ghz Pentium IV, 4Gb memory, LTO tape backup, a 1 Tb RAID5 disk array, redundant power supplies and UPS) serve the LTERnet.edu domain. The combination of the Sun Solaris operating system on the UltraSparc platform and the Linux and Windows NT operating systems on the Intel platform allows for maximum flexibility in incorporating new developments and

technology. MS SQL server, Mysql, and Oracle are used for databases. In addition, the office has a number of large format color output devices and a variety of formats of scanning data input devices.

The UNM campus is wired with a new Gigabit redundant fiber backbone that connects all the zones in which the LNO will operate. Our facilities have both fiber and copper gigabit ethernet connections. Research activities at UNM enjoy a fractional OC-3 fiber connection to the Internet II via Denver that is connected directly to the gigabit backbone infrastructure.

Public welfare beyond science and engineering

Three of the objectives of the LTER Network directly address public welfare beyond science and engineering:
- To create a legacy of well-designed and documented long-term observations, experiments, and archives of samples and specimens for future generations.
- To promote training, teaching, and learning about long-term ecological research and the earth's ecosystems, and to educate a new generation of scientists.
- To reach out to the broader scientific community, natural resource managers, policymakers, and the general public by providing decision support, information, recommendations and the knowledge and capability to address complex environmental challenges.

Since the mission of the LNO is to support the objectives of the LTER Network, many of our activities facilitate the efforts of the Network to address the welfare of the public.

Objectives and scope

No substantive changes in the ten core activities outlined in the Cooperative Agreement are anticipated during the next year. Specific additions or deletions to the Cooperative Agreement are discussed in each section of this report as well as in the draft Strategic Plan.

Appendix 1: LNO major activities

Research and support activities in the LTER Network Office (LNO) are organized into 10 categories, arranged to reflect the organization of the Scope of Work for our Cooperative Agreement. This and future reports will adopt the same organization. These general categories and specific activities under each category are given below.

Network Office Administration and Service Activities

- Interact with external entities
- Administer funds
- Prepare proposals

- Coordinate meetings
- Report and communicate
- Plan
- Review and evaluate staff
- Perform community service

Computational and Communication Infrastructure

- Maintain 24x7 access to email, web, ftp servers.
- Assure database integrity through daily backup and verification routines.
- Provide for backup and restoration of LNO computer file systems.
- Monitor and maintain Local Area Network.
- Enforce LAN, WAN, and computer security model.
- Upgrade and maintain server operating systems and application software.
- Upgrade and maintain desktop operating systems and application software.
- Provide user support to Network Office Staff.
- Provide ad-hoc technical assistance to LTER sites. The future scope of this assistance will be evaluated through a user needs assessment as part of the strategic planning process.
- Plan for and procure hardware, software, and supplies.
- Upgrade and maintain computer and network hardware.
- Monitor and maintain remote sensing archive.
- Provide for and manage off-site backup storage of LTER site data.
- Communicate knowledge about technical advances computational and communication infrastructure to LTER sites. (LTER)

Information Management and Methods Development

- Promotion of metadata standards
- Curation, maintenance, and expansion of LTER Network Databases
- Data standardization

Network Development, Community Outreach, and Training

- Network Development
- Community Outreach and Network Linkages
- Training

Publications and Public Outreach

- Prepare and print two site brochures per year.
- Revise and print the LTER Network brochure every third year.
- Prepare, edit, print, and distribute two Network Newsletters each year.

- Provide editorial support to LTER sites preparing synthesis volumes for the Oxford University Press series.
- Design, develop content, and supervise maintenance of LTER network web sites.
- Revise and print the LTER Personnel Directory every third year.
- Review and upgrade the LTER traveling exhibit every third year.
- Prepare materials for All Scientists Meetings every third year.
- Provide limited support to LTER Network scientists in producing quality publications that describe the importance of LTER research aimed at general scientific audiences.
- Research and synthesize widely scattered historical documents associated with the development and scientific significance of the LTER program.
- Foster collaborations with organizations such as the Ecological Society of America to produce scientific fact sheets and other material that conveys scientific information to an audience that includes the general public, educators, managers, and policy-makers.
- Prepare and disseminate short descriptions of LTER research results on a regular basis and make these available to funding agencies, policy makers and the general public.
- Disseminate information to organizations involved in encouraging the participation of underrepresented minorities in science to increase the diversity of LTER scientists.

Synthesis

- In coordination with the CC, identify and support at least one major synthesis effort each year
- Lead in developing one value-added database per year in association with the science theme meeting.
- Participate in and organize scientific activities as part of the All Scientists Meetings in 2003, 2006, and 2009, including planning and follow-up working groups.
- In off years (2004, 2005, 2007, 2008), facilitate the organization of joint symposia at annual meetings of associated disciplines and support participation of LTER scientists in these symposia.
- Identify and support 6-8 small research working groups a year, and seek other funds to increase that number to 20-25 following an All Scientists Meeting.
- Organize and lead annual meetings of the Committee on Scientific Initiatives, whose role is to identify and evaluate opportunities for Network-level scientific investigations.
- Facilitate the production of site volumes for the Oxford Synthesis series by providing editing and other technical assistance to sites, so that a complete set of volumes synthesizing research at all sites is available by the end of the decade.
- Participate in research activities designed to achieve the objectives of the LTER Decade of Synthesis.

Network Information System Design and Development

- Establishing the distributed data network
- Community collaboration and standardization efforts
- Promoting and supporting synthetic research collaborations

International LTER

- Participate in the review of the ILTER program during 2003-2004.
- Provide funding for the annual ILTER meeting planned for Beijing, China and coordinate the U.S. participation with the Southeast Asian regional representative
- Edit and post the report of this meeting on the ILTER website
- Represent the LTER Network in interactions with international sites and networks.

Education

- Facilitate the activities of the LTER Education Committee in developing a strategic plan for education.
- Maintain the SLTER web site.
- Facilitate logistics of an evaluation of the Schoolyard LTER program if requested to do so by NSF.
- Promote participation of under-represented minorities in LTER-supported education activities.
- Develop a generic model for LTER education that incorporates activities from Schoolyard to post-doctoral levels and suggests sources of support for these integrated programs.
- Develop partnerships with organizations involved in Environmental Education (e.g. National Oceanographic and Atmospheric Administration, North American Association of Environmental Education, OBFS, Organization for Tropical Studies).
- Collaborate with the Ecological Society of America's Education Committee to coordinate education efforts.

Strategic Planning for the LTER Network

- Develop a strategic plan focusing on LNO's mission, its role in relation to other organizations, and the most effective structure for managing LNO and its relations with external entities.
- Pending availability of supplemental funding, engage an independent consulting firm to facilitate the strategic planning activity.
- Specifically incorporate into the LNO strategic plan five-year plans and budgets for 1) further development of the information infrastructure and informatics capabilities of the LTER Network and 2) creation of high-level leadership and facilitation of future Network synthesis activities as part of the strategic plan.

- Implement a new relationship between UNM and the Network Office as an institute under the Dean of Arts and Sciences.
- Design and complete an evaluation by the LTER community of the activities of the LNO, including: 1) an assessment of the functional requirements of LTER scientists, and 2) the effectiveness of LNO in responding to those requirements.
- Coordinate the results of evaluations of the International LTER program and LTER educational activities into the LNO strategic plan.
- Coordinate LNO strategic planning with the development of a strategic plan for the LTER Network being carried out by the Executive and Coordinating Committees.

Appendix 2: Project Participants

Senior Personnel
Name: Waide, Robert
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for management of the LTER Network Office, supervision of employees,
development and execution of budgets,
coordination of network level research and planning activities, and proposal preparation

Name: Michener, William
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for development of new initiatives between the LTER Network and other
networks and centers, informatics
development, and training

Name: Vande Castle, John
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for the coordination and implementation of new technologies, including
geographic information systems and remote
sensing within the LTER and ILTER networks. Provides expertise on wireless
communications and other cutting edge
technologies. Coordinates triennial All Scientists Meetings.

Name: Brunt, James
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for the management of LTER Network data bases, the supervision of LNO
and KNB technical staff, and the
coordination of information management preactices at sites through the Committee on
Information Management

Name: Gosz, James
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for planning at Network level

Undergraduate Student
Name: Brooks, Brooke
Worked for more than 160 Hours: Yes
Contribution to Project:
general clerical work

Name: Trujillo, Josh

Worked for more than 160 Hours: Yes
Contribution to Project:
general clerical work

Name: Perry, Katy
Worked for more than 160 Hours: Yes
Contribution to Project:
general clerical work

Technician, Programmer
Name: Maddux, Troy
Worked for more than 160 Hours: Yes
Contribution to Project:
management of LTER Network Office and Network data bases

Name: Murillo, Michelle
Worked for more than 160 Hours: Yes
Contribution to Project:
management of LTER Network Office and Network data bases

Name: White, Marshall
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for integration of information management and web services

Name: Blankman, David
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for support to LTER sites in technical matters and development of Ecological
Metadata Language

Name: Griego, Pamela
Worked for more than 160 Hours: Yes
Contribution to Project:
program administrative assistant

Name: Sprott, Patricia
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for technical editing, web site content, and development of LTER Network
Office newsletter and brochures

Name: Shore, Greg
Worked for more than 160 Hours: Yes
Contribution to Project:

responsible for hardware and software support for communications and computational infrastructure

Name: Costas, Duane
Worked for more than 160 Hours: Yes
Contribution to Project:
responsible for programming and development of the LTER Network Information System

Name: Schroeder, Alan
Worked for more than 160 Hours: Yes
Contribution to Project:
contract employee responsible for support of the International LTER Network

Name: McGann, Jeanine
Worked for more than 160 Hours: Yes
Contribution to Project:
maintenance of LTER web sites

Appendix 3: Organizational Partners

University of California-Santa Barbara
We collaborate with the National Center for Ecological Analysis and Synthesis on various ecological informatics projects including the Knowledge Network for Biocomplexity and the Science Environment for Ecological Knowledge. Primary collaborators are Jim Reichman, Sandy Andelman, Matt Jones, and Mark Schildhauer.

University of Kansas Main Campus
We collaborate with the Natural History Museum on various ecological informatics projects including the Knowledge Network for Biocomplexity and the Science Environment for Ecological Knowledge. Primary collaborators are Jim Beach, Dave Vieglas, and Town Peterson.

Brown University
We collaborate with Steve Hamburg who is co-chair of the US International Committee on matters related to International LTER coordination.

USDA Forest Service
We coordinate activities with representatives of the Forest Service, which has a Memorandum of Understanding with the LTER Network.

NBII
We are in negotiations with NBII to provide support for informatics infrastructure at the University of New Mexico.

GTOS
We collaborate with GTOS on a project to ground truth satellite measurements of primary productivity at ILTER sites.

Organization of Biological Field Station
We provide support and training to OBFS in the area of informatics and technology.

San Diego Supercomputer Center
We collaborate with SDSC on ecological informatics projects as well as training efforts and technology transfer. Primary contacts are Chaitan Baru and Tony Fountain.

National Science Foundation
Sonia Ortega from NSF is on detail in the Network Office

NASA
We have negotiated access to remotely-sensed data for LTER sites with NASA.

Ecological Society of America
We coordinate education and outreach efforts with similar programs at ESA.

Partnership for Biodiversity Informatics
With the National Center for Ecological Analysis and Synthesis, the San Diego Supercomputer Center, and the University of Kansas Museum of Natural History, we develop new approaches to the management of ecological information.

University of Colorado at Boulder
We collaborate with Patrick Bougeron who is co-chair of the US International Committee on matters related to International LTER coordination.

Other Collaborators or Contacts
The Network Office interacts on a regular basis with the 25 member networks of the International LTER Network, as well as representatives from countries in the process of developing networks. This list can be found on the web at: http://www.ilternet.edu/.