LTER
Network News
Newsletter of the Long–Term Ecological Research Network
Vol. 19 No. 1 Spring 2006

Traditional Ecological Knowledge gains currency in LTER

Researchers seek new ways to study ecological processes

Ancient Shinto lore from a shrine on Lake Suwa, Japan, features a temple with a male and female god, who had an argument. The female god decided to build her own temple on the other side of the lake. Every winter after the ice formed on the lake the male god visited her and a serpentine ice ridge (*Omiwatari*) formed across the ice from the tail of the dragon accompanying him to mark this event.

Each winter since 1452 the Shinto priest held a religious ceremony on the lake to mark the event and recorded the date. This date was also used to judge whether the rice crop would be good in the following season. The ceremony continues to this day.

The Shinto priest's annual record of freezing and other ice events provides the oldest known annual time series of ice phenology. "Long-term annual observations that stretch back over the centuries are rare," says John Magnuson, a North Temperate Lakes (NTL) LTER investigator who heard this story during a visit to the Shrine in November 2005.

With Japanese colleagues, Magnuson visited a Shinto Shrine to see the original records and talk to the priest about them. One concern was whether the calendar correction at the end of the Edo period in the late 1800s had been made. "Preliminary examination of the time series suggest that the ice-on dates, while highly variable from year to year, had a weak trend from 1452 until the early to mid 1800s, while later in the series from 1897 to 1993 the rate of change had increased markedly to 20 days later per 100 years." Magnuson also notes that the number of winters that the lake did not freeze has increased in recent years.

"The Lake Suwa ice records remind us that some of our longest time series based on direct human observation are from non-scientific observers," Magnuson says. "The longer of these records will help sort out rates of change before and after the period of rapid warming that is now occurring."

See "TEK," p. 3

Photo: J. Magnuson

Lead Shinto priest at Suwa Ko, Japan, Mahaska Kiyoshi, examining the Shrine's ice records from the period of calendar change in the late 1800s.

In This Issue

LTER site acronyms: AND=H.J. Andrews; ARC=Arctic; BES=Baltimore Ecosystem Study; BNZ=Bonanza Creek; CAP=Central Arizona–Phoenix; CCE=California Current Ecosystem; CDR=Cedar Creek;CWT=Coweeta; FCE=Florida Coastal Everglades; GCE=Georgia Coastal Ecosystem; HFR=Harvard Forest; HBR=Hubbard Brook; JRN=Jornada Basin; KBS=Kellogg Biological Station; KNZ=Konza; LNO=LTER Network Office; LUQ=Luquillo; MCM=McMurdo Dry Valleys; MCR=Moorea Coral Reef; NWT=Niwot Ridge; NTL=North Temperate Lakes; PAL=Palmer Station; PIE=Plum Island Ecosystem; SBC=Santa Barbara Coastal; SEV=Sevilleta; SGS=Shortgrass Steppe; VCR=Virginia Coast Reserve.

The Network News

Vol 19 No 1 Spring 2006

The Network News
is produced each
spring and fall at the
LTER Network Office
through a cooperative agreement
between the
National Science Foundation
and the
University of New Mexico

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Printed on recycled paper with soy-based inks at Starline Printing.

In some cases articles are abridged to fit in the printed version of the Newsletter. A complete, color version is available on the LTER World Wide Web site:

www.lternet.edu

Editorial

Reflections on LTER beginnings, challenges, and the future

Learning from the past is key to long-term ecological research and to how we conduct and organize our science. My thoughts here focus on our beginnings and how far we have come. I will mention some of the challenges we face, many of which are similar to those we faced in the past.

The LTER network of sites first met in Washington, D.C. in 1980. Six just-funded sites attended (Andrews, Coweeta, Konza, Niwot, North Inlet, and North Temperate Lakes); many of us had never met before. We learned from John Brooks, then Director of the Division of Environmental Biology and James (Tom) Callahan, the first NSF Program Director for LTER, that we were a network for intersite science (Magnuson et al., 2006). Tom's hopes and aspirations for the network (Callahan, 1984) are delineated in his charge at this first meeting: "The LTER network of research projects...and the Foundation are entering into an experiment. The results of this experiment can promote an advance in ecosystem science which will cause the field to change from a largely descriptive discipline to a predictive science." At a network coordinating committee meeting in 1986, John Brooks observed that the opportunities for really new science lay in LTER network science, not just in individual site science (Magnuson et al., 2006). His comments, using the "carrot and the stick" approach, were a challenge to us to do network science. These aspirations and challenges continued and were recognized by the 10- and 20-year reviews of the program. Challenges, both administrative and scientific, were not easily addressed. But we began the process and NSF provided funds to stimulate the effort even in the 1980s.

At that first network meeting in 1980 we exchanged addresses and phone numbers (email did not exist). We set up a few network study groups, such as information management and analytical chemistry. The computing centers at our campuses had less capacity and speed than the laptops we carry around today. Some sites had no long-term data. We wrote a proposal to organize and run the network, and our first attempt at network science was to compare leaf area indices among the sites. A working group examined the issue at a coordinating committee meeting and concluded that it made no sense, so we dropped the idea. We have certainly come a long way since those humble beginnings.

Further efforts in the 1980s were more successful at intersite comparisons, for example, the inter-annual and spatial variability among 12 LTER sites (Riera et al., 2006). For sites as disparate as deserts, lakes, and forests, spatial variability always exceeded inter-annual variability and biological properties were most variable, while chemical and physical properties were progressively less variable. These were system characteristics that extended across the entire LTER network of sites. By the 1990s we were conducting comparative studies such as tree decomposition and other long-term experiments. Currently, a synthetic analysis of trends and dynamics across the sites is in progress.

We are in a decade of synthesis; through the planning grant process, we are developing the blueprint and structure to carry out interdisciplinary, network level science. Challenges for the network and for the sites are, perhaps, the same: how to embrace the new while maintaining the old, balance program growth with manageability, maintain the continuity and integrity of long-term research, and synthesize even as we make system specific advances to science (see Magnuson et al., 2006).

The challenges that were identified early in the LTER program may well be addressed in the decades ahead with long-term data, sophisticated data information systems, conditioned human resources, and the potential for significant funding of intersite science. We are in an exciting time to look back and to look ahead.

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John J. Magnuson, Interim Chair,
LTER Coordinating Committee.

TEK (continued from p.1)

Efforts to decipher the story of a landscape often reveal more questions than answers and some LTER ecologists are consulting alternative sources for knowledge. "While TEK often implies Euro-Americans working with non-western or native populations of one kind or another, it is probably more appropriate to think of it as the knowledge held by local populations and/or that which is not immediately attributable to formalized education," says Ted Gragson, Coweeta LTER investigator.

Most importantly, Gragson says, TEK opens up the possibility of incorporating all available human knowledge within the research.

Long recognized as a valuable companion to empirical research in fields such as pharmacology, botany (ethnobotany), and agriculture, the use of alternative sources for knowledge is gaining ground in LTER research. For most readers, the literary works of Henry David Thoreau provide pleasant bedside reading. For David Foster, a Harvard Forest LTER researcher, Thoreau's journals serve as a primary research source for his studies of landscape change in New England's forests. Notably, Foster was struck by how the forested landscape he observed varied so greatly from the agricultural landscape Thoreau described.

"The Lake Suwa ice records remind us that some of our longest time series based on direct human observation are from non-scientific observers"—John Magnuson.

Foster uses Thoreau's journals to depict the historical practices that shaped the New England landscape in order to interpret their modern ecology and propose approaches to conservation of the forests and farmland. For example, Thoreau noted that "the general aspect of fire is beneficial"—thinking that took more than a century to be accepted in modern management practice. In his 1999 book, *Thoreau's country: journey through a transformed landscape* (Harvard University Press), Foster attributes a great deal of his understanding of the current New England landscape to Thoreau's historic accounts and notes that ignorance of history limits our understanding of current landscapes, such as how livestock grazing affects a forest.

Arctic LTER investigator Gus Shaver agrees. He cites the work of Roosevelt Paneak, an Inupiat from Anaktuvuk Pass (the nearest town to Toolik Lake, about 70 miles away; it is the only inland Inupiat village) as an excellent example of the use of indigenous knowledge. While working for the Toolik Logistics office at the University of Alaska in Fairbanks, Paneak, who died recently, developed an Inupiat dictionary of place, plant, and animal names from the Toolik region that has proved invaluable to researchers. Shaver adds that Paneak's father, Simon, was also well known in the history of the Naval Arctic Research Laboratory at Barrow as a guide to scientific parties and an endless source of local knowledge and practical advice.

Photo: T. Hanazato

Omiwatari that formed on Suwa Ko, 2003. Ice ridges form from the thermal contraction and expansion of ice and are typically serpentine.

Many ecologists are learning that traditional knowledge can provide valuable insights that complement and support research findings—a fact long understood by agricultural researchers. "Agriculture practice and research are practically the same," says Dick Harwood, chief LTER agronomist at the Kellogg Biological Station (KBS) LTER. On a field trip to Indonesia in the 1970s, Harwood and his students encountered a traditional Indonesian farmer dressed in simple garb and barefeet, standing in his small but highly intercropped field. "He was not literate," Harwood recalls, "but he described to us in great detail his intercrop design based on trophic levels of solar intensity within the crop canopy over time." That information led to research by several students to verify the details.

In a 7-year-long "Innovative Farmers of Huron County" project, Harwood's team measured the effects of the farmer's innovative tillage practices on carbon and nitrogen processes, and to water infiltration, other soil parameters, and productivity. The study combined farmer-designed changes with LTER science, and some of the practices became an integral part of the LTER design. Although the team co-authored a publication based on the findings with the farmers, Harwood observes that "Farmer understanding and integration capacities are not really well captured by anyone."

At NTL, a small team of scientists and managers used a framework developed by the United Nations Millennium Ecosystem Assessment to study the dynamics of a region in transition, focusing on water quality and fish populations. The analysis involved data collection, analysis, and synthesis as well as discussion with various experts familiar with different areas of northern Wisconsin. "All the scenarios included input from Native Americans, as well as other groups in the Northern Highlands Lake District," says

See "TEK," p.19

Engaging social scientists in LTER research

The current and future role of the social sciences in the LTER Network was the focus of a two-and-a-half-day workshop held in Athens, GA, on 3-5 August, 2005. All but three LTER sites sent a social science representative to the workshop and 19 sites also responded to a 10-question survey. This article contains selective results from both the workshop and the survey.

It is widely acknowledged that researchers should view human activity as integral to ecosystem functioning, and that it is important to carry out forward-looking research on how to simultaneously maintain Earth's life support systems while meeting human needs (Palmer et al., 2004; Schiermeier, 2006). Moving LTER science to a higher level of research collaboration, synthesis, and integration in this arena requires shifting the view about the role of humans from that of ***drivers*** to that of ***agents***. How to achieve such a shift was the foundation of a workshop in August 2005 held in Athens, GA, to seek answers to two questions: (1) what is the status of the social sciences in the LTER Network?, and (2) what are the challenges that need to be overcome to better engage social scientists?

Disciplinary breadth and technical expertise are not evenly distributed across the Network, and this situation is even more pronounced with respect to the social sciences. There are approximately 51 social scientists in the Network representing diverse disciplinary backgrounds. Eight sites have at least one social scientist directly involved in site-level research, eight others have none, and the maximum number at any one site is 20. The current biophysical-to-social scientist ratio at sites ranges from 6:1 at one site (the Kellogg Biological Station), to the more typical 20:1, to the "completely outnumbered" category. But what would be the ideal biophysical-to-social scientist ratio? Many site scientists think a ratio between 5:1 and 10:1 would be ideal.

Eight sites currently have research with an explicit social science dimension and seven sites plan to continue their current social science research, expand it, or incorporate an explicit human dimension in their next renewal proposal. It is, therefore, surprising that only three sites have social scientists playing a significant role in site research orientation, organization, or activities. Social scientists have a minimal role at five sites and play no role at all in shaping the research agenda at seven sites.

While real social science capacity does exist in the Network, there are significant challenges to mobilizing this capacity to realize its potential and achieve the integration between the social and biophysical sciences that numerous reports have urged in recent years. The current situation is that most social science research is not carried out in the context of the existing LTER structure, but through *ad hoc* informal channels of communication that are highly dependent on serendipity and luck for achieving their objectives.

The result is that while some LTER sites have been directly funded or supplemented to carry out social science research, the social sciences are not currently institutionalized in the Network. The "whys" for this situation stem from the research culture at certain sites; the lack of participation by social scientists in site research design; the incentives and disincentives to participating in interdisciplinary research; and the general absence of core social science datasets.

Moving the social sciences from outside the sphere of explicit recognition where they currently reside to full partnership with the biophysical sciences will ultimately require long-term funding. Social scientists have made significant contributions to LTER science as professional outsiders, but engaging social scientists at the level required for meeting LTER's "Grand Challenges" requires direct and sustained investment. As ecologists discovered 25 years ago when the LTER was established, short-term funding does not yield long-term results. To further justify the need for engaging social scientists in LTER research, Boynton et al. (2005) noted that "Without ready and open access to these social areas of expertise and practice, ecologists may not exploit the most cogent or important connections of their research."

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Ted L. Gragson (CWT), J. Morgan Grove (BES) and *Dan Childers (FCE).*

SEEDS of partnership

LTER and ESA SEEDS program cultivating common grounds

The Ecological Society of America's (ESA) Strategies for Ecology Education, Development and Sustainability (SEEDS) Program provides a variety of opportunities—campus chapters, research fellowships, meeting travel awards, and field trips—to stimulate and nurture the interest of minority undergraduates in ecology. Established in 1996, over the last decade the program has made great strides in increasing the representation of minorities in ecology. Since 2003, the LTER network has had a growing role in this success.

The SEEDS field trips, which offer exciting opportunities for undergraduate students to explore their interest in ecology, have given rise to a developing partnership between ESA and the LTER network. LTER sites are ideal locations for the field trips as they provide undergraduate students the chance to explore a broad range of research areas and to interact with a large network of researchers in one place. Common features of each field trip include face-to-face interactions with experienced ecologists and a diverse group of graduate students; participation in hands-on field research; a panel for professionals to share their career pathways and advice with the students; and strong peer mentoring and support as students from all over the nation meet to share and develop their interests in ecology.

Top: ESA SEEDS participants during a field trip to the Sevilleta LTER (photographer unknown). **Left**: Aja Reyes (University of Hawaii at Monoa) displays a "friend" she caught on the ground (photo: Nancy Grimm). **Right**: Pavithra Ramani (University of Virginia) and Cheyenne Garcia (Western Washington University) confer with Scott Collins, SEV PI (on the right) during the SEEDS field visit to the Sevilleta (photo: Nancy Grimm).

When the field trips occur at LTER sites, the LTER community has, in turn, the opportunity to meet a group of promising and diverse students in the beginning stages of their ecology careers. LTER ecologists participate in the field trips in a number of ways, ranging from hosting the group and helping prepare the agenda, to presenting their own research and serving on a career panel.

The first collaborative ESA SEEDS/LTER field trip was led by Dr. Alan Berkowitz at the Baltimore Ecosystem Study in November 2003. The trip followed the Gwynns Falls watershed from a relatively low density area to an urban Baltimore neighborhood. Along the way students discussed topics like soil ecology, forestry, hydrology, and water monitoring and interacted with many researchers and community members. The trip was a powerful eye-opener for many students who learned about the existence of urban ecology for the first time. One student observed, "It was so amazing to be surrounded by a diverse group of awesome scientists. The field trip introduced me to ideas that I had never heard before. It was so cool to see the many directions one can take in an ecology degree, even into the city."

The second SEEDS/LTER field trip took place in November 2005 at the Sevilleta LTER in New Mexico. Led by Dr. Scott Collins, this group of students toured several different research sites within the Sevilleta LTER and saw the diversity within this unique desert ecosystem where several biomes converge—the Chihuahuan Desert to the south, Great Plains grassland to the north, subalpine forests in the higher elevations, and the riparian area created by the Rio Grande valley that runs through the site. Many students on this field trip came from moist, humid climates and had never seen a desert ecosystem. The subtle changes in biomes and the diversity of microbes that dwell underground helped the students understand that there is more than meets the eye in the realm of ecological diversity. In addition, students gained an appreciation of the scale of long term research, and the number of people involved in generating ecological knowledge.

The next two SEEDS/LTER field trips are planned for June 2006 at the Konza Prairie LTER site in Kansas and November 2006 at the Coweeta LTER site in the Appalachian Mountains of North Carolina. The evolving partnership between the ESA/SEEDS program and the LTER network is natural given the shared objectives of both programs to advance the science of ecology in the broader student community. We hope that this collaboration will continue to grow as both have much to offer one another.

For more information about the SEEDS field trips please visit *www.esa.org/seeds or email seeds@esa.org.*

Jeramie Strickland, Melissa Armstrong, Katherine Hoffman, and *Jason Taylor, ESA SEEDS Program.*

CCE holds first Annual Meeting

The first California Current Ecosystem (CCE) annual site meeting was held on December 5, 2005 at Scripps Institution of Oceanography (SIO), preceding the California Cooperative Oceanic Fisheries Investigations (CalCOFI) Annual Symposium held the same week. The CCE LTER studies the coastal upwelling biome of the California Current and related waters in the first 500 km of the coastal ocean off southern California. The CCE site was funded in September 2004 by the NSF and now provides augmented measurements in coordination with the CalCOFI program, satellite remote sensing observations, three different types of modeling activities, and experimental cruises.

The CCE LTER Principal Investigator, Mark Ohman, opened the meeting with an overview of the site's first year. Other major topics included the CCE field program overview and update by Ralf Goericke; satellite remote sensing (Greg Mitchell); modeling (Pascal Rivière); process cruises (Mike Landry); information and data management (Karen Baker); education and outreach (Beth Simmons); and graduate student activities (Brian Hopkinson). We rounded out the meeting with brief science vignettes from scientists, associates, and students, and planning discussions for the first process cruise scheduled for May 8-June 7, 2006.

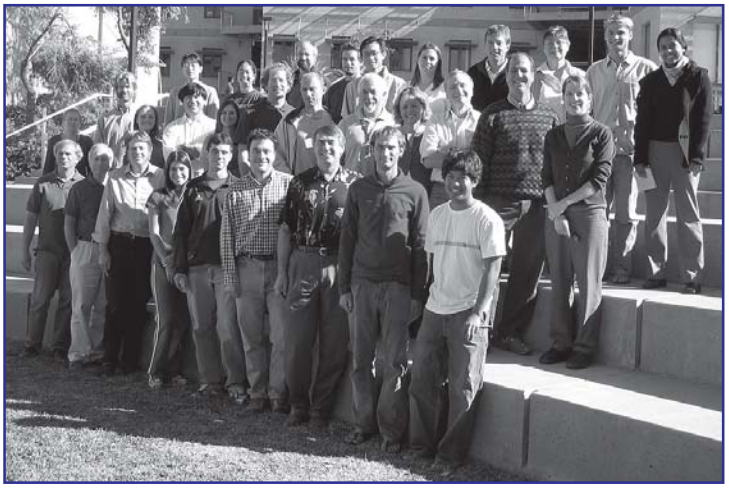


Photo: Karen Baker

Gathering for the annual meeting were more than 40 investigators, associates, and affiliates including fifteen graduate students and three post graduate researchers. Scientists attended from SIO, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Duke University, and Point Reyes Bird Observatory Conservation Science.

We also took the opportunity to launch our redesigned website (cce.lternet.edu) and to conduct a local site survey. The 10-question survey was designed to gather community input on the meeting itself, LTER community awareness, information management and social informatics, and education and outreach. We received 27 surveys (a 66 percent return rate). The findings were very interesting; for example, gauging awareness using familiarity with the three letter LTER site acronyms, knowledge of this LTER network practice was limited, although CCE participants were familiar with 14 LTER sites and identified existing collaboration with PAL and SBC. Responses to an unstructured request for keywords and phrases illustrating "what the LTER means to you and your work" could be grouped into topics including research themes, scientific practices, scientific mission, the research community, data, and projects. Frequently mentioned terms included ecosystem, time series, networking, and biogeochemistry.

All but one survey respondent were familiar with information management and more than half were familiar with some of our education activities. Responding to a question about interest in exploring new web applications and collaborative tools, eight participants said they were willing to work with information management on targeted topics. With an eye on growing the program organically based on participant interests, we asked respondents what type of educational resources they were interested in sharing. Responses ranged from photos, equipment, data, ideas, and stories to interfacing with two of our education outreach partners: The Ocean Institute (*www.ocean-institute.org*) and Aquatic Adventures (*www.aquaticadventures.org*). The CCE and the Ocean Institute, an outreach program located north of San Diego at Dana Point, have initiated a time-series measurement program focusing on phytoplankton variations in relation to ocean temperature.

The CCE annual meeting will continue to be an important forum for discussion and community building within and between CCE and its partners. One participant was glad just to have the "opportunity to interact with other researchers," while another was interested in "developing a community-based approach" to research. The predominant suggestion for the next meeting was to plan more time for exchange of information and ideas, particularly on the topics of joint interdisciplinary work and data acquisition and exchange.

Karen S. Baker and *Mark D. Ohman, CCE.*

Service at Salado

CAP LTER's Schoolyard program benefits students and teachers

Service at Salado is an exemplary LTER education program in which scientists and schoolchildren have joined forces to help re-establish an urban riparian area. School children participating in after-school clubs in the CAP LTER study area are gaining experience in ecology and civic involvement and coming to see themselves as agents of change in conserving and improving their local landscape.

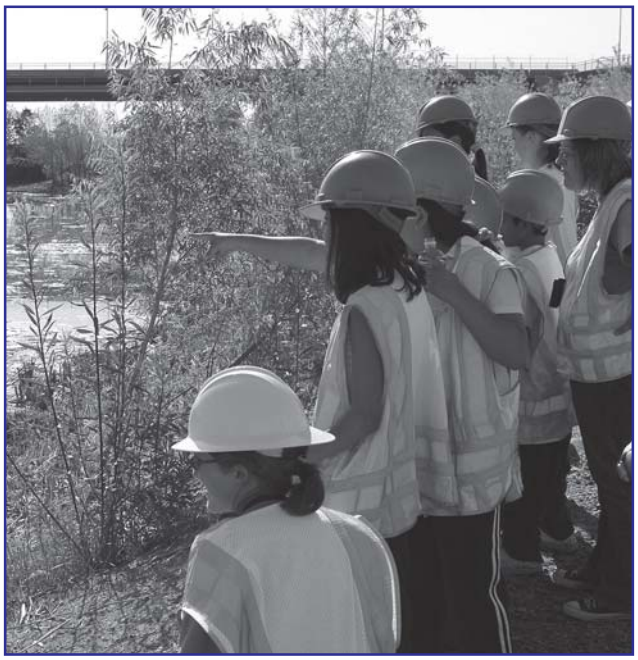


Photo: Timothy Trumble

Service at Salado students visit City of Phoenix Rio Salado Project.

Since 1998, the City of Phoenix, Arizona, and the US Army Corps of Engineers have been restoring the Salt River, a river bed that runs through the heart of rapidly urbanizing Phoenix. The "Rio Salado" Project is creating a preserve easily accessible to city-dwellers, with miles of walking trails, wetland ponds, and restored habitats. The City always envisioned Rio Salado Park as a place where citizens could learn about their local environment and help care for it.

"Helping the students realize [their place in the community] through discussions and taking trips within their community was empowering for me. I feel as if we made an imprint in their mind to have a positive outlook on where they live and how they can be a member. I believe that being able to give them an idea or a small sense of involvement they may take this with them into their future and create more positive contributions. I am able to take my experiences using them in the future when working with other communities."—Elizabeth Glowacki (Urban Planning, Junior, Fall 2005)

Service at Salado draws upon the resources of the Rio Salado Project and CAP LTER's home institution, Arizona State University (ASU), to link interdisciplinary concepts about the urban ecosystem with environmental stewardship. CAP LTER's *Ecology Explorers* Program (*www.caplter.asu.edu/explorers*) obtained funding from the Nina Mason Pulliam Charitable Trust, ASU's University-School Partnerships, and NSF LTER EdEn funds to establish after-school clubs at four elementary schools in South Phoenix. Participating schools are in areas surrounding the Rio Salado Project, characterized by large Hispanic populations and underperforming schools. CAP LTER graduate students and researchers participate as "guest speakers" to the clubs. Children investigate the natural world with their ASU mentors and develop permanent projects for Rio Salado Park. They learn to work as a team as they design, propose, and implement ideas that will become permanent fixtures of their local landscape. The caliber of their creations has been outstanding (*http://caplter.asu.edu/explorers/riosalado*). Student projects have included information sheets and posters for park kiosks, painted trash cans, stepping stones with animal footprints, bird houses, bat boxes, an informational spinning wheel, a rain gauge with a booklet explaining how animals depend upon rain, a calendar of local birds, and a digital video disc (DVD) cartoon about the invasive bullfrog.

Photo: Randy Bailey

Students admire exhibit created by Service at Salado after school club.

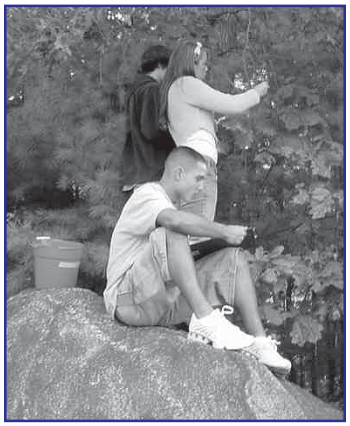
"This experience has brought me closer to real life and the reality of being a minority child in the inner city. I grew up in the same situation as many of these kids, but it seems like the older I get, the more I forget my past, and where I came from." —Teresa Yacoub (Biology, Sophomore, Fall 2005)

To date, nearly 350 middle-school students and 50 ASU undergraduates have participated in the program. The clubs proved to be so popular that in Fall 2005, one school was forced to institute a lottery system to select participants. *Service at Salado* has introduced science and technology as viable career options to a host of middle-school students and shown them the impact of community service. The value of *Service at Salado* is not limited to local schoolchildren and their communities; ASU undergraduates run the clubs and learn how to design an environmental-education program, develop inquiry-based lessons, mentor schoolchildren, and communicate science to a diverse audience.

Charlene Saltz, Environmental Education Coordinator, CAP.

Harvard Forest Schoolyard science project featured in Boston Globe

The Harvard Forest Schoolyard LTER program continues to grow and has recently made the news. One of the four research projects currently supported through our program (Buds, Leaves, and Global Warming) was featured in an article in *The Boston Globe* (*www.boston.com/news/local/articles/2005/11/10/reading_the_tree_leaves?mode=PF*). The article featured teacher Elaine Senechal and her high school students who are participating in the HF-SLTER program. Ms. Senechal was introduced to the Harvard Forest (HFR) field research program during a Climate Change teacher institute organized by Liz Duff, the Plum Island SLTER representative. Duff invited HFR's Pamela Snow to present the phenology protocol project related to Dr. John O'Keefe's research at HFR to high school teachers in Eastern Massachusetts. Ms. Senechal was so impressed by the project that she contacted the Boston Globe to write about it. Appearing on November 10, 2005, the article contained several color photos and was followed a week later by a cartoon about the project.



High school students studying plant phenology.

The HFR Schoolyard web page was recently updated by Data Manager, Emery Boose. The site now features project descriptions, research protocols, suggested reading, and actual data for each research project, which can be viewed at *http://harvardforest.fas.harvard.edu/ museum/schoolyard.html* by clicking on the project theme that interests you. In early 2006 two new partners, the Nashua River Watershed Association (*www.nashuariverwatershed.org/*) and the SCA Massachusetts Parks AmeriCorps (*www.volunteersolutions.org/mass-service/org/10679058.html*), joined our existing partnership that includes the Hitchcock Center for the Environment (*www.hitchcockcenter.org/*) and the Millers River Environmental Center (*www.millersriver.net/*). Current funding for the program is provided by the National Science Foundation's Schoolyard and EdEn Venture programs and the Massachusetts Environmental Trust (*www.massenvironmentaltrust.org*).

Pam Snow, HFR.

HFR Schoolyard teachers present at Environmental Education Conference

Two teachers from Harvard Forest's Schoolyard LTER program shared their experiences in schoolyard ecology with participants at the Massachusetts Environmental Education Society's annual conference in March 2006. As part of their presentation about "Community Investigations and Using the Environment in an Integrating Context," Mary Gagnon and Kate Bennett shared their experiences in implementing HFR field research protocols at the J.R. Briggs Elementary school in Ashburnham, MA. Ms. Gagnon discussed her participation in the *Freshwater Ecology: Vernal Pools* study, which is related to Dr. Betsy Colburn's research at HFR, while Ms. Bennett highlighted her experiences doing the *Hemlock Trees and the Pesky Pest: The Woolly Adelgid* study that is related to Dr. David Orwig's work.

Pam Snow, HFR.

Photo: Pam Snow

Teacher Kate Bennett shares her experiences of working with HFR Schoolyard LTER with other teachers.

BES teacher shares earthworm research with Maryland colleagues

Earthworms wriggled into popularity at the Maryland Association of Environmental and Outdoor Educators Annual Conference at Ocean City on February 4, 2006. Jenny Harvey, a Baltimore Ecosystem Study (BES) education fellow, and Janie Gordon, BES Education Coordinator, presented the earthworm population review unit to a crowd of over 50 outdoor educators, including teachers from several Maryland school systems. After a quick overview of the unit's learning goals and activities, participants had a chance to conduct an earthworm sampling procedure on the lawn of the Princess Royale Hotel.

Although no earthworms emerged from the sandy soil on that cold and windy winter day, the hands-on experience prepared the educators to guide their students through the protocol that comprises the data collection phase of scientific inquiry. Each participant was provided a CD-Rom review copy of the unit, which comes in two versions—for middle school and high school. In both versions, students formulate and test hypotheses about earthworm distribution in diverse habitats and draw conclusions based on their data, and on earthworm data compiled by the Baltimore Ecosystem Study.

The review unit is part of a larger Urban Soil module and was developed by Harvey with contributions from LTER ecologists Katalin Szlavecz, Richard Pouyat, and Ian Yesilonis. Review copies of the unit are available on CD-Rom by contacting Janie Gordon at *janie.gordon@parkandpeople.org*.

Jenny Harvey, BES Education Fellow and science teacher
Hereford High, Baltimore, MD.

NSF hosts 6th LTER mini-symposium

Each spring a community of LTER scientists and educators gathers in Washington to share with federal agency peers and policy makers the status and future of long-term ecological research through a mini-symposium of exciting presentations about research and synthesis activities.

Photo: Michelle Kelleher

FCE researcher Tiffany Troxler-Gann presenting at the 6th annual LTER Mini-Symposium at NSF, Washington, DC.

The 6th Annual LTER Mini-Symposium was held at the National Science Foundation (NSF) in Arlington, VA, on March 9, 2006. In only its sixth year, the LTER Mini-Symposium in DC has come to serve as an important forum for awareness, discussion, and partnership forging among LTER scientists and educators and interested peers and policy makers. This year's focal topic, "Building on the Legacy of LTER Research: Ecology for the Future" attracted close to 100 people.

As in previous years, attendees came from all over the nation's capital and beyond, including the American Institute of Biological Sciences (AIBS), Ecological Society of America (ESA), National Ecological Observatory Network (NEON), various non-governmental organizations, and several academic institutions. Federal representatives came from the National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), Department of Agriculture (USDA), including the USDA Agricultural Research Service (ARS) and USDA Cooperative State Research, Education, and Extension Service (CSREES), U.S. Geological Survey, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Global Change Research Program (USGCRP), as well as program officers, senior management, and staff from across the NSF. A number of LTER Principal Investigators, scientists, and educators also showed up to support the symposium.

This year's featured speakers were: Alan Knapp (Colorado State University/KNZ), who gave a presentation on "Global change and change in paradigm"; John Briggs (Arizona State University/KNZ/CAP) on "Combining archeology and ecology in the Sonoran desert and desert grasslands"; Scott Pearson (Mars Hill College/CWT) on "Land use history and patterns of biodiversity in Southern Appalachian forests"; Michelle Mack (University of Florida/BNZ) on "Global change and arctic systems"; Deb Peters (USDA-ARS/JRN) on "Human impacts and land cover change in drylands"; Tiffany Troxler-Gann (Florida International University/FCE) on "Ecosystem responses to hydrologic change in Everglades tree islands: Findings and future directions"; and Scott Collins (University of New Mexico/SEV, on "LTER vision for the future: Synthesis across time, over space and among disciplines."

Photo: Michelle Kelleher

Participants listen attentively to presentations during the 6th annual LTER Mini-Symposium.

The purpose of the annual mini-symposia is to showcase to federal agency officials and policy makers in Washington the relevance and broader impacts of the scientific research undertaken by the LTER network. Each year the LTER coordinating committee solicits nominations for topics and speakers with the following year's topic announced each fall.

To add yourself or someone else to the invitation announcement list, please send name, organization, and email address to Henry Gholz at *hgholz@nsf.gov*.

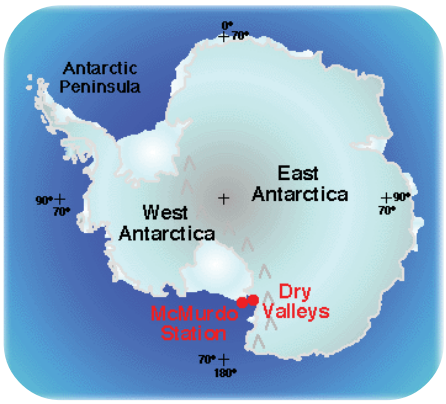
Michelle Kelleher, BIO/DEB
Science Assistant, NSF.

Lost Seal
McMurdo D

New LTER book captures childr

A true story about an encounter between I Dry Valleys of Antarctica has inspired a Diane McKnight, a scientist at the McMu of the Institute of Arctic and Alpine Research (framework for showing how different Antarcti ments with which children are familiar. It is the tion (NSF)-supported LTER children's book seri *tains* by Tiffany Fourment, was featured in The

In 1990, McKnight, who is also a professor of environmental engineering at the University of Colorado, and other limnologists (scientists who study the ecology of inland lakes and other bodies of water) were installing a network of stream gauges in Taylor Valley, Antarctica, when they came across a young seal. Although exhausted, the seal eventually made his way to the scientists' camp, but it was clearly miles away from his natural habitat on the sea ice of McMurdo Sound. McKnight tells the story of the seal in the context of the harsh Dry Valleys environment and the LTER scientific work taking place there.

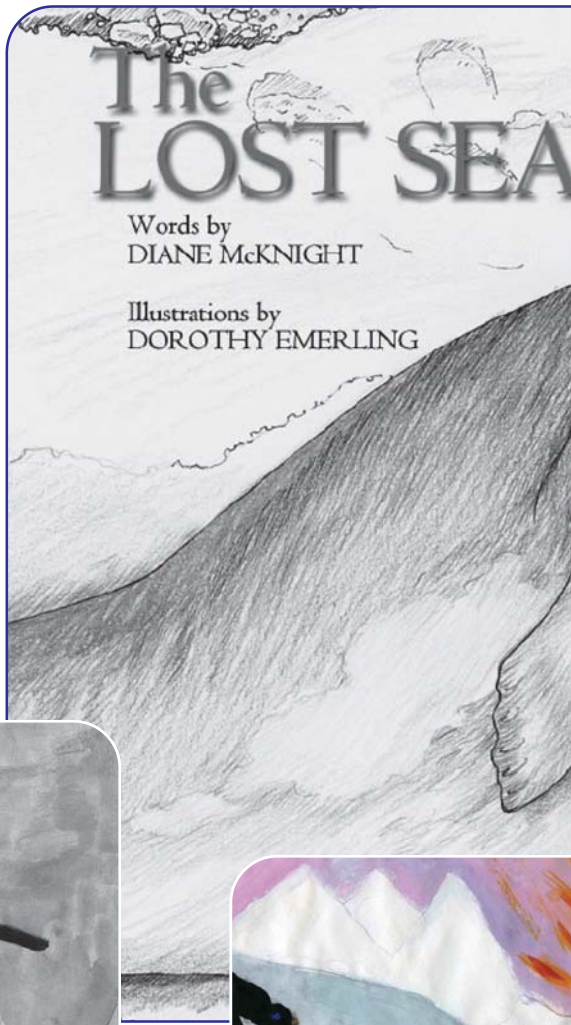


Overview map of Antarctica.

Photo: Karen Cozzetto

Drilling Cryoconite holes on a glacier in Taylor Valley.

Dorothy Emerling, a well-known illustrator who worked on *My Water Comes from the Mountains*, also illustrated *The Lost Seal* with vivid scenes of the Antarctic landscape, the animals found there, and LTER scientists at work. But Emerling's aren't the only pictures in the book: she had plenty of help from children and their teachers from four different countries and continents. The story of the seal, videos taken at the time of the event, and photos of the Dry Valleys region were sent to forty elementary school classrooms across Australia, New Zealand, the United Kingdom, and the United States, reflecting the involvement of explorers and scientists from these countries in research in the Dry Valleys. The students created original artwork, some of which is included in *The Lost Seal*. All the artwork from participating children—more than 400 pieces—can be seen, along with the children's own description of their work, on *The Lost Seal* website (*www.mcmlter.org/lostseal*). The site also relates illustrations from the book to real-life events and places in the Dry Valleys through maps; links; and video clips and photos of the seal, camp, and a visiting penguin.



"The helicopter is taking the lost seal away." (*Original artwork by Matthew, Leongatha Primary School, Leongatha, Victoria, Australia*).

‘found’ in Dry Valleys

ren’s fascination with Antarctica

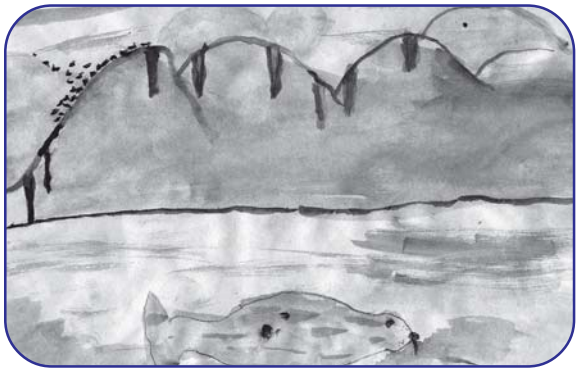
LTER scientists and a young Weddell seal in the new children’s book, *The Lost Seal.* Written by urdo Dry Valleys (MCM) LTER site and a fellow INSTAAR), *The Lost Seal* provides an engaging ica and the Dry Valleys are from the environ- e second book in the National Science Founda- es (the first, *My Water Comes from the Moun-* Network Newsletter Vol. 17 No. 2 Fall 2004).

“Pinguin in snow.” (*Original artwork by Lizzi, Granby Elementary, Worthington, OH, USA*).

The Lost Seal story was written originally only as a handout to use in classroom presentations. It took McKnight two years to rewrite, edit, illustrate, and publish it into a book. The book is currently in press and will be available in June 2006. Funding from the NSF supported the outreach activities involving the elementary school students, production of the book, and development of the website through the MCM’s Schoolyard LTER Program.

The Lost Seal is consistent with the science standards for 2nd to 5th grade students, for whom it was written. Its strengths include its focus on the total environment of the Dry Valleys and its thoughtful portrayal of the daily lives of scientists. McKnight observes, “Creating the book has been an exciting team effort, and we have all been inspired by the responses from the children.”

Classroom sets of *The Lost Seal* will be distributed to all participating schools. Moonlight Publishing, LLC (*www.moonlight-publishing.com*) is currently accepting preorders of the book which, together with *My Water Comes from the Mountains*, may also be ordered through Amazon and Barnes and Noble. The Georgia Coastal Ecosystem (GCE) and Hubbard Brook (HBR) LTER sites are also planning books for the series.



“A seal it is lying on the snow trying to find his way home. He had been there for a while and he is going to die without food.” (*Original artwork by Laurea, Arbury Primary School, Cambridge, England*).

A workshop to discuss the children’s book series will be held during the LTER All Scientists Meeting scheduled for Estes Park, CO, from September 20-23, 2006. For more information about the book series, please contact Diane McKnight (*Diane.Mcknight@colorado.edu*).

By Shelly Sommer, INSTAAR University of Colorado at Boulder.

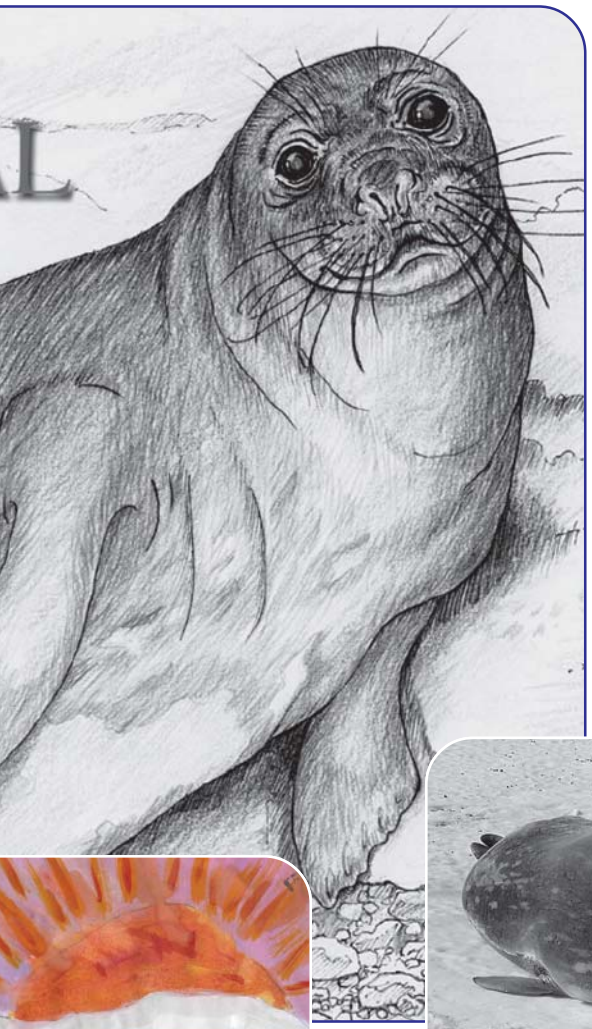


Photo: Karen Cozzetto

Top: *Lost Seal* cover. **Above**: Mother and baby Weddell Seals lay on the frozen ice of McMurdo Sound. **Left**: “Adelie penguins sliding on the ice under the setting sun.” (*Original artwork by Meg, Tarras School, Central Otago, New Zealand*).

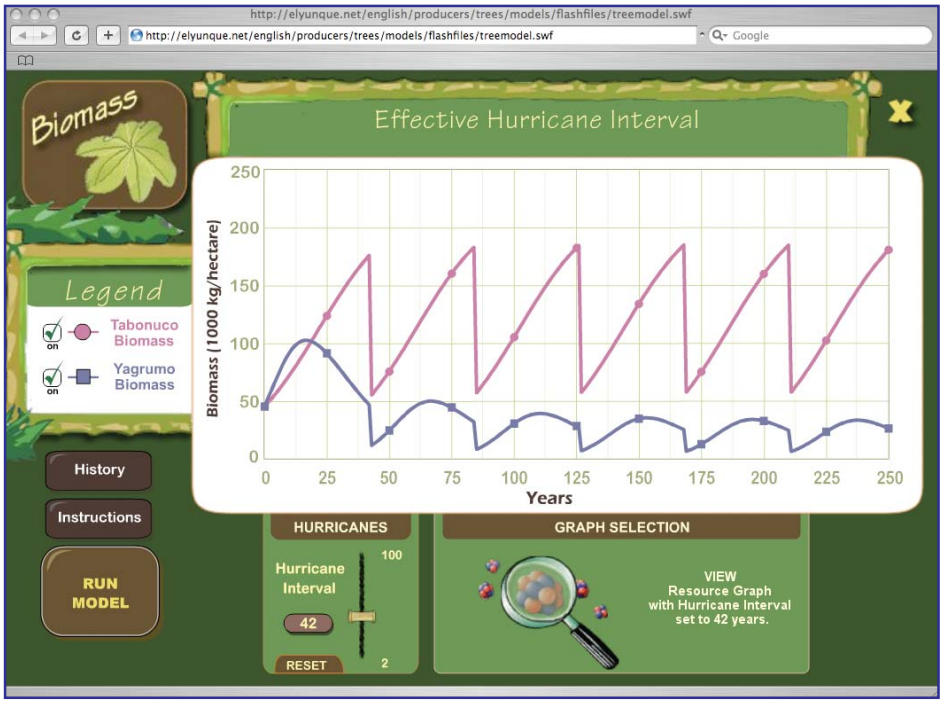
Luquillo's Journey to El Yunque curriculum gets excellent rating

The *Journey to El Yunque* middle school ecology curriculum isn't just another sugarcoated science project that's long on fun and short on real learning. According to Dr. Steven McGee, Principal Investigator of *Journey to El Yunque* and president of The Learning Partnership, a rigorous, standards-based evaluation of the curriculum has confirmed that students using the *Journey to El Yunque* curriculum gained greater understanding of population dynamics than a comparison group using a traditional ecology curriculum.

McGee believes that real world problem solving and open-ended inquiry are what make the *Journey to El Yunque* curriculum so powerful, although further evaluation and research is needed to prove this conclusively. McGee, together with Dr. Nick Brokaw, director of the Luquillo LTER at the University of Puerto Rico, and Dr. Steven Croft, senior science education specialist at the National Optical Astronomy Observatory, recently received supplemental funding from the National Science Foundation (NSF) to conduct the next phase of the *Journey to El Yunque* evaluation. In addition, The Learning Partnership recently applied for $1.5 million of new NSF funding to use *Journey to El Yunque* as the blueprint for developing new models of assessment and new approaches for supporting the implementation of inquiry-based curricula.

The success of *Journey to El Yunque* does not surprise McGee, considering that the curriculum is the result of a four-year, ongoing collaboration between two competitively funded NSF research programs. In *Journey to El Yunque*, McGee has combined The Learning Partnership's cutting edge educational research, funded through an NSF Instructional Materials Development grant, with the advanced ecological research of the Luquillo LTER. The Learning Partnership infuses *Journey to El Yunque* with expertly designed curriculum, easy-to-use educational technology that supports student learning, and rigorous standards-based evaluation. Working hand-in-hand with The Learning Partnership, ecologists at Luquillo in the rainforests of Puerto Rico provide the meaningful research questions and rich datasets that are essential to the success of the curriculum.

Along with *Journey to El Yunque*, The Learning Partnership is playing a key role in the evaluations of the "Project-Based Inquiry Science for Middle School," a $3 million NSF-funded curriculum venture and "Inquiring with GIS," a $1 million NSF-funded information technology experiences venture. The Learning Partnership also focuses on enhancing the learning process by providing teachers of grades 5-12 with a comprehensive suite of classroom assessment tools delivered via the Internet.



Above: Students use interactive models to explore the population dynamics of species in El Yunque. **Right**: "Walkingstick Weekly"—Background reading materials are designed to both enlighten and entertain.

For more information about *Journey to El Yunque* please visit *http://elyunque.net/journey.html*. To learn more about The Learning Partnership, contact Dr. McGee at *mcgee@lponline.net*.

Anna Tarnoff, LUQ.

SGS Schoolyard LTER student partners win awards at science fair

Two students from the Rough Rock Community School of Rough Rock, Arizona, recently won outstanding prizes and recognition at the National American Indian Science and Engineering Fair (NAISEF), held in Albuquerque, NM, on March 23-25, 2006, for work based on projects with the Shortgrass Steppe (SGS) LTER/University of Northern Colorado (UNC) EdEn partnership. The project is co-led by SGS's John Moore and UNC's Lori Reinsvold and Rob Wang, who have been very involved in the hands-on activities with the students.

The Fair also recognized five other students or teams from the school for excellence in their area of science and engineering. Teachers at Rough Rock attributed the success of these five partly to the excitement about scientific research generated by the SGS LTER/UNC EdEn partnership.

Will Rosenberg and *Helena Al-Kubaisi, Teachers, Rough Rock Community School.*

Of the following NAISEF results, the first two student projects were a direct result of Rough Rock's partnership with UNC and the SGS LTER.

Natasha Gail

Project Title: Conditions that Affect the Resolution of the Global Positioning System

Grand Prize: American Science and Engineering Society (AISES) - Automatic funding from AISES to attend the Intel International Science and Engineering Fair in Indianapolis, Indiana, May 17-13.

First Place: Earth and Space Science

Special Awards for Geoscience Excellence (Association for Women Geoscientists); Most Outstanding Exhibit in Materials Science (The ASM Materials Education Foundation); 3rd Place-The NASA Space Exploration Special Award (NASA Glenn Research Center); Ability and Creativity in an Atmospheric Science Exhibit (American Meteorological Society Computer & Computational Sciences Divisions); Scholarship Award of $5,000 (Los Alamos National Laboratory); Naval Science Award of $75.00 (The Office of Naval Research); Outstanding Science Project Award (The United States Army); and Outstanding Science & Engineering Award of jump drive, portfolio, and scientific calculator (United States Air Force).

Alissa Riggs

Project Title: Water Quality on the Navajo Nation

Second Place: Environmental Science

Special Awards: Water Prize Award (United States Environmental Protection Agency); Water Prize Award (Water Environment Federation); and nomination for the US Stockholm Junior Water Prize Competition.

Alissa was promised that if she does well at the Stockholm Junior Water Prize Competition, she will advance to the Intel International Science and Engineering Fair.

The following results are only indirectly related to the partnership with SGS LTER/UNC, in particular to the energy and enthusiasm developed for scientific research in the above projects.

LaDonna Sam

Project Title: The Lung Capacity of Rough Rock High School Students

1st place: Medicine and Health

Special Awards: Senior Math Competition Award of $75.00 (American Indian Science and Engineering Society)

Norvell Tsosie

Project Title: The Beliefs of Rough Rock High School Students Regarding Marijuana

3rd Place: Behavioral and Social Sciences

Garrison Yellowman and **Dan Yazzie**, Team Project

Project Title: Rat-Trap Powered Vehicle & Motor Powered Vehicle: A Comparison Study

2nd Place: Engineering

Raviana Nez, **Vircina Nez** and **Misha Yazzie**, Team Project

Project Title: Traditional Corn vs. Commercial Corn

3rd Place: Botany

Natasha Thomas and **Johanna Tsosie**, Team Project

Project Title: Watermelon and Squash Grown Hydroponically

3rd Place: Botany

We believe that the successes of our students at NAISEF are a testimony to the positive effect that the SGS LTER/UNC partnership with Rough Rock Community School has had on our students. On behalf of the students of Rough Rock Community School, we thank SGS LTER and UNC for the support and opportunities that they provided to our students as a result of this partnership.

Remote sensing data for LTER sites

The LTER Network Office (LNO) is coordinating access by LTER sites to historical and recent satellite reconnaissance data, as well as MODIS time series subsets and imagery from the International Space Station. This effort is to provide access for LTER sites to data that are acquired and archived by collaborating partners, including the National Aeronautics and Space Administration (NASA) and the United States Geological Survey (USGS). Information on these and other LTER Network remote sensing data is available on the LTER remote sensing and GIS information page at *www.lternet.edu/technology/ltergis/*.

GFL Reconnaissance imagery of LTER Sites

The Global Fiducial Program and its "library," the Global Fiducial Library (GFL), resulted from a National Research Council (NRC) panel recommendation for the collection of data from a global network of fiducial sites as a tool to address global issues such as sea-level change, tectonic plate movements, and other global change issues. The full recommendations are summarized in the NRC committee's report, "International Network of Global Fiducial Stations: Science and Implementation Issues," published in 1991. With the approval of the LTER Coordinating Committee in 1996, the LNO has worked with the USGS to register all LTER sites as GFL targets and to enable operational collection of GFL data from current reconnaissance satellites. In 2002, the government declassified raw imagery from older intelligence satellites and transferred the rolls of film to the National Archives and the USGS EROS Data Center. The data provided high-resolution imagery from 1959 to 1980, in some cases greater than 1 meter. Although the historic data are publicly available, the operational acquisition of data from currently classified systems will capture this record for retrospective analyses as

See "Informatics," p.15

An image from the International Space Station of the upper Great Lakes region including the North Temperate Lakes (NTL), Cedar Creek Natural History Area (CDR), and Kellogg Biological Station (KBS) LTER sites (image courtesy of the Science and Analysis Laboratory, NASA-Johnson Space Center, *http://eol.jsc.nasa.gov/*).

Informatics (continued from p.14)

part of the GFL archive. Access to these current data requires proper security clearance, although the data will eventually be declassified for public use. Further background information and examples of declassified data acquired for some LTER sites is available at *www.lternet.edu/technology/gfl/*.

Data from the MODIS sensor of the Terra and Aqua satellites

Time series subsets of MODIS data provide summaries of selected MODIS land products to validate models and remote sensing products, and to characterize LTER field sites. These data include leaf area index and fraction of photosynthetically absorbed radiation (LAI/fPAR), land cover, normalized difference vegetation index and enhanced vegetation index (NDVI/EVI), gross primary productivity (GPP), net primary productivity (NPP), surface reflectance, and land surface temperature. The data are available as part of an ongoing collaboration between LTER and the National Aeronautics and Space Administration's (NASA) Distributed Active Archive Center (DAAC) at the Oak Ridge National Laboratory. The MODIS data subsets were initially extracted from the MODIS data archive for LTER sites that have active NASA validation research projects. Information for these time series products was recently updated to include data from at least one 7 km x 7 km area at all LTER sites. These MODIS subsets will be available as the data are reprocessed during 2006. Specific site locations can be viewed most easily using the DAAC map services viewer: *webmap.ornl.gov/mascol5/viewer.htm*.

The DAAC has also developed a subsetting and visualization tool that can generate MODIS subsets for any North American location. Subset data can be extracted from areas of 1 km x 1 km to 201 km x 201 km, and for a user-selected time period of the complete MODIS record. These data can be accessed directly at *www.modis.ornl.gov/modis/NorthAmerica_Tool/*. For more information on the MODIS subset data visit *www.lternet.edu/technology/nasa/modis/*.

Global Fiducial Library image of the Virginia portion of the Delmarva Peninsula.

International Space Station Imagery for LTER Sites

The LNO and NASA's Johnson Space Center (JSFC) are working on the potential use of International Space Station (ISS) photography for LTER Sites. The ISS imagery is a uniquely useful dataset for the LTER Network as it varies greatly in spatial scale and temporal frequency (i.e., geographical scope and how often the data are collected). Used with traditional remotely-sensed data, ISS imagery can increase the temporal resolution of observed variables such as land cover, land use change, vegetation dynamics, and surface soil processes. The data can also capture extreme events such as fires and hurricanes to supplement data from other sources. A search of the ISS archive revealed hundreds of images of some LTER sites captured during past missions. William Stefanov, a JSFC scientist who formerly worked at the Central Arizona-Phoenix LTER site was instrumental in getting JSFC to add LTER sites as specific targets for ISS missions. With Stefanov's help, LTER submitted to JSFC a science plan requesting acquisition of nadir digital imagery with less than 10 percent cloud cover to capture spring, summer, fall, and winter seasonal changes in vegetation. The science plan has been followed by ISS missions since the ISS 011 crew. Since image resolution depends on the lens used, the plan specifies both wide angle lenses for general site mapping and telephoto lenses to capture details such as tree-shrub-grassland transitional areas. Arctic and Antarctic LTER sites are not included in these data due to the ISS's orbital characteristics, but data are available for most other LTER sites. More information on this collaboration can be found at *www.lternet.edu/technology/nasa/iss/*. The ISS imagery is freely available online at *http://eol.jsc.nasa.gov/*.

John Vande Castle, Associate Director for Technology, LNO.

For more information, read *DataBits*, the Information Managers' newsletter, online at *www.lternet.edu*.

KBS helps kick-off new agricultural LTER site in Taiwan

Phase III of the International Workshop on Long Term Ecological Research in Agricultural Ecosystems took place in Taiwan from March 8-11, 2006. The event was organized by the Kellogg Biological Station (KBS) LTER and the Taiwan Ecological Research Network (TERN) and made possible through the support and cooperation of the US National Science Foundation (NSF), National Science Council (NSC) of Taiwan, the Taiwan Agricultural Research Institute (TARI), the Tainan District Agricultural Research and Extension Station (DARES), the Taiwan Forestry Research Institute (TFRI), National Taiwan University, and National Chung Hsing University.

International workshop participants at the Taiwan Agricultural Research Institute.

The workshop's objective was to introduce KBS scientists to the proposed sites and to consult with TERN investigators on the best ways to launch a new agricultural LTER site funded by the Taiwan Council of Agriculture (COA). The KBS advisory team of Phil Robertson, Stuart Gage, Dick Harwood, and Andrew Corbin was very impressed with the expertise and credentials of the scientists assembled to develop and run the agricultural LTER project. They agreed that the good mix of disciplines, high enthusiasm, and experienced and younger scientists in sync with an impressive array of field resources, could only contribute to the success of the project.

A one-day symposium involving KBS and TERN scientists was followed by visits to three proposed field sites in central Taiwan: a long-term high versus low-input Litchi (Lychee) orchard experiment at the Chia-Yi Research Station; and upland versus lowland rice paddy experiments at the Chi-Ko Branch Farm and the Yuin-Lin Experiment Station. The scientists then regrouped at Yuin-Lin for an in-depth discussion of the experimental design. Observing that the current design for the rice systems required more area than was available, unless the plot sizes became very small, the KBS researchers recommended an alternative experimental design consisting of high-input conventional (HIC) and low-input ecologically driven (ED) treatments. The HIC treatment would be based on standard agricultural practices, but the ED treatment could be a combination of both reduced tillage and reduced chemical subsidies. Chiu-Chung Young, Executive Director of the National Chung Hsing University Advisory Committee agreed that this could be a realistic approach. "Any observations made on the crop, soil, pest management, and soil amendments in these plots can be easily interpreted and transferred to the farmer through extension programs," he said, noting that "new experimental designs and plots based on the present realistic farming conditions could simplify basic data collections from each plot."

Photo: Zueng-Sang Chen

Chi-Ling Chen (left), Horng-Yuh Guo, and Jer-Way Chang introduce KBS researchers Robertson, Gage, and Corbin to the zero-input Litchi orchard experiment at the Chia-Yi Research Station.

Commenting on the next steps to move this project forward, Dick Harwood noted that a collaborative effort by a potential

See "ILTER," p. 17

ILTER (continued from p.16)

core scientist group will be needed to design the field crop portion of the research at the two stations. He said, "A balance must be made between broadness of applicability (as in number of crops and rotations), and in selection of management types to represent high inputs versus an integrated, ecologically-based approach which looks to the future trends in reduced soil disturbance and enhancement of ecosystem services, both to the crops themselves and to the surrounding environment."

♦ Develop an ecological approach to the study of population dynamics. Monitor predators, parasitoids, and plant pest species to help determine whether pests are under natural regulation, as they are likely to be under reduced inputs.

♦ Consider engaging the Taiwan sensor industry as a partner to test and deploy new types of sensor instrumentation to monitor important ecosystem driving variables in diverse landscapes.

Photo: Andrew Corbin

Shan-Ney Huang discussing rice cropping experimental design with Dick Harwood at the Yuin-Lin Experiment Station.

Additional recommendations for the TERN group to consider were offered by the KBS team, most importantly:

♦ Incorporate agronomic experiments during the first few years of the study to show the best way to carry out low-input farming (e.g. ED).

♦ Develop a conceptual model, including a diagram of the system, to capture all important processes grouped under the major topic areas: nutrient availability, plant competition, consumers/pathogens, and modeling.

♦ Involve social scientists, particularly agricultural and resource economists, in the project.

The KBS team and a core group of TERN scientists and administrators later met Jen-Chyuan Lee, the Deputy Minister of the Taiwan Council of Agriculture, in Taipei and briefed him on the progress of the new LTER project. Acknowledging the importance of the effort, Minister Lee assured the participants of COA's continued cooperation and support.

For information on the first two phases of this project, see *The Network Newsletter Vol. 18 No. 1 Spring 2005*, and *Vol. 16 No. 1 Spring 2003*.

The author wishes to thank Chi-Ling Chen and Chau-Chin Lin for coordinating this effort and their incredible hospitality.

Andrew Corbin, KBS.

News Brief

BES research helps city of Baltimore to set 'green' goals

The City of Baltimore has announced plans to increase tree canopy cover from the current 20 percent to about 40 percent. Research from the Baltimore Ecosystem Study (BES) LTER contributed to the Maryland Department of Natural Resources' (DNR's) new policy for forestry and water quality issues in urban areas. Based upon that change, Maryland DNR encouraged cities in the Chesapeake Bay watershed to adopt an urban tree canopy goal. At this juncture, BES has helped the city and state to assess the existing land available for urban tree canopy using high-resolution data from state, city, and BES sources. Through this process BES assisted in formulating the goal that was announced in March 2006. BES anticipates involvement in writing the plan that will be implemented, including data, data analysis, application of research findings, formulation of protocols for monitoring and evaluation and, over the next 30 years, also monitoring and evaluating the social and ecological benefits and costs associated with the plan. Baltimore County is beginning this process in summer 2006 and BES expects to collaborate with them as well. We believe this is an example of the benefits of a long term experiment on a large scale, interdisciplinary research, links to policy and management and, ultimately, benefits to society. You can read more about this story in the Baltimore Sun at: *http://www.baltimoresun.com/news/local/balmd.canopy30mar30,0,6530633.story?coll=bal-local-headlines*.

Morgan Grove, BES.

Global change effects on grass-shrub interactions in an arid ecosystem

The Sevilleta LTER recently started a multi-factor global change experiment in its desert grassland. The experiment simulates an environment 50-100 years in New Mexico's future, with increased nighttime temperatures, winter precipitation, and nitrogen (N) deposition. The experiment will address (1) whether plant traits can predict shifts in community composition, (2) whether these global changes will increase the establishment of creosote into these grassland communities, and (3) whether global changes will interact in their effects on ecosystems and plant communities.

Most people know that the earth is getting warmer; many do not know that nighttime warming is occurring twice as fast as daytime warming. We apply a novel nighttime warming treatment (based on the European CLIMOOR experiment) using a large piece of aluminum fabric, similar to a 'space blanket', that unrolls over the vegetation at night. This fabric reflects long-wave radiation, which would otherwise be lost to the atmosphere, back onto the plants, increasing temperatures by over 1°C.

The last several decades have seen an increase in the frequency and magnitude of El Niño events, and the majority of global climate models predict this trend to continue. El Niños have a predictable climatic signature, increasing winter precipitation at the Sevilleta, on average, by 50 percent. Our precipitation treatment is designed to mimic the effects of El Niño in both its seasonal timing and size of its rainfall events.

As cold air drains down the Rio Grande Valley, the Sevilleta receives air-borne nitrogen pollutants from feedlots and the city of Albuquerque. Although these nitrogen inputs are small, they may have a significant effect on plant communities since Sevilleta soils have extremely low levels of nitrogen to begin with.

To determine whether species traits can predict responses to global change, we will measure traits associated with water use, nitrogen use, and phenology. We will test the hypotheses that species with higher tissue N are favored by N deposition, that drought tolerant species are favored by warming, and that species with phenology utilizing the spring growing season are favored by winter precipitation and by a longer spring growing season associated with increased nighttime temperatures.

Creosote has encroached upon about 17 million hectares of grassland in the southwestern United States in the last century. The SEV study site is dominated by black grama and blue grama, two widespread species that are economically important as cattle forage. The invasion of creosote into grasslands is associated with a decrease in forage value and increases in carbon sequestration and nitrogen leaching, which have implications for ranching, climate change feedbacks, and water quality. To determine the effects of global change on creosote establishment, we will add and monitor seed and seedlings of creosote on each plot.

This study uses a novel nighttime warming technique in an arid system to test for interactions among multiple changes in their effect on species at their range margins, where species are thought to be more susceptible to climate change. The study also provides opportunities for cross-site collaboration, with other warming experiments scheduled to start later in 2006 at the Shortgrass Steppe and Cedar Creek LTER sites.

Joe Fargione, Scott Collins, Will Pockman, Jim Elliott, and *Chelsea Crenshaw, SEV.*

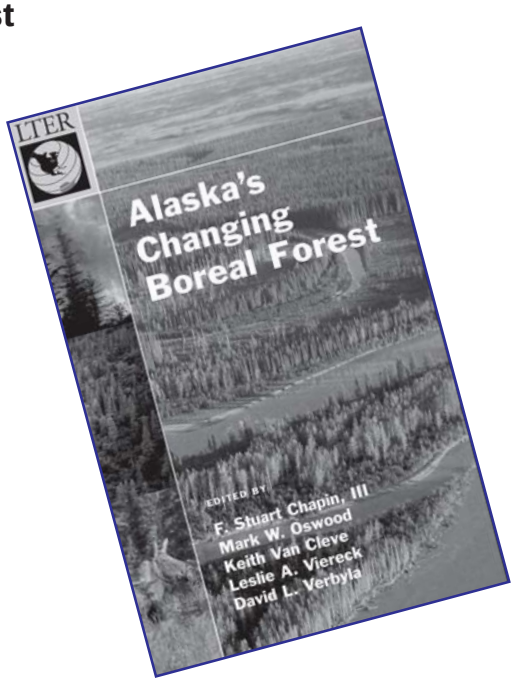
Publications

Bonanza's OUP/LTER synthesis volume out

Alaska's Changing Boreal Forest

By Chapin, F.S., III, M.W. Oswood, K. Van Cleve, L.A. Viereck, and D.L. Verbyla (editors). 2006. Oxford University Press, New York.

The boreal forest is the northernmost forested biome, whose organisms and dynamics have been shaped by cold high-latitude conditions. The Alaskan boreal forest is now warming as rapidly as any place on earth, providing an unprecedented opportunity to examine a biome as it adjusts to change. This book, based on Bonanza Creek LTER research, describes the processes that have shaped the development and current dynamics of Alaska's boreal forest. This forest developed over the last 13,000 years in response to a gradually cooling, moistening climate, punctuated 6,000 years ago by an increase in wildfires when flammable black spruce ecosystems became widespread.



Permafrost (permanently frozen soil) is patchily distributed in the boreal forest. Where present, it impedes drainage, producing cold wet soils that constrain biogeochemical cycles and productivity. Landscape patterns of biogeochemistry are therefore strongly controlled by cycles of disturbance (flooding in lowlands and fire in uplands), with pulses of nitrogen input and loss in early succession shifting to tight plant-microbial recycling in later stages. Successional changes in abundance of a few key functional types (nitrogen-fixing alder, moose, and snowshoe hares in early succession; mycorrhizal fungi, mosses, spruce, and beetles in late succession) generate threshold changes in structure and function through succession.

Recent warming has increased drought stress in trees, frequency of wildfire and insect outbreaks, sporadic loss of permafrost, loss of nitrogen from nitrogen-limited watersheds, and changes in feedbacks to regional and global climate. Many of these changes have substantial societal importance, both regionally and globally, suggesting that continuing efforts to develop a predictive understanding of ecological resilience and change are critical.

New England Forests Through Time now in paperback

By David R. Foster, John F. O'Keefe

Over the past three hundred years New England's landscape has been transformed. The forests were cleared; the land was farmed intensively through the mid-nineteenth century and then was allowed to reforest naturally as agriculture shifted west. Today, in many ways the region is more natural than at any time since the American Revolution. This fascinating natural history is essential background for anyone interested in New England's ecology, wildlife, or landscape. In *New England Forests through Time* these historical and environmental lessons are told through the world-renowned dioramas in Harvard's Fisher Museum. These remarkable models have introduced New England's landscape to countless visitors and have appeared in many ecology, forestry, and natural history texts. This first book based on the dioramas conveys the phenomenal history of the land, the beauty of the models, and new insights into nature.

Selene Báez, Scott L. Collins, David Lightfoot and Terri L. Koontz. In Press. **Bottom-up regulation of plant community structure in an aridland ecosystem.** *Ecology*.

TEK (continued from p.3)

Steve Carpenter. "TEK is a terrific opportunity for interdisciplinary research. The principal barrier is lack of funding for research that integrates TEK with scientific ecological knowledge."

Are there parallel lines that can be drawn between traditional knowledge and modern ecological science? "A 'long view' is built into many native cultural practices," Carpenter observes, "It is good to have a balance, so it seems to me that we ought to be looking for cross-calibration of traditional knowledge and technological knowledge."

Roosevelt Paneak's dictionary and map project are available at the Toolik Field Station web site (*www.uaf.edu/toolik/*). A Simon Paneak Museum in Anaktuvuk Pass has more information on Simon and his links to research in northern Alaska in the 1940s-1970s (*www.north-slope.org/nsb/55.htm*).

Patty Bonito, Special Projects, LNO.

Calendar

Coming Events of Interest to the LTER Community

MAY 2006

May 1-6: The Science Environment for Ecological Knowledge (SEEK) All Hands Meeting, University of New Mexico, Student Union Building, Albuquerque, NM. For more information contact Deana Pennington (*dpennington@lternet.edu*).

May 15-16: The Network Information System Advisory Committee (NISAC) meeting, Room 505, Ecology Building, University of Minnesota, St. Paul, MN. For more information contact Pamela Griego-Madrid (*pgriego@lternet.edu*) or Jeff Corney (*jcorney@umn.edu*).

May 16: LTER Executive Committee Meeting, Family Seminar Room, The Weisman Museum, Minneapolis, MN. For more information contact Pamela Griego-Madrid (*pgriego@lternet.edu*) or Jeff Corney (*jcorney@umn.edu*).

May 17-18: LTER Coordinating Committee Meeting, Family Seminar Room, The Weisman Museum, Minneapolis, MN. For more information contact Pamela Griego-Madrid (*pgriego@lternet.edu*) or Jeff Corney (*jcorney@umn.edu*).

JUNE 2006

June 6-8: SEEK Site Review, LTER Network Office, University of New Mexico, Albuquerque, NM. For more information contact Deana Pennington (*dpennington@lternet.edu*).

June 20-23: LTER Planning Grant Committee on Education, Outreach and Training (EOT) meeting, Madison, WI. For more information contact Caleb Hickman (*caleb@sevilleta.unm.edu*).

AUGUST 2006

August 6-11: 91st Annual Meeting of the Ecological Society of America (ESA), Memphis, TN.

SEPTEMBER 2006

September 20-23: 6th LTER All Scientists Meeting (ASM), YMCA of the Rockies, Estes Park, CO. **Theme**: "The next 25 years of LTER: Contributions to understanding ecological change." For more information, visit the LTER website at *http://www.lternet.edu/asm/2006/* or contact Pamela Griego-Madrid (*pgriego@lternet.edu*).

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