The Network Newsletter

From the Executive Director

Gauging Network Priorities

Robert B. Waide, LTER Network Office

The LTER Network Office (LNO) has recently begun to employ written and electronic surveys to seek feedback from the LTER community on a variety of network activities. The results of these surveys will be used to prioritize efforts at the LNO and to determine community preferences for specific Network activities. Three surveys have been employed so far. We aimed the first of these at individual LTER scientists and distributed it to over 700 people at the 2003 All Scientists Meeting (Seattle, WA). We also sent the survey electronically to the complete LTER mailing list. This survey was designed to determine preferences of individual LTER and ILTER scientists, students, and educators. The second survey, which was distributed to sites in November 2003, had two functions. Sites were asked to provide collective expressions of priorities to guide the allocation of effort to LNO task areas. In addition, the survey attempted to gauge satisfaction with the direction and results of LNO activities. We developed a third, Web-based survey to determine satisfaction with the recent All Scientists Meeting and to

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LTER Scientists Engage Policymakers

On 2-3 March 2004, Rich Pouyat and Charlie Nilon, both of Baltimore Ecosystem Study LTER, joined ESA's Nadine Lymn for Congressional Visits Day (CVD) in Washington D.C.

Photo: Nadine Lymn ESA

Charlie Nilon, Baltimore Ecosystem Study, Congressional Visits Day 2004

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LTER Presents Applied Research at NSF Symposium

On 26 February 2004 the LTER Network presented a broad scope of presentations on applied research at the National Science Foundation (NSF). Dozens of people from several NSF directorates as well as various agencies and representatives from the national press filled the room throughout the morning sessions.

The goal of this annual event is to encourage support and involvement from other agencies and help optimize communication and coordination between LTER and other programs.

Henry Gholz welcomes visitors to the LTER Symposium on Applied Research, held at the National Science Foundation 26 February 2004. Please view presentations from this and all LTER Symposia on the LTER Web site: http://www.lternet.edu

In this Issue

The Network Newsletter

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Please contact the LTER Network Office with your questions, comments, ideas, and requests for copies:
LTER Network Office
University of New Mexico
505/272-7316

This issue of the LTER Network Newsletter was edited, designed and produced by Patricia Sprott Bonito
psprott@lternet.edu

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http://www.lternet.edu

Network Office Surveys LTER Sites

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determine preferences for future meetings.

Innovative Technology Partnerships (ITP), a consulting firm contracted by the University of New Mexico to assist with the LNO Strategic Plan, helped design the first survey ("Individual Survey"). We received 209 responses to this survey out of 711 surveys distributed at the ASM. This level of response (29%) represents a marginally acceptable return rate, as most surveys hope to realize a 33% return. The 209 responses were distributed among the following demographic categories:

* LTER Scientists (85)
* Graduate Students (57)
* Educational Representatives (21)
* Others (19)
* LTER Lead PI (15)
* Information Managers (7)
* International Scientists (5)

The Individual Survey was organized to reflect the nine task areas of the LNO, and questions were designed to elicit community needs, LNO strengths, and areas for future development. ITP prepared an analysis of the results of this survey, which is available in the document archive on the LTER intranet page (http://intranet.lternet.edu) along with a copy of the survey instrument and qualitative responses to the survey. The survey did not uncover any critical issues that needed immediate response, but did identify a number of community needs and areas for future development. They included:

* Continuation of triennial All Scientists Meetings.
* Leadership role from LTER Network Office to develop tools and activities that facilitate synthesis across sites.
* Logistical support for synthesis workshops.
* Centralized Web entry point for access to information about site and LTER activities.
* Tools available to allow access to data at all LTER sites through a single interface.
* Organization and support of workshops to facilitate the development or use of standard protocols.
* Leadership and technical support to insure that informatics standards, approved and endorsed by the Coordinating Committee, are adopted by individual LTER sites.
* Seek funding to provide a staff person at least half-time to work with site information managers on technology transfer.
* Expansion of educational efforts to provide information on funding activities in education.
* Expansion of educational efforts to facilitate communication among site education coordinators.
* Expansion of outreach efforts in publications and educational television.
* Expansion of outreach efforts in mass media.

Analysis of the results of the Individual Survey continue, and conclusions will be made available to the LTER community as they are reached. We plan to administer updated versions of this survey every three years. The LNO has begun to implement policy changes to address issues raised by respondents to the survey.

The second survey, administered to sites ("Site Survey"), was similar to the Individual Survey in that it was also organized along LNO task areas.

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Site News

Comings and Goings

The LTER Network has experienced quite a bit of movement among its members in the past few months. A brief sample is noted on this page, our own version of **bold faced names**...

As of 1 January 2004, **Alan Knapp** moved from Kansas State University to Colorado State University in Fort Collins. "It was hard to leave KSU after almost 20 years with my colleagues at the Konza Prairie LTER," says Knapp. Upon locating lost boxes, books, and files, Knapp says he "fully expects to play an active role in the SGS LTER program."

Meanwhile, **Dr. Corinna Gries** has assumed responsibility as the new data manager at Central Arizona – Phoenix LTER.

At the Bonanza Creek LTER site in Alaska, data manager **Scott D. Miller** is leaving LTER for the U.S. Park Service. Also **Marilyn Walker**, lead-PI at BNZ, is leaving to pursue a business interest in Colorado; **Jamie Hollingsworth** has been promoted from research technician to site manager; and **Brian Charlton** is the new senior research technician.

At Kellogg LTER, **Sven Bohm** has replaced **Tim Bergsma** as data manager. Tim and his family are now in Connecticut.

As of 1 October 2004, **Dr. Kari Bisbee O'Connell** will take over the helm as the new Director of the H.J. Andrews Experimental Forest. She replaces **Art McKee** who retired after 22 years. O'Connell's involvement with LTER began at the Shortgrass Steppe site in Colorado where she was an NSF-Research Experience for Undergraduates fellow in 1994. She is a co-Principal Investigator of the Andrews LTER program and has been involved with the education program at the Andrews for the past two years.

O'Connell will spend 50% of her time at the Andrews Experimental Forest headquarters in Blue River (phone: 541-822-6336) and 50% of her time in Corvallis (336 FSL; 541-750-7324). Email: kari.oconnell@oregonstate.edu.

Clockwise, from upper left, Kari Bisbee O'Connell, Director of Andrews Forest, Michelle Murillo, LTER Network Office data manager, Jeanine McGann, Network Office Web designer, and Duane Costa, Network Office computer analyst/programmer.

At the Santa Barbara Coastal LTER site, **Margaret O'Brien** began as information manager in January 2004. O'Brien began work with the data management group in 2003. Before joining the LTER, she was a programmer at ICESS (Institute for Computational Earth System Science, UCSB). Margaret joins the SBC team with a Master's degree in Biological Oceanography from Oregon State University. She can be reached via email at: mob@icess.ucsb.edu.

The LTER Network Office has recently replaced two staff positions and filled one new staff position. **Duane Costa** (dcosta@LTERnet.edu) is the new analyst/programmer working on the Network Information System. Duane brings 15 years of programming experience to this position. Currently, Duane is working on a metadata harvester to populate the LTER metadata catalog from site metadata documents. **Michelle Murillo** (mmurillo@LTERnet.edu) returned to LTER as data manager, replacing the position recently vacated by **Troy Maddux**. Michelle, who was previously involved with the Andrews and Sevilleta LTER sites, is in the process of bullet-proofing our databases as part of the integration of network databases project.

And, finally, **Jeanine McGann** (jmcgann@LTERnet.edu) was hired as Web Designer, filling the position vacated by **Marshall White**'s promotion to Senior Web Developer. Jeanine cut her teeth at the LNO on documenting Ecological Metadata Language. Jeanine is currently mapping all the LTER Network Websites to get an understanding of their breadth and complexity. We welcome all of these folks to the LTER Network and anticipate a productive relationship with each.

Site News

New Method Brings Tropical Rain Forest Canopy into Reach

Nancy Harris, Luquillo LTER

Plant physiologists and ecologists alike long to understand the exchange processes of tree canopies at different spatial locations. But repeated, non-destructive, in situ measurements have been difficult to obtain. Walkup towers are time-consuming to construct and access is limited to the trees in their immediate vicinity, while canopy cranes are expensive and impractical to operate in areas with rugged topography.

Nancy Harris is a Ph.D. student in Dr. Charles Hall's ecological modeling group at SUNY College of Environmental Science and Forestry (SUNY-ESF) in Syracuse, NY. Harris has chosen to implement a unique method that allows access to virtually any tree in any forest, regardless of topography. By hanging from a branch in the canopy using technical rock climbing equipment, she can choose from a wider variety of survey sites, trees, and canopy heights than those working from fixed towers. This rope-climbing method has been used in the past primarily for the construction of new canopy towers and walkways, but has been applied less frequently in the context of ecological research.

Above, Ms. Harris prepares for her ascent using technical rock-climbing equipment... and eventually (right) makes her way up into the canopy, sampling a broader spectrum of trees at Luquillo Experimental Forest

Rigging a tree to climb can take as little as an hour. A giant slingshot is used to shoot a 3-oz. fishing weight attached to 12-lb. test fishing line over a branch high in the canopy. Once the line is over the branch, it is replaced first with parachute cord and then with a 12-mm diameter technical rock-climbing rope that can be climbed using a harness and mechanical ascenders. A separate pulley system is rigged so that by pulling a rope from ground level, the photosynthesis machine can be raised or lowered to any height desired.

Empirical data on the carbon sequestering abilities of tropical forests are scarce, yet they might prove to be critically important for balancing the global carbon budget. Many regional models of forest productivity exist, such as that of Wang et al. (2003) for the Luquillo Experimental Forest (LTER LUQ), Puerto Rico [*Forest Ecology and Management* 179: 69-94]. However, this and many other models often use generalized parameters and equations to simulate exchange processes without ever testing or otherwise validating results with site-specific information.

As part of her dissertation work, Harris is testing the validity of Wang's forest productivity model by gathering physiological data on the gas exchange of leaf, trunk, and soil surfaces at 13 georeferenced locations situated along an elevational gradient in the Luquillo Forest. She has measured the photosynthetic rates of both canopy and understory leaves of different tree species as well as rates of trunk and soil respiration using a portable photosynthesis machine and soil chamber (model 6400, LI-COR, Inc. Lincoln, NE). Currently, Harris is combining these measurements with climate modeling techniques in order to compute carbon budgets for specific 'columns' of the forest, which will then be extrapolated in order to evaluate how values of gross primary production (GPP), respiration and net primary production (NPP) vary over both time and space. In addition to model validation, Harris's measurements also serve as a type of ground-truthing for satellite image analysis.

The evaluation of global- and regional-scale carbon models requires adequate field parameterization of plant-atmosphere exchange processes. Through the use of new and unique field methods, these measurements and understanding of ecological and physiological processes can now be evaluated over both time and space.

New Flux Tower Facility Tracks CO_2 in the Florida Coastal Everglades

Mangroves Prove Significant Carbon Sink

J.G. Barr, T.L. O'Halloran, J.D. Fuentes, T.A. Frankovich, J.C. Zieman, and D.L. Childers
Florida Coastal Everglades LTER

Throughout the world, scientists are studying the ability of the biosphere to sequester carbon because of the climatic impacts of increasing ambient carbon dioxide (CO_2) levels. The resulting knowledge is utilized to constrain levels of atmospheric carbon dioxide. One biome that has yet to be investigated for its carbon uptake capabilities is the mangrove forests. Mangrove ecosystems represent a potentially significant carbon sink because of year-round physiologically active foliage, as well as carbon exchanges at the estuary interface and continuous accretion of sediments.

During June 2003, a 30-m tall triangular tower was erected in a riverine mangrove forest (Figure 1) to use as a platform to deploy flux measurement systems. The study site is located along the Shark River in the western region of the Florida Everglades, and is adjacent to the Florida Coastal Everglades Long-Term Ecological Research (FCE-LTER) site SRS-6 (Figure 2). The dominant tree species around the tower include red (*Rhizophora mangle*), black (*Avicennia germinans*), and white (*Languncularia lacemosa*) mangroves. The average tree height for this forest canopy is 15 m but trees as high as 25 m can be found randomly scattered throughout the landscape. The tower flux site is reached via a 30-km boat ride from the Flamingo ranger station in the Everglades National Park.A raised 200-meter-long boardwalk was installed to provide tower access from the shore. This is essential because the sediment floods with 0.5 m of water during high tides. The boardwalk also protects prop roots, seedlings, and the sediment from repeated disturbances. The tower (Figure 3) is currently instrumented to define the micrometeorological conditions inside and just above the canopy, and to study mangrove physiology. Current measurement and data acquisition systems are powered with a combination of solar panels and batteries.


Fig. 1


Fig. 2


Fig. 3

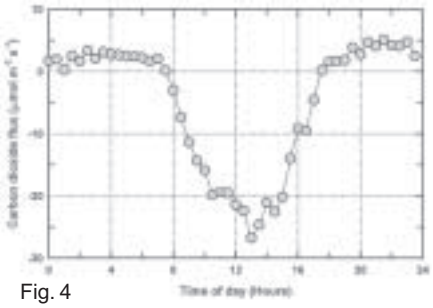
Fig. 4

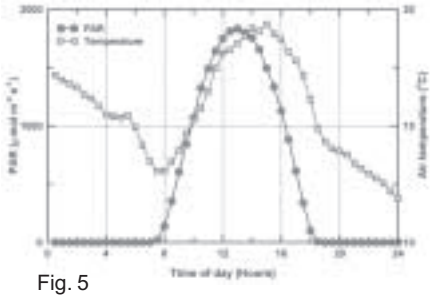
Fig. 5

Figure 1. To continuously estimate forest carbon dioxide uptake, a three-dimensional sonic anemometer and an open-path infrared gas analyzer are placed over the canopy. Instruments are placed on booms that are mounted on top of the 30-m tower. **Figure 2**. Constructing the base of the tower. This picture illustrates that substantial amounts of sunlight reach the forest floor because plant species such as red mangroves have leaves whose inclination angle changes with time of day thereby minimizing light interception during high irradiance levels. **Figure 3.** The triangular tower is used as a platform to mount instrumentation. **Figure 4.** Diurnal patterns of carbon dioxide fluxes for the mangrove forest in the western Florida Everglades during 20 January 2004. Positive flux quantities signify carbon dioxide transport from the forest to the atmosphere. Negative flux quantities denote carbon dioxide uptake by the mangrove forest. **Figure 5.** Time series for air temperature (□) and photosynthetically active irradiance (PAR, ●) measured above the mangrove forest canopy during 20 January 2004.

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Network News

LTER Graduate Student Mixer Planned for Ecological Society Meeting

Please join us for the LTER Graduate Student Mixer and Panel Discussion at the Annual Meeting of the Ecological Society of America in Portland, OR!

NSF Program Managers exchange ideas with LTER investigators and graduate students at the LTER Grad Student Mixer — an ESA Annual Meeting tradition.

The LTER Graduate Student Committee was established to foster interaction among graduate students working at LTER sites and between students and senior LTER scientists, to create student opportunities for inter-site research, and to develop interdisciplinary graduate student training programs.

The LTER Network Graduate Student Co-chairs would like to invite graduate students working in the LTER and ILTER Networks and students interested in information about LTER, to join us for an evening mixer and discussion session. This session is an opportunity for students interested in learning more about LTER to network, exchange ideas, and inform others about their research interests and current projects. Our event will include a group discussion with LTER Principle Investigators and NSF staff. Topics for discussion will include: ongoing student research, opportunities for students, and current and upcoming LTER student events and activities.

The event will be held on Wednesday, August 4, 6:30 - 8:00 PM (Location TBA). Appetizers will be served and a cash bar will be available. We will be joined by LTER personnel interested in participating in the panel discussion. For more information, please contact Tiffany Troxler Gann, troxlert@fiu.edu.

2003 LTER All Scientists Meeting - Follow-up workshops

John Vande Castle and Robert Waide, LTER Network Office

More 70 scheduled and ad-hoc workshops filled the program during the September 2003 LTER All Scientists Meeting (ASM) in Seattle. Following the meeting, a call for proposals for follow-up activities to the ASM resulted in 27 requests for support. This support covers continued planning and synthesis activities. The LTER Executive Committee reviewed the proposals, and 16 were approved.

The LTER Network Office has funds allocated in its 2004-2005 budget for several additional working groups focusing on cross-site and network-level synthesis. There will be a call for new proposals distributed to the all_lter e-mail list in April 2004. Please begin thinking about ideas for synthesis projects.

Funded follow-up workshops include:

- LTER Education Outreach Planning (McGee-LUQ) *see article page 12.*

- Ecosystem Disturbance and Variance (Rusak, Fraterrigo and Turner - NTL, CWT)

-Performing Network-Level Synthesis by Quantifying Ecosystem Goods and Services at LTER Sites (Wilson and Childers - BES and FCE)

-Decline of Dominant Species due to Invasive Pests and Pathogens (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 (Sievering - NWT)

-Biogeochemistry of Dissolved Organic Matter in Aquatic Environments of the LTER Program (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 (Lauenroth - SGS)

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

-Distribution, Abundance and Dynamics of Stream Macro-invertebrates (Gibson, Whiles and Collins - SEV and KNZ) *see article, pg. 10.*

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

-Biodiversity of Riparian Ecotones (Li - AND)

Continued next page, column 3

LTER Network Information System Advisory Committee

John Vande Castle, LTER Network Office

Network-based research in LTER involves a diverse array of activities requiring multiple solutions for supporting its information needs. One of the goals of the LTER Network is to have a simplified way to access and synthesize data at the individual research sites, as well as across the entire LTER Network. To provide for this, a system known as the LTER Network Information System (NIS) will support LTER site scientific research as well as network-level datasets such as information on site characteristics, climate, hydrology and cross-site datasets produced for LTER science themes and workshops. The LTER NIS will contain generic solutions or tools that will make discovery, access, aggregation, and visualization of data across multiple sites easier and more efficient. To provide a vision and to guide the development of the NIS, the LTER Network Information System Advisory Committee (NISAC) was approved as a standing committee. The NISAC is chaired by Andrews LTER information manager Don Henshaw, and includes five LTER site principal investigators: Mark Harmon, Tim Kratz, Stuart Gage, Debra Peters, and Robin Ross, four LTER information managers: Peter McCartney, Barbara Benson, Emery Boose, and Don Henshaw, and four members of the LTER Network Office: James Brunt, Bill Michener, John Vande Castle, and Bob Waide.

Mark Harmon (Andrews LTER) leads discussion at a session of the LTER Network Information System Advisory Committee.

The NIS Advisory Group provides a necessary forum for discussion and planning among the three crucial sets of participants—the LTER science community, LTER Information Managers, and the LTER Network Office—in designing and implementing an information infrastructure to support network synthetic science. As part of a strategic plan, the NIS Advisory Group will make recommendations on goals and timeframes for NIS development and will prepare an assessment report for presentation to the LTER Coordinating Committee.

The NISAC first met at the Kellogg Biological Station in May of 2003 to begin the task of defining what the LTER Network Information System (LTERNIS) will be and a strategic plan for its implementation. The NISAC produced a report outlining their initial discussions and also presented their ideas to the LTER Executive Committee and full LTER Coordinating Committee in May of 2003.

The NISAC feels that the LTER NIS will need collaborations and partnerships with information specialists beyond the LTER Network, and will explore potential partnerships by holding its upcoming meetings at the National Center for Supercomputing Applications (NCSA) and San Diego Supercomputer Center (SDSC), as well as at the NCSA in Champagne, IL.

The NISAC will review development of the LTERNIS including network-level databases, site participation within a tiered LTERNIS functionality framework, as well as the synthesis products themselves. They will also meet with researchers at NCSA to discuss potential projects, collaborations, and partnerships. The NISAC will meet again in early June 2004 with researchers at SDSC. Further information regarding the LTER NISAC can be found on their committee web page at: http://committees/lternet.edu.

2003 LTER All Scientists Meeting—Follow-up workshops

Continued from page 6

- Litter Decomposition Synthesis (Gonzalez - LUQ)

- Functional Response to Resource Change across LTER sites [Suding (NWT), Clark (CDR), Collins (SEV and KNZ), Gough (ARC), Gross (KBS), Milchunas (SGS), Pennings (GCE)]

- Assessing Needs for a Large-Scale Cross-Site Synthetic Effort to Characterize the Controls on Nitrogen Transport through Streams and Rivers (Dodds - KNZ)

Further information regarding the workshops held during the LTER ASM meeting and follow-up reports can be found at: http://www.lternet.edu/asm/2003/workshops/workshop_reports

Network News

Giant Leaps: Integrating and Sharing LTER Data Via the Web Services

By Kristin Vanderbilt (Sevilleta), Longjiang Ding (SDSC), and Nicole Kaplan (Shortgrass Steppe)

Since May 2002, LTER and the San Diego Supercomputer Center (SDSC) have been working on a method to integrate data from LTER sites via the Web Services. A giant leap in progress toward creating and using these cross-site databases occurred at a recent workshop, attended by LTER information managers at the SDSC.

LTER Information Managers attended a workshop (2-4 Feb 2004) at the SDSC to learn and brainstorm about how web services technology can be used to create cross-site databases. Web Services enable easy application integration and resource sharing across platforms with a standardized XML messaging system (Figure 1). This collaboration was initially reported in the LTER *Network News*, Fall 2002. Through this workshop, SDSC scientists transferred information to the LTER community to build and deploy web services.

Workshop participants went through tutorials written by Longjiang Ding (SDSC) that used Java and Apache Axis software to publish data with web services. Participants learned to install a web service, and were able to test this process on their own laptops while receiving expert advice and explanations from instructors Longjiang Ding, Matt Jones (NCEAS), Robin Schoeninger (CAP), and Ashraf Memon (SDSC).

Participants conferred in small groups to explore possible uses for web services within the LTER Network. One group discussed how to augment the functionality of ClimDB with web services that would return metadata, visualize data, or return temporally aggregated data. Another group discussed the use of web services to retrieve and integrate spatial data to assess land use change. A third group focused on an international cooperative research project and the implementation of web services to collect, validate, organize, and share data from remote lakes at NTL and Taiwan (see pg. 16). Participants departed with an understanding of the investment required to deploy web services, and how they can be used to accomplish network-wide or synthetic research goals, including the development of the Network Information System (NIS).

Finally, the workshop introduced the LTER information management community to other IT research projects that will facilitate data sharing and synthesis in the future. Presentations were given on semantic mediation, ontologies, and technologies for building the EcoGrid, which will provide standard interfaces to diverse data and computational networks using web and grid services (http://geon05.sdsc.edu:8080/lterws/workshop.jsp).

This workshop was the first of its kind, in which LTER information managers met with experts from other organizations for training in new technologies. Opportunities for technology transfer events like this underscore the value of the LTER IM group's efforts to partner with institutions like SDSC for the benefit of the whole LTER community.

This workshop was supported by funds from the LTER Network Office, NSF, SDSC, GEON, and PRAGMA.

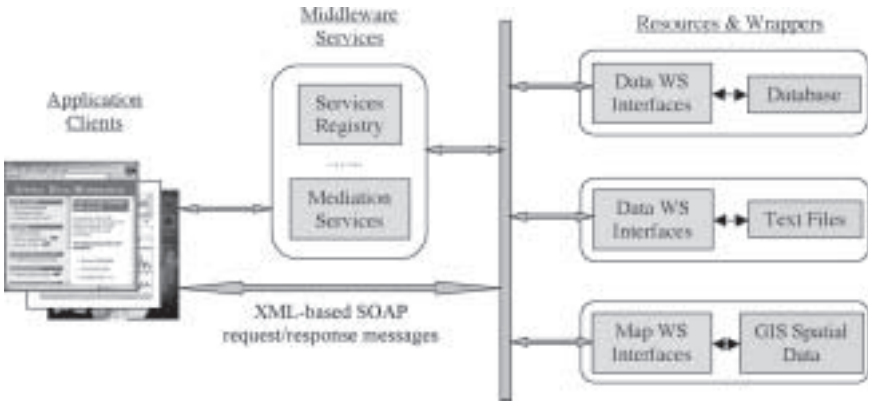

Figure 1. A possible architecture to share LTER data resources using web services. A simultaneous query to SEV and NTL to get temperature data would occur as follows: a) a user application sends out a query encapsulated in a SOAP message; b) Mediation services (in the Middleware services) receive the SOAP request, parse the message, and send the data request to the NTL and SEV site services; c) both NTL and SEV site services receive the SOAP request, parse the message, query their own site database for temperature, and send the result data back to Mediation services; and d) the Mediation services massage the result temperature data into a standard data format, encapsulate them into a SOAP response message, and send them back to the user application.

Cross-site Study Links Micro-climate to Plant Physiology in Watersheds

LTER's HydroDB Tool Facilitates Project

Part 1: The Study

Using a daily time-step over one- and five-year intervals, Julia Jones (Prof., Geosciences, OSU and Andrews LTER co-PI) is comparing streamflow response to forest removal at deciduous versus coniferous forest sites, as well as among sites with and without snow-packs. This research breaks ground for ecohydrology because it gives a basis for linking climate controls to the ecophysiology of plants in the watershed, to streamflow, and to the effects of streamflow variability on aquatic ecosystems. Findings based on long-term records from Andrews, Coweeta, and Hubbard Brook sites (as well as Caspar Creek, Coyote Creek, and Fernow Experimental Forests) indicate that conversion of older forests to young forests can create persistent changes in snow accumulation and melt, affecting spring runoff, as well as summer streamflow deficits 10-25 years after forest conversion, potentially influencing stream habitat and biogeochemistry.

Andrews WS1 just after cutting in 1968—one of the sites in the cross-site ecohydrology study (Jones and Post (in press)). Photo is courtesy of Al Levno, Forest Science Data Bank.

A paper describing this research has been accepted for publication in *Water Resources Research*, an interdisciplinary journal integrating research in the social and natural sciences.

Part II: Using HydroDB

The HydroDB tool was "extremely easy" to use for this study, Jones says.

"It would be good for additional sites to add their data, particularly those spanning a wider range of climate and vegetation types (currently most sites in the HydroDB are forested). A number of LTER sites have interesting, albeit shorter, hydro records from places with alpine, coastal/estuarine, desert, grassland, or other ecosystem types."

HydroDB is a powerful tool, and there are many questions that could be investigated beyond what Jones and Post (in press) looked at. "Many of these were discussed at the eco-hydrology workshop at the LTER ASM last fall [ASM Sept 2003]," Jones says. "There's lots of potential for a network of LTER sites to make a major contribution to the emerging discipline of eco-hydrology through the use, and augmentation of, HydroDB." As well, many sites are already involved in related studies that are good candidates for integration, including: Forest ecosystems–Barbara Bond (AND), Emery Boose/Betsy Colburn (HFR), Bruce Haines/Alan Yeakley (CWT), and Alan Covich/Todd Crouse (LUQ); Coastal ecosystems–Nat Weston (GCE), Sherry Mitchell-Bruker (FCE), and Jen Wu Stanhope (VCR); Alpine/tundra ecosystems–Tyler Erickson (NWT), and Jay Jones (BNZ); Desert/grassland ecosystems–Cliff Dahm (SEV), Keith Gido (KNZ), and Deb Peters/Nathan Hayes (JRN). For more information, contact these investigors, who all participated in the ASM workshop, regarding what questions they are asking, and what future questions we could address as a network of LTER sites looking at eco-hydrology.

In addition, Jones adds, HydroDB could be expanded to address much broader issues, well beyond the LTER Network, for example: How informatics is revolutionizing ecosystem studies, as manifested by activities at NCEAS, Bill Michener's SEEK project (see *LTER Network News* Fall 2003), and the recently funded IGERT in Ecosystem Informatics at OSU (Julia Jones, PI, Mark Harmon, co-PI) "which will provide interdisciplinary graduate education in Ecosystem Informatics," Jones says. For more information on the IGERT program for graduate student funding, please see the Oregon State University Web site.

A tool such as HydroDB also could help a national (or international) network of observatories to identify and address key questions in ecosystem science. "This relates to what I understand to be the AIBS recommendation for the structure and function of NEON," Jones says.

For more information on HydroDB, see *LTER Network News*, Fall 2003: http:// www.lternet.edu/newsletter

Network News

Cross-site Stream Invertebrate Study— *Breaking New Ground for LTER Science and Synthesis*

"Distribution, Abundance and Dynamics of Stream Macroinvertebrates: Metapopulation Dynamics and Metacommunity Structure"

A new study tests the applicability of a major hypothesis, using data sets from several research sites, including five LTERs.

A group of LTER investigators, as well as some 'outsiders' have been funded by the LTER-intersite initiative to look at common stream invertebrate datasets. "In particular," says David Gibson of Konza Prairie LTER and co-investigator on the project, "we are investigating the applicability of the Core-Satellite Species Hypothesis and metacommunity models for interpreting these large datasets through space and time."

Below: D. Gudder (l) and Matt Whiles (r) examining stream invertebrates in the field at Konza Prairie LTER site. Right: Caddisfly larvae, among the subjects of the study.

The LTER folks involved include David Gibson (KNZ), Matt Whiles (KNZ, CWT), Scott Collins (SEV, KNZ), Bob Hall (HBR), and Alex Huryn (ARC), as well as Tom Heatherly from Southern Illinois University, John Jackson of the Stroud Water Research Center in Philadelphia, and Margaret Palmer of the University of Maryland. The field sites for this study are located at Konza Prairie, Coweeta, Hubbard Brook, and Arctic LTERs, as well as at sites in Alabama, Maine, Maryland, New York, Pennsylvania, and New Zealand.

The Core-Satellite Species hypothesis is a metapopulation model of community structure and composition that allows for the incorporation of regional scaling processes into the understanding of community structure and ecosystem function. The CSS relates to the proportion of patches (in this case, sites that were sampled) occupied by a species and predicts that the core species are those widely distributed and abundant in space, while satellite species are rare and patchy in their distribution. Thus, the hypothesis predicts a bimodal distribution of site occupancy frequencies. This model has been used successfully in the past by Scott Collins (SEV, KNZ) to understand plant, bird, and small mammal communities at Konza Prairie.

"Regionalization is a key goal of the LTER Network strategic plan," says Scott Collins, a Konza Prairie researcher, now located at Sevilleta LTER. "Our working group is proposing to conduct one of the first analyses of metacommunity structure for stream invertebrate communities." In addition, the stream datasets allow the testing of some of the recently proposed metacommunity models (e.g., nestedness sensu Atmar and Patterson, 1993; and coherence sensu Leibold & Mikkelson, 2002).

One of the goals of the project is to determine the degree to which local stream insect communities are linked regionally into metacommunities. A metacommunity, or a set of local communities in different locations, is coupled by dispersal of one or more of their constituent members (Gilpin & Hanski 1991).

The data sets cover a time frame from 1989 through 2002. Most data sets are from a single year, but some cover longer periods, eg., a spatial data set from New York spans 2000-2002. Within a year many of the datasets represent monthly or bimonthly samples.

This project brings a diverse group of investigators with large datasets together for the first time and represents an important synthesis activity among investigators at different sites. The partnership between LTER and non-LTER studies also expands the impact of the four LTER sites and provides a framework for stronger interpretations studies— inside LTER and beyond.

The purpose of the study is to

understand the structure of stream invertebrate communities across temporal (year-to-year, and within-years) and spatial (within and between regions) scales. "But a preliminary analysis of data from Konza Prairie indicated a potential difficulty in using stream invertebrate data to fit an important metapopulation model of community structure," i.e., the Core-Satellite Species hypothesis (CSS). Gibson says, "One significant problem that we identified was that stream invertebrates are often identified to different levels of taxonomic resolution, depending on the scope of the study and the principal investigators involved." Sometimes taxa are identified to species, sometimes just to genus, and for some groups, only to family. "Looking at four stream reaches on Konza from 1988-2000, it appeared that the data provided a good fit to the bimodal prediction of the CSS," Gibson says. "However, when 11 groups of uncertain taxonomic resolution were removed from the analysis, the fit was lost. We realized that to address the CSS across several dataset we would need to work closely with the original investigators of each group so that issues of taxonomic resolution could be discussed."

The datasets were generally in good shape and were provided directly by the investigators that are part of the group, according to co-investigator Matt Whiles. "However, the group has spent considerable time putting them into a common format for this particular analysis, and a big part of the project is standardizing the taxonomy, and deciding which level of taxonomic resolution to retain across datasets," Whiles says. "For example, we quickly removed all non-insect taxa from our datasets when we realized that these were almost always incompletely resolved."

Gibson says the excellent level of cooperation among investigators has made the project a pleasure. "The funding has been critical for working with the data and getting together as a group," Gibson says. "And the LTER infrastructure is helpful in providing a context to work under for most of the datasets."

"The results of this project will provide important insight into stream invertebrate communities across spatial and temporal scales," Gibson says. "The results will also allow us to assess any commonality in patterns of temporal dynamics across large regional scales." The project also drives home the need for comparability among data from disparate locations.

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Above left: One of the stream study sites at Coweeta LTER. Above: damselfly nymph—among the study subjects. Below: A stream study site at Konza Prairie LTER.

Education and Outreach

Ecologists Confront Congress at CVD

Continued from Page 1

The main goal of this event was to urge federal support for research at agencies including NSF, USDA's National Research Initiative, and EPA's Science to Achieve Results Program.

Following a workshop organized by the Biological Ecological Sciences Coalition (BESC) and the Coalition for Agricultural Research Missions, Pouyat and Nilon met with their respective congressional delegates (Maryland and Missouri).

Charlie Nilon met first with Mike Shumaker of Rep. Hulshof's office. "He initiated a conversation about water quality because of some local issues in Columbia, MO that involve the state of Missouri and EPA," Nilon said. "He also was interested in the link between ecosystem health and potential impacts of terrorism."

Next Nilon met with John Stoody of Sen. Bond's office. "He was less interested, saying 'It's a tight budget year,' " Nilon said, adding that Bond has been an active supporter of NSF funding.

The BESC workshop on funding issues was very good, Nilon said. "LTER's and ecological research are way below the radar," and applied research has a slightly higher profile. Nilon felt that the event could use a tighter focus, "perhaps identifying issues that make ecological research more relevant to policy makers."

Baltimore Ecosystem Study's Rich Pouyat (right) joined by Alison Power, ESA's Vice President for Public Affairs, and Evan Notman (center), ESA's Congressional Fellow to the Senate Agriculture Committee. *Photo: Nadine Lymn ESA*

Education Projects Pave the Way for the Future

Sonia Ortega, LTER Network Office

In November 2003 the Ecological Society of America's Strategies for Ecology Education, Development and Sustainability (SEEDS) program in collaboration with LTER sponsored an undergraduate field trip to Washington D.C. and to the Baltimore Ecosystem Studies LTER (BES). Steward Pickett and Alan Berkowitz led 25 students through the field to teach them about hydrology and urban ecology. Students learned from other LTER scientists about specific research questions and sampling taking place at BES. This was the first SEEDS trip to an LTER site.

The Network Office is developing a partnership with SEEDS/ESA to include more LTER sites in these field trips. The benefits will be mutual: SEEDS students and faculty will learn about research at LTER sites, and scientists at LTER sites will have an opportunity to meet and interact with underrepresented students to attract them to their projects.

Education representatives also have been working toward developing cross-site initiatives to integrate LTER research, data, and education.

In February 2004 Steve McGee (LUQ) hosted a proposal-writing workshop at the Center for Environmental Technologies (CET) at Wheeling Jesuit University in West Virginia with participants from 10 LTER sites.

Baltimore LTER ecologist Alan Berkowitz guides SEEDS undergraduates on field trip.

The group discussed the components of and drafted the initial plan for submitting cross-site funding proposals to the NSF's Teacher Professional Continuum (TPC), and Instructional Material Development (IMD) Programs.

The thrust behind the TPC proposal is to create tools and resources for teachers to help them use LTER data in their classrooms. Peter McCartney, information manager from CAP, provided much needed input in the development of a possible model to include in the proposal. Education Committee chair Robert Bohanan (NTL) led the discussion.

The main focus of the IMD proposal is to develop a life-science curriculum for middle schools based on major LTER synthesis themes. Steve McGee led the discussion with Monica Elser (CAP), Ali Whitmer (SBC), and Pamela Snow (HFR).

Also participating were David Campbell, NSF program director via

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Education and Outreach

Florida Coastal Everglades LTER's

EdEn Venture

This outreach program, funded as a supplement from the NSF Informal Education program to the Florida Coastal Everglades LTER (FCE), represents a joint project between FCE, Everglades National Park (ENP), and several Dade County, Florida, schools.

The FCE-ENP "EdEn Venture" will involve a two-pronged action plan for implementation. The first involves working with Sandy Dayhoff (ENP Environmental Education Coordinator) to initiate a park ranger training program. Second, Susan Dailey (FCE Education and Outreach Coordinator) will develop relationships with local teachers and schools to make the direct educational links among school children, ENP rangers, and FCE science about the Everglades. For this part of the program ENP rangers will be educated about current scientific findings using FCE scientists and data. This information will allow rangers to educate visitors to ENP. More than 1 million visitors visit ENP each year, and half of them interact with ENP rangers.

Doug Vogel (right), the EdEn Science Education Ranger, and Susan Dailey (below, left) have served 16 schools since October 2003. Both Susan and Doug also work with the park rangers.

The overall goal of this project is to maximize the quality, delivery, and understanding of scientific information provided by FCE scientists to rangers, by rangers to the general public, and by environmental educators to teachers and students.

The FCE Ed&Outreach Coordinator and a uniformed Science Education Ranger will regularly visit classrooms to deliver interactive presentations about the Everglades that have been developed with FCE scientists. After presenting the LTER scientific discovery information, teachers will have the opportunity to involve their classes in field sampling at permanent Schoolyard LTER sites. The ranger will also lead field trip classroom tours at ENP environmental education annex sites (e.g. the ENP Shark Road Environmental Education Center).

The Science Education Ranger will present environmental education information (based on FCE science) at regular training sessions for all ENP interpretive park rangers. A Web page will feature virtual tours, material from the ranger training program, and findings of FCE research, accessible by both ENP rangers and by the general public. This Website, which is scheduled to be launched in April 2004, will also include tools for teachers to use in their classrooms. Finally, regular "Webcast" chat sessions will involve multiple classrooms, FCE scientists, and ENP rangers.

A series of evaluation questionnaires, pre- and post-activity tests, and on-site observation visits will be used to track the program's success, and the project's implementation can be monitored and recommendations can be provided by all involved. All participants in the FCE-ENP EdEn Venture program (ENP rangers, FCE scientists and staff, K-12 teachers, and students) will be strongly encouraged to provide recommendations and comments on the project. The presentation and delivery of LTER research into environmental education will be adapted accordingly. In the event that the FCE-ENP EdEn Venture is continued for multiple years, summative evaluations from student records of science class grades and career choice assessments from participating schools will become a critical component of the long-term success evaluation.

Education Projects

Continued from Page 12

conference call, Debbie Reese (CET), and Sonia Ortega, Education Director from the Network Office.

While it is exciting to see these network-wide education projects develop, both these initiatives will depend on the participation of many LTER sites.

International LTER Network

Introducing: the Mongolian Long Term Ecological Research Network

J. Tsogtbaatar[1], Clyde E. Goulden[2], Bazartseren Boldgiv[3]

[1] Geoecology Institute, Mongolian Academy of Sciences, Ulaanbaatar 211238, Mongolia
[2] Institute for Mongolian Biodiversity and Ecological Studies, Academy of Natural Sciences, 1900 Benjamin Franklin Pkwy. Philadelphia, PA 19103
[3] Department of Biology, University of Pennsylvania, Philadelphia, PA 19104

Mongolia lays on a plateau in eastern Asia with an average altitude of 1300 meters, bordered by the Altai and Sayan Mountains in the west and north, the Gobi in the south, and broad steppe grasslands in the east (Figure 1). It covers an area about equal in size to Alaska, and with a population of only 2.5 million people. The climate is harsh with high summer temperatures and very cold winters (-40 to -50° C in the winter) and a precipitation gradient from south to north ranging from 10-20 mms annual rainfall in the Gobi, to 250 to 350 mms in the northern mountain regions around Lake Hövsgöl and in the Hentii. The northern region marks the southern boundary of the Siberian taiga and of continuous permafrost. A belt of steppe crosses the mid-region from west to east, the major grazing lands of nomadic herders. The nomads live in portable tent-like "gers" that can be dismantled and conveniently transported on camel or yak-drawn carts when the herders move their animals to seasonal feeding grounds.

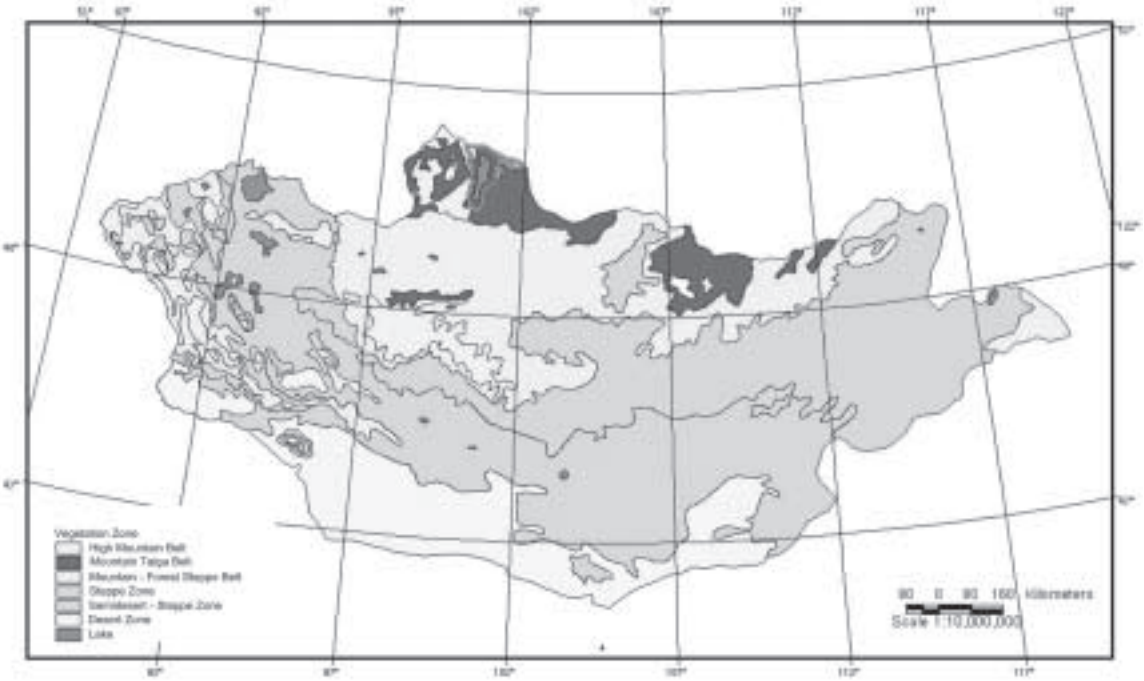

Figure 1. Vegetation zones of Mongolia with Lake Hövsgöl National Park.

The MLTER was approved by the Government of Mongolia in 1997. It is sponsored by the Mongolian Academy of Sciences (MAS), and is directed by a Steering Committee consisting of representatives from the Academy, major universities, and ministries. The purpose of the MLTER is to provide objective scientific information for achieving the goals of both economic growth and the protection objectives of Mongolia's Biodiversity Action Plan. It also supports the training of young Mongolian scientists in biodiversity and ecological research. The MAS hosted the fourth meeting of the East Asian ILTER at Lake Hövsgöl. Some of the presentations can be found at http://www.acnatsci.org/~goulden/mlter_2001_meeting.htm.

Because of its geographic isolation and small population, large areas of the countryside remain almost pristine, and have remnant populations of large mammals (e.g., Bactrian Camel (*Camelus bactrianus ferus*), Saiga (*Saiga tatarica*), Snow Leopard (*Uncia uncia*), Desert Bear (*Ursus arctos gobiensis*), Musk Deer (*Moschus moschiferus*), and a large migrating population of the Mongolian Gazelle (*Procapra gutturosa*, one of the remaining large migrating populations), as well as other species that once roamed throughout the vast Asian steppe.

The first site of the MLTER was designated at Lake Hövsgöl, a tectonic "sister" lake and located southwest of Baikal. Other sites with active programs that should soon be designated as ILTER sites occur in the Gobi, eastern grassland, and in the Hentii

Mountains.

The primary objectives of research at the Hövsgöl MLTER include defining biodiversity and ecosystem impacts from nomadic pastoralist activity, increased incidence of fires in taiga forest and interactions with long-term climate change, including the thaw of permafrost. Hövsgöl is very appropriate for such studies because its location at the boundary of the taiga forest and steppe make it an area of substantial future change. Its north south alignment and series of parallel east to west stream valleys entering the lake allow studies of climate change and impacts on permafrost (Figure 3). Pasture use is greatest near towns where the herdsmen congregate to sell products.

The six study valleys along the eastern side of the lake south of the town of Hanh have a gradient of livestock use ranging from intense in the northern valleys, to low use or an absence of grazing in the southern valleys.

Specific research areas of monitoring and research include: climate and hydrology, active layer depth and temperature of permafrost associated with plant cover, forest regeneration, steppe ecology, plant decomposition, terrestrial insects including following a gypsy moth eruption, stream biodiversity and water quality, ornithology, small mammals, livestock pasture use and observation of activities of the nomad families. A GIS is being developed, and we hope to incorporate community and ecosystem level modeling soon.

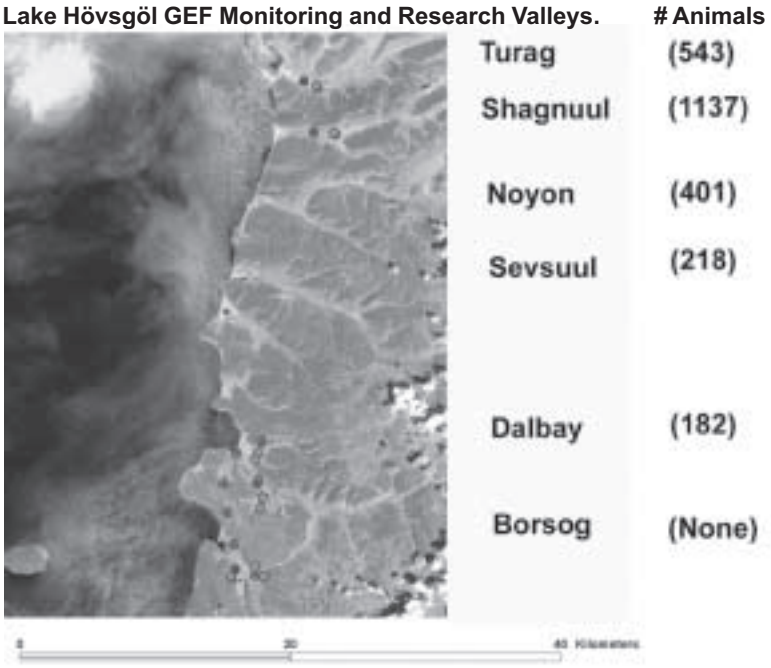

Figure 2. Satellite image of study valleys on northeastern shore of Lake Hövsgöl. Green areas are mostly covered by taiga forest, brown areas are steppe valley bottoms and south-facing slopes.

Research activities at the Hövsgöl MLTER site have developed in conjunction with scientists from international institutions who are working within teams consisting of a senior Mongolian scientist, a young Mongolian researcher in training, an international scientist and the International Consultant (Figure 3). Biostatistics and experimental design have been an important part of the training.

The Mongolian Academy would like to encourage cross-site comparison studies with other LTER and ILTER sites around the world, especially in steppe studies, biogeochemistry, forest studies, climate and ecosystem modeling. Please see the Web site, http://www.acnatsci.org/~goulden.

Figure 3. Research team of Hövsgöl ILTER site (June 2003).

International LTER Network

New Wireless Sensor Network for Studying Lake Metabolism

Researchers in the U.S. and Taiwan have teamed up to study lake metabolism in a first-of-its-kind project using intercontinental wireless connectivity to field sensors on two sides of the Pacific Ocean. Scientists at North Temperate Lakes (NTL), the University of California San Diego (UCSD), San Diego Supercomputer Center (SDSC), the Taiwan Forestry Research Institute (TFRI), the Taiwan National Center for High-Performance Computing (NCHC), and Academia Sinica (AS) have joined forces to instrument several lakes at the NTL site in Wisconsin and Yuan-Yang Lake in Taiwan with sensors enabling measurements of gross primary production, respiration, and net ecosystem production. Wireless communication with the buoys from anywhere in the world with internet access is a prominent part of the research.

Understanding the factors influencing the carbon balance of lakes is a longstanding goal in aquatic ecology (Cole et al. 1994, Kling et al. 1991) because the carbon balance reflects both a lake's biological activity and its links with its landscape and climatic settings. Lake metabolism can be described as the balance between the complementary processes of gross primary production (GPP) and respiration (R) (Hanson et al. 2003). It is a fundamental lake characteristic that helps describe the source of carbon incorporated into all trophic levels of the ecosystem. If GPP is greater than R, then the lake is considered autotrophic and internally produces reduced carbon sufficient to fuel higher trophic levels. Alternatively, if GPP is less than R, then the lake is considered heterotrophic and must receive an external source of reduced carbon to fuel higher trophic levels. Total phosphorus (TP) and dissolved organic carbon (DOC) are two important drivers of net ecosystem production (NEP=GPP-R) in lakes (del Giorgio and Peters 1994, Hanson et al. 2003, Prairie et al. 2002). At moderate to low DOC concentrations, both GPP and R are directly related to TP. However, when DOC concentrations are moderate to high, GPP and R are uncoupled and NEP is negative, indicating heterotrophic conditions. Previously published studies considered mostly north temperate lakes and relied on short sampling durations on individual lakes.

At the entrance to Yuan Yang Lake in Taiwan. L to R. Chih-Yu Chiu (AS), Bill Chang (NSF), Peter Arzberger (UCSD), Tim Kratz (NTL), Grace Shau-Wei Hong (NCHC), Fang-Pang Lin (NCHC), Steven Shiau (NCHC).

In the current project, lake metabolism will be measured using high frequency (~ every 10 minutes) observations of dissolved oxygen in the surface waters of lakes in Wisconsin and Taiwan. Over a diel period decrease in O_2 at night will be used to calculate R. Oxygen increase during the day reflects the difference between GPP and R (Cole et al. 2000, Hanson et al. 2003).

In October 2003 Tim Kratz (NTL), Peter Arzberger (UCSD), and Bill Chang (NSF) visited Yuan Yang Lake to assess its suitability for an intercontinental comparison of lake metabolism using wireless connectivity. They met with Fang-Pang Lin (NCHC), Steven Shiau (NCHC), Grace Shau-Wei Hong (NCHC), and Chih-Yu Chiu (AS). After visiting the lake, the American contingent met with Dr. Hen-Biau King (TFRI), a co-PI on the project. Yuan Yang Lake is particularly interesting because it is a subtropical lake subject to several typhoons each year. A single typhoon can drop as much as several meters of precipitation on the 4.5 meter deep lake, causing rapid flushing of the lake. This contrasts with the Wisconsin lakes which have much longer water retention times.

In February 2004, five Taiwanese

scientists, accompanied by Arzberger, traveled to the Trout Lake Station in Wisconsin to observe the metabolism buoys deployed on the NTL lakes. Drs. Fang-Pang Lin, Julian Yu-Chung Chen of NCHC, Drs. Chau-Chin Lin, Meei-Ru Jeng, and Sheng-Shan Lu of TFRI visited the NTL site. Dr. Robert Bohanan (NTL and chair of the LTER Education committee) also attended the meeting to discuss possible educational outreach opportunities presented by the wireless buoy project.

Visiting an instrumented buoy on Sparkling Lake, Wisconsin (February 6, 2004): Kneeling (L to R): Fang-Pang Lin (NCHC), Julian Yu-Chung Chen (NCHC), Meei-Ru Jeng (TFRI), Tim Kratz (NTL). Standing (L to R): Peter Arzberger (UCSD), Sheng-Shan Lu (TFRI), Chau-Chin Lin (TFRI).

The development and deployment of wireless sensors and appropriate cyberinfrastructure will be critical to the success of the project. Yuan Yang Lake is remote and building a wireless network, beginning with a careful selection of location of radios and radio relays, to establish connectivity between the buoy on the lake and the file server system at NCHC will be a significant challenge. Secondly, software tools need to be developed to automate the movement of data from where it arrives at NCHC to a publicly accessible database. Initially we will be developing and deploying web services to publish data from NTL and Yuan Yang Lake, and developing other web services to automate the reduction of raw buoy data to estimates of daily R, GPP, and NEP. As the project matures, other services will be developed to automate aspects of the system for quality control of the data, intelligent signal detection (e.g., major external meteorological events), and automated series of analyses and visualizations.

Web services, an emerging framework that integrates legacy and new IT infrastructure and software applications, builds on a set of protocols and network services for passing information between distributed endpoints of the network[1] from computers to sensors (see article, page 8, this issue). Web services are being widely adopted by a global scientific and industrial community, thus providing a standard way for interfacing machines, software, and data. By providing dynamic data access and integration via web services, the system supports cross-site studies and collaborations. By basing the architecture on web services technology, the system is extensible and scalable, supporting the smooth integration of new data collections, new analytical services, and new sites and communities.

This project will leverage the buoy, sensor, and information management experiences of North Temperate Lakes[2], the infrastructure and wireless experience of Ecogrid Project[3] in Taiwan led by NCHC in collaboration with the Taiwan Ecological Research Network and the Taiwan Forest Research Institute, the long-term interactions between the US LTER Network and SDSC/UCSD[4] in building web services, and collaborative framework and technologies of the Pacific Rim Application and Grid Middleware Assembly (PRAGMA)[5] collaborating with NCHC, the Chinese Network Information Center (CNIC), the Asia-Pacific Advanced Network (APAN), and the National Agriculture Organization in Japan in building interoperating web services for meteorological data.[6]

We view the activities described here as developing a prototype system that, once functioning, can be expanded to more sites and be used as a model for other international collaborations that are now possible because of the technology.

Acknowledgements

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Dr. Bill Chang (wychang@nsf.gov), OISE, National Science Foundation
Ms. Jennifer Hu (jenhu@nsc.gov.tw), National Science Council of Taiwan
Dr. Hen-Biau King (hbking@serv.tfri.gov.tw), Taiwan Forest Research Institute
Dr. Fang Pang Lin (fplin@nchc.org.tw), the Knowledge Innovation National Grid project, NCHC, NSC.

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Continued on Page 19, column 2

LTER Forms International Committee

The Executive Committee formed the International Committee in the fall of 2003 with a mandate to strengthen ties between the U.S. LTER network and the member networks of the ILTER. The International Committee held an informal meeting as part of the All Scientist's Meeting in September 2003, drafted a mission statement in November 2003, followed by election of co-chairs. Elected co-chair Steven Hamburg (Hubbard Brook) will serve a three-year term, and Patrick Bourgeron (Niwot Ridge) will serve a two-year term. Steven will represent the U.S. LTER on the ILTER Steering Committee.

The International Committee also drafted a mission statement comprising five parts:

The Mission of the U.S. LTER International Committee

1. To facilitate the development and maintenance of long-term projects and collaborations between US-LTER scientists and ILTER colleagues.

Many US-LTER scientists already have on-going and successful international ties. Therefore, the added value of the US-LTER International Committee should be to facilitate the initiation of new projects that will strengthen the ILTER and/or its individual country member networks. In addition, the committee will act as a clearinghouse for knowledge about how to successfully initiate and maintain collaborations and funding, as well as help solve institutional problems as they arise. When appropriate, the committee should function as a matchmaker, connecting interested scientists from either the U.S. or abroad with suitable potential collaborators.

2. To facilitate and coordinate the involvement of U.S. LTER scientists in developing and strengthening regional networks as well as individual country networks.

Given their more-than 20-years of experience in LTER activities, U.S. scientists are well positioned to help scientists from other countries and regions in building and strengthening their research networks. Such assistance is best leveraged through coordinated efforts, since one scientist seldom has the time or contacts to perform such activities alone. This area of activity is focused on strategic planning, program development, and/or transfer of technology and knowledge.

3. To facilitate the participation of U.S. LTER scientists in the establishment and maintenance of effective data/information infrastructures within the ILTER.

Availability of data and information from a diversity of study areas is one of the ILTER's central missions. Given the depth of experience of U.S. LTER information managers and researchers with issues of information management (IM), they can make a significant contribution to ensuring globally accessible and useful data. The International Committee should play a catalytic role in establishing the working group and assisting it in defining useful activities.

4. To create an atmosphere in which participation in the ILTER network is seen as a central component of each U.S. LTER site's activities.

The Committee needs to create a feeling among U.S. LTER PIs and co-PIs that ILTER activities are important and provide new opportunities not only to leverage existing data, but also to ask important and timely questions that cannot be answered within the sites available through the domestic network.

5. To facilitate cooperation between the ILTER and other global science programs e.g. International Geosphere-Biosphere Programme, the International Human Dimensions Programme, and DIVERSITAS.

In order to maximize the usefulness of the data collected through the LTER we need to participate in a wide range of collaborative international collaborations. The International committee can assist in this effort by representing LTER interests at national and international meetings, and promoting ILTER connections with these other groups when possible.

A proposal is currently being negotiated with the National Science Foundation to facilitate the work of the committee. Anyone interested in participating in the work of the committee or with ILTER member networks is encouraged to contact either Patrick (Patrick.Bourgeron@colorado.edu) or Steven (Steven_ Hamburg@Brown.edu). The work of the Committee will be supported by Laura Sadovnikoff, Program Manager, Global Environment Program, Watson Institute for International Studies, Brown University (Laura_Sadovnikoff@Brown.edu). Laura is available to help coordinate and

Continued next page

International LTER Committee

Continued from previous page

facilitate visits by ILTER scientists to U.S. LTER sites, though primary responsibility for supporting such visits will reside with the individual sites. The coordination of U.S. LTER activities related to the ILTER, previously facilitated by the Network Office, will now be handled by the International Committee.

The membership of the U.S. LTER International Committee currently stands as follows: Nick Brokaw (Luquillo), Patrick Bougeron (Niwot), Ted Gragson (Coweeta), Steven Hamburg (Hubbard Brook), Dave Hartnett (Konza Prairie) Brian Kloeppel (Coweeta), Dick Lathrop (North Temperate Lakes), Kate Lajtha (Andrews), Berry Lyons (McMurdo), Chris Madden (Florida Coastal Ecosystems), Dennis Ojima (Short-grass Steppe), Deb Peters (Jornada Basin), Kristin Vanderbilt (Sevilleta) and Bob Waide (LTER Network Office).

New Flux Tower Facility at FCE LTER

Continued from page 5

Continuous field measurements from an eddy covariance (EC) system provide the net exchange of carbon dioxide across the forest-atmosphere interface every half hour. The EC system consists of a three-dimensional sonic anemometer and a fast response open-path gas analyzer (Figure 1). When measured over days and weeks, these measurements provide the magnitude of the net carbon exchange between atmosphere and forest, sediment accretion, and estuary exchange. Several key local climate variables are also continuously measured from the tower. These variables control carbon sequestration on short (half-hour) time scales, and are being used in a coupled forest-atmosphere biophysical exchange model to predict forest productivity. Additional tower instruments include radiometers to measure light levels, anemometers to measure atmospheric turbulence, air thermometers, hygristors to measure humidity, and soil thermometers. These measurements, combined with tidal and salinity information, elucidate the response of the mangrove biome to climate change (e.g. sea level rise) and changes in the quantity and quality of freshwater flow from the greater Everglades.

The CO_2 fluxes to the mangrove forest show strong diurnal variations and unusually high values, with maximum daytime fluxes reaching -30 micro-moles (CO_2) m-2 (ground area) s-1 (Figure 4). Photosynthetically active irradiance (PAR) and temperature (Figure 5) principally and strongly modulate the diurnal patterns of CO_2 fluxes. Atmospheric turbulence also exerts a great influence on the magnitude of CO_2 fluxes. The observed patterns and magnitude of CO_2 fluxes (Figure 5) support the hypothesis that mangrove forests constitute an important carbon sink.

Sensor Web Reaches from North Temperate Lakes LTER to Taiwan

Continued from page 17

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Notes

1) http://www.extension.ucsd.edu/Programs/index.cfm?vAction=certDetail&CertificateID=6

2) See Environmental Cyberinfrastructure Needs for Distributed Sensor Networks, Estrin, D., Michener, M., Bonito, G. http://lternet.edu/sensor_report/cyberRforWeb.pdf, Box 10, page 53 (or Biosciences Article - Jan 2003)

3) http://ecogrid.nchc.org.tw/

4) http://www.iigee.org

5) http://www.pragma-grid.net, PRAGMA is supported by the National Science Foundation (Grant No. INT-0216895 and INT-0314015), its 20 member institutions.

6) See http://intranet.lternet.edu/archives/documents/Newsletters/DataBits/03spring/#3fa.

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NARC, http://narc.naro.affrc.go.jp/narc-e/index.html

MetBroker, http://www.agmodel.org/index.html.en

Network Office Studies Survey Results

Continued from Page 2

However, because the LTER bylaws call for this survey to be used in an annual evaluation of the LNO, the Site Survey emphasized assessment more than the Individual Survey (see link to "Bylaws" on the LTER Web site—http://www.lternet.edu). Twenty-two of 24 LTER sites responded to the Site Survey, and most sites provided useful additional comments on needs and priorities. Generally speaking, sites were satisfied with the basic services provided by LNO, but two areas stood out as requiring further effort. Support of synthesis and information management and methods development were both identified as topics that could benefit from increased attention from LNO. Suggestions for ways in which the LNO can address these issues include increases in support for synthesis working groups, pursuit of new funds for cross-site and network synthesis, support of the Network Strategic Planning activities, support of the activities of the Network Information System Advisory Committee, and development of mechanisms to provide additional technical support in informatics directly to sites. The Coordinating Committee will provide recommendations to NSF for changes in the LNO Cooperative Agreement to address site and Network needs.

Comments submitted by sites as part of the survey provided valuable ideas for modifications to LNO activities. A few representative comments are available in the full-text version of this article, on the LTER Newsletter Web site: http://www.lternet.edu/newsletter.

Publications

Steve Carpenter recently authored a volume in the series published by the International Ecology Institute (Germany): Carpenter, S. R. 2003. Regime Shifts in Lake Ecosystems: Pattern and Variation. Volume 15 in the Excellence in Ecology Series, Ecology Institute, Oldendorf/Luhe, Germany. PDFs of the chapters are available: http://limnology.wisc.edu/regime/

Detail of graphic featured in a new volume authored by Steve Carpenter of North Temperate Lakes LTER in Wisconsin.

The Kuparuk River, Alaska (near the Toolik Field Station, photo by Jon Benstead) featured in the April 2004 issue of the journal *Ecology.*

The April 2004 issue of *Ecology* features the article "Long-term responses of the Kuparuk River ecosystem to phosphorus fertilization," by Slavik, K., B. J. Peterson, L. A. Deegan, W. B. Bowden, A. E. Hershey, and J. E. Hobbie.

Mitch Aide, John Thomlinson, Xiaoming Zou, Eileen Helmer, and Jess Zimmerman published this article on land-use research, featured on the cover of the December 2003 issue of *BioScience*. Most of the research in the article was supported by NASA, Zimmerman says, "but the overall project grew out of our land-use studies in the Luquillo LTER."

Kings Creek, Konza Prairie LTER, featured in the March 2004 issue of *BioScience.*

The article, "Life on the Edge: The Ecology of Great Plains Prairie Streams," is authored by Konza Prairie LTER scientists Walter Dodds, Keith Gido, Matt Whiles, and others.

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Calendar

Coming Events of Interest to the LTER Community

18-24 April 2004
International Symposium on Impacts of Soil Biodiversity on Biogeochemical Processes in Ecosystems/International Workshop on Molecular Methods in Soil Biological and Biochemical Diversity in Terrestrial Ecosystems. Taiwan Forestry Research Institute, Taipei, Taiwan. Contact: Dave Coleman dcoleman@lternet.edu or http://www.tfri.gov.tw/tfri_web/index.php

20-23 April 2004
15th Global Warming International Conference and Expo. San Francisco, California. http://www.globalwarming.net

29 April-1 May 2004
LTER Coordinating Committee meeting Santa Barbara Coastal LTER, host http://intranet.lternet.edu/meetings/

26-28 April 2004
Coastal Environment 2004: 5th International Conference on Environmental Problems in Coastal Regions. Alicante, Spain. http://www.wessex.ac.uk/conferences/2004/coastalenvironment04/

6-10 June 2004
North American Benthological Society Annual Meeting. Vancouver, British Columbia. http://www.benthos.org/Meeting/index.htm

13-18 June 2004
ASLO 2004 Summer Meeting: The Changing Landscapes of Oceans and Freshwater Savannah, Georgia. http://www.aslo.org/meetings/savannah2004/

21-23 July 2004
Conference on Climate Change and Aquatic Systems: Past, Present & Future. Plymouth, United Kingdom. http://www.biology.plymouth.ac.uk/climate/climate.htm

27 September-1 October 2004
4th European Ecological Modelling Conference. Bled, Slovenia. http://http://www-ai.ijs.si/SasoDzeroski/ECEMEAML04/ecem.html

1-6 August 2004
Ecological Society of America Annual Meeting: "Lessons of Lewis & Clark: Ecological Exploration of Inhabited Landscapes" Portland, OR. http://www.esa.org/portland/theme.html

17-22 August 2004
LTER Coordinating Committee Meeting. General meeting is in Bonanza Creek in Fairbanks 17-18 August, followed by a three-day visit to Toolik Lake. http://intranet.lternet.edu/meetings/

Long Term Ecological Research Network
LTER Network Office
UNM Department of Biology, MSC03 2020
1 University of New Mexico
Albuquerque NM 87131-0001

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