The Network Newsletter

Message from the Director

Robert Waide

I am pleased to announce that Dr. Sonia Ortega has joined the Network Office for a temporary assignment. During her sojourn here, Sonia will focus on strengthening the connections between LTER research and education programs, as well as the interactions between education and international programs.

Sonia is uniquely qualified for this assignment. Originally from Nicaragua and Honduras, she studied biology at the University of Costa Rica. She joined NSF while a research associate at Duke University. Her ecological research background combined with her NSF educational experience and her international experience through the NSF-NATO program affords her the tools to communicate effectively between the education community and the LTER and ILTER networks.

While at the Network Office, Sonia plans to increase the understanding of NSF goals and programs among LTER scientists and students. This increased understanding will allow students at LTER sites to benefit more from NSF programs in graduate education. In addition, Sonia will have an important positive effect on our efforts to incorporate activities focusing on K-12 education into the LTER program. For example at NSF, she assisted in the development of the G-K12 program, in which graduate students are a conduit for information to flow from NSF research programs to K-12 educational institutions. LTER's more than 400 graduate students provide a pool of excellent candidates for this program, and Sonia can help them learn more about getting involved.

The international network of LTER sites in over 20 countries provides opportunities for graduate students to collaborate with international colleagues and institutions. During her time in the Network Office, NSF International Programs director Christine French facilitated international exchanges of graduate students between U.S. and Asian LTER networks. Sonia hopes to inform the LTER network about how similar exchanges may be developed for Eastern Europe, Latin America, and Africa.

We are pleased that the University of New Mexico and the National Science Foundation have agreed to Sonia's assignment. The University of New Mexico will benefit directly from the detail by strengthening the expertise available in the LTER Network Office. Graduate students involved in LTER research programs at the University of New Mexico and New Mexico State University as well as other research programs will benefit through increased understanding of NSF programs and access to advice about them. This access would be particularly important to minority students, who make up a large proportion of the students enrolled at these two institutions. Sonia's assignment to the Network Office is a perfect fit to the goals of the recent NSF initiative on Environmental Research and Education. Ultimately, Sonia will contribute to the integration of research and education, one of NSF's highest priorities.

Please join me in welcoming Sonia to the LTER Network. You can contact her at 505/272-7350 or sortega@lternet.edu.

David Blankman helps Sonia Ortega set up her computer as she get settled into her new space at the Network Office.

Preparing the space for Sonia Ortega's two-year stay at the Network Office.

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The Network News

Vol 14 No 2 Fall 2001

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

LTER

The National Science Foundation

The University of New Mexico

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Edited, designed and produced by
Patricia Sprott
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Printed on recycled paper with soy-based inks at Academy Printer

This publication is available in its entirety on the LTER World Wide Web Site:

http://www.lternet.edu

Kudos for Konza Scientist

Melinda D. Smith, a graduate researcher at Konza LTER and a PhD candidate in the Division of Biology at Kansas State University, won the Murray F. Buell Award for Excellence in Ecology at the 86th Annual Meeting of the Ecological Society of America in Madison, WI, August 2001.

The award is given to a student for the outstanding oral paper presented at the ESA Annual Meeting. The title of her talk, coauthored by Alan K. Knapp, was "Loss of subordinate species affects productivity of a C4-dominated grassland."

KSU's Melinda Smith, winner of the 2001 Buell Award for excellence in Ecology.

Why are exotic species so rare in the shortgrass steppe ecosystem?

Graduate Student Research at the SGS-LTER

Petra Lowe and Bill Lauenroth

Unlike many other ecosystems, the shortgrass steppe has not been invaded by exotic species to any significant degree. Prior research on the SGS-LTER has shown that exotic species are virtually nonexistent in undisturbed shortgrass steppe, but can be found in areas of disturbance and higher resource availability such as roadsides and riparian areas. Prior research has also found that exotic species are more likely to germinate and survive in areas on the shortgrass steppe that are not grazed by domestic cattle. The seeming unique resistance of the shortgrass steppe to invasion by exotic plants has prompted LTER researchers and graduate students to investigate the dynamics of exotic species in this ecosystem.

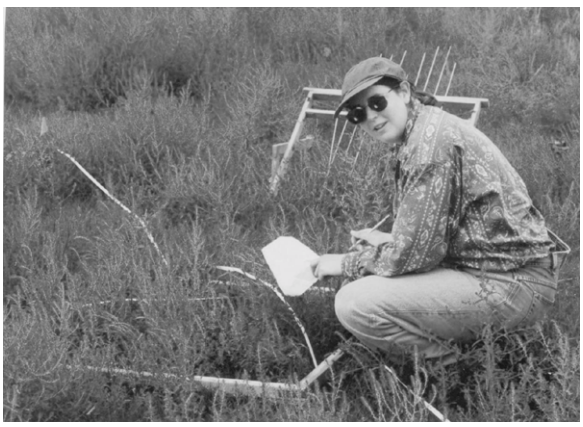
We asked two questions in an attempt to understand why so few invasives were found in the steppe: 1) Is invasion limited by seed availability? 2) Is invasion limited by resource (water and nitrogen) availability? Samples of the soil seed bank indicated that availability of invasive seeds declined exponentially from the roadsides to 25 meters into the steppe suggesting that the presence of invasive species in the steppe is limited by seed dispersal.

Experimental additions of water and nitrogen to plots in which the invasive annual grass *Bromus tectorum* was seeded indicated that increased availability of water combined with nitrogen had a significant positive effect on survivorship, and that nitrogen alone and in combination with water significantly increased aboveground biomass.

Both seed and resource availability are apparently influencing the current success of invasive plants in the shortgrass steppe. Our results suggest that anything that increases the dispersal of invasive propagules into the steppe in combination with increased water and nitrogen availability could result in a plant invasion.

The current disturbance regime occurring in the shortgrass steppe results in a continuous supply of microsites with increased water and nitrogen availability. A substantial plant invasion may only be awaiting the introduction of a species with an effective long distance seed dispersal mechanism.

If increased resource availability causes invasion in shortgrass



Graduate student Petra Lowe collects plant community data on a research site that has been heavily invaded by exotic weeds as a result of resource manipulation on the shortgrass steppe.

steppe, can reducing availability reverse this?

Previous research on the shortgrass steppe has found that short-term increases in nitrogen and water availability above what this system normally experiences leads to a dramatic, long-term shift from native steppe to a community dominated by exotic, invasive annuals.

Additional research found that the exotic plants sequestered more nitrogen in their aboveground tissue, and it was hypothesized that the community change persisted through time due to a plant tissue/soil organic matter feedback mechanism. If increased resource availability encouraged the dominance of the exotics, could reducing availability decrease exotic species? We tested the hypothesis that adding carbon amendments in the form of humus precursors and sucrose would indirectly reduce the prevalence of exotic species, and increase native species, by decreasing plant available nitrogen on short-term and long-term time scales.

We superimposed six new carbon treatments, control, sugar, lignin, sawdust, lignin and sugar, and sawdust and sugar, on a historic study site that received nitrogen, water, or the combination from 1970-1975, resulting in a dramatic increase in exotic species on the water plus nitrogen amended plots, a community change that persists into today.

All of the new carbon treatments significantly reduced exotic species richness and aboveground biomass compared to the controls, regardless of the historic treatment. The new carbon treatments, with the exception of lignin alone, reduced exotic species density by an average of 50% on the historic water plus nitrogen plots. Our results show that the addition of carbon amendments can reduce exotic species density on the shortgrass steppe, at least over short time scales.

Research associate Nicole Kaplan spreads lignin on an experiment designed to reduce plant available nitrogen in an effort to reduce exotic species.

Future research

Although very few exotic species have been found in undisturbed shortgrass steppe in the past, recently patches of one exotic species, *Linaria dalmatica* (dalmatian toadflax), have been discovered growing in pastures on the SGS-LTER. It is unknown how the plants arrived at their current location, but it is known that the patches are expanding.

A new graduate student is planning on investigating the dynamics of these unusual exotic species patches by mapping the patch boundaries with a GPS unit, counting tillers, and looking at the root development of this potentially invasive species.

FCE Graduate Student Research in the Everglades

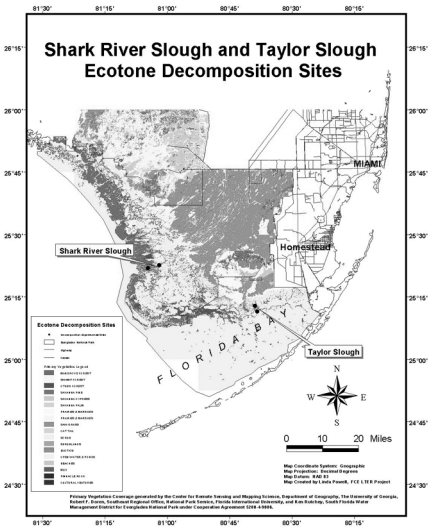
Graduate Student Research at the Florida Coastal Everglades LTER Site

Decomposition of *Cladium jamaicense* and *Eleocharis spp.* in the ecotone regions of Taylor Slough and Shark River Slough

Gustavo Rubio, Department of Biology, Florida International University

A project that combines science *and* technology can obtain superior results than one that just includes one or the other. This project is set to mix science and technology to measure the ecosystem process of decomposition for two predominant macrophyte species *Cladium jamaicense* and *Eleocharis spp.*. The project is to take place in the ecotone regions of Shark River Slough and Taylor Slough located in the Everglades National Park (ENP). The ecotone regions of both sloughs experience a mixing between fresh water and salt water that makes them unique from all the other regions found in the sloughs.

Decomposition rates for *Cladium jamaicense* and *Eleocharis sp*p. will be measured by using litter bags which contains



dead plant material for both species. Litter bags will experience three different treatments 1) open air to account for decomposition of leaves before they are shed by the plant, 2) soil surface to account for decomposition once the leaves have been shed by the plant and reach the soil surface, and 3) macroinvertebrates in which the mesh size of the litter bags will be bigger to allow macroinvertebrates in the bags. Three bags from each treatment will be collected after 0, 1, 2, 4, 6, 12, and 18 months.

Two scenes from NASA Airborne Visible InfraRed Imaging Spectrometer (AVIRIS) hyperspectral sensor will be used to measure nitrogen and lignin content, which are important components that determine leaf litter decomposition, in dead *Cladium jamaicense* leaves for both ecotone regions. The results of this project will be useful for management and restoration project that are being done in the ENP.

Investigating tree island community response to increased water flow in a Southeastern Everglades ecosystem

Tiffany Gann, Department of Biology, Florida International University

Tree island communities have a distinct flora and are likely to be functionally different from the Everglades marsh community. This experiment takes advantage of levee removal in the southern Everglades as a part of the hydrologic restoration of freshwater flow to Florida Bay.

We are utilizing three treatment groups: 1) islands that are most affected by increased water flow as a result of levee removal; 2) islands that are located in an area of the marsh where increased freshwater flow is negligible, and; 3) an experimental manipulation in which freshwater flow is diverted with plastic walls. With this experimental design,

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we will test how tree island communities respond to long-term changes in water flow, and also determine the trajectory for tree island community response.

To investigate these effects, we are quantifying plant community structure, plant productivity, litterfall production, nutrient use efficiency, litter decomposition and soil biogeochemical properties of nine tree island communities.

Primary Productivity, Periphyton metabolism

David Iwaniec Department of Biology, Florida International University

We are studying patterns and magnitudes of periphyton metabolic responses to reveal local system reactions to spatial and water source effects. Our study sites are within the Southern Everglades, along marsh transects anchored at the C-111 canal and extending into Taylor Slough to Florida Bay. We will quantify metabolic rates of periphyton assemblages using standard oxygen change techniques every 6-8 weeks during the wet season. Biannually, periphyton from each site is incubated with water from each site in a complete factorial design.

FCE graduate student Ralph Mead working at one of the Taylor Slough mangrove sites (photo: FCE LTER).

Origin, Transport and Fate of Organic Matter From the Florida Coastal Everglades: An Organic Geochemical Approach

Ralph Mead, Environmental Geochemistry Group, Department of Chemistry, Florida International University

Organic matter dynamics in small sub-tropical estuaries have not been studied in great detail. The Florida Everglades are one of the largest coastal wetlands in the world, and drain a significant amount of water into the coastal environment of South Florida. As such small sub-tropical estuaries are a key component of this ecosystem. Two such estuaries, namely the Shark and Taylor River Estuaries are characterized by quite different hydrological conditions. They are expected to be affected differently by the restoration efforts of the Everglades. While the main goal of our LTER is to predict, monitor and model such changes, this particular study is

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CAP LTER Research

Preliminary Results from the 200-Point Survey

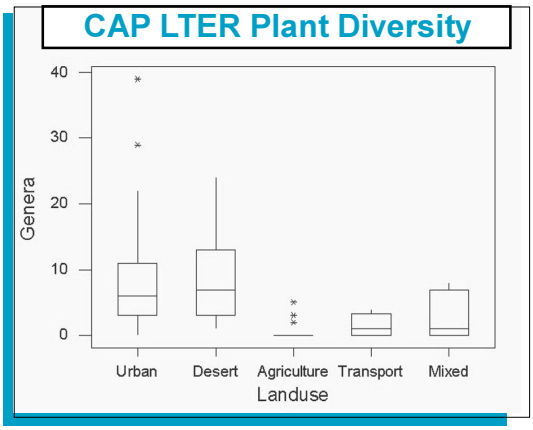
Dr. Diane Hope, CAP LTER Field Director

In spring 2000 CAP LTER researchers undertook a major field survey as part of the project's core monitoring efforts. The survey's goal was to measure key ecological characteristics of the study area, provide a baseline for future monitoring, and give an overview of features such as plant diversity, soil chemistry, etc., which can only be gained through field investigations. The entire study area (some 6,400 km2) was covered with a 5 x 5-km grid. In the developed urban areas, one such point was located in every grid cell, while in undeveloped land, one random point was chosen in every third grid. This method resulted in 206 sample sites, of which we surveyed 204 between February and May 2000.

Field measurements were done in 30 x 30-m survey plots and included identifying all native and exotic plant species to genus; mapping the area of surface cover types; collecting samples of soils, insects, microbes and pollen; and taking cardinal-direction photos from the center of each plot. Since this survey, bird abundance and diversity, along with human activity, has been monitored at 40 of the 204 sites, 4 times a year.

The field data has been entered into the CAP LTER database and is now available to researchers. All major plot features (surface cover types, built structures, individual trees and shrubs), along with locations of soil, prokaryote, and pollen samples within the plot are fully georeferenced. Lab analysis of pollen and litter bags for decomposition are complete, while soil chemistry (pH and major nutrients) and textural analyses will be completed shortly.

The dataset is intended to provide a comprehensive picture of select ecological characteristics of the Phoenix metro area and surrounding agricultural and desert lands, at one point in time. However, the sites will be resurveyed every 5 years to monitor how these variables change over time and with continued development. Another use of the data is to compare features such as plant diversity and soil nutrient status in the city and the outlying desert. Preliminary analyses by Steve Carroll show that total plant diversity becomes greater as the elevation of the site increases, and soil nitrate-N content decreases from south to north.



Variations in total plant diversity between CAP LTER

Human geographic and socioeconomic variables are also important factors in explaining spatial patterns in plant diversity and soil-nutrient status. In general, plant diversity was similar between desert and urban sites, although the total number of plant genera was higher for urban versus desert sites, similar to findings in European cities, which have higher plant diversities than their surrounding countrysides. Even more interestingly, human geographic and socioeconomic variables are also important factors in explaining spatial patterns in plant diversity and soil-nutrient status. Both median family income and human population density are both positively correlated with plant diversity. In other words, wealthier neighborhoods and those with more residents tend to have a greater number of plant types.

Meanwhile soil nitrate-N content was related to the type of land use. Plots dominated by transportation use, in urban and fringe areas on average have the highest N contents, while desert sites have the lowest. Soil nitrate-N content was also related to human population density (soil nitrogen contents were higher in plots located in more populous neighborhoods) and proportion of impervious surface cover (the more concrete and asphalt at the survey site, the lower the soil N content). These preliminary findings are the subject of ongoing studies by CAP LTER researchers.

Jornada Basin LTER Site

A Flying Start for the Chihuahuan Desert Nature Park

Stephanie Bestlemeyer, Director, Chihuahuan Desert Nature Park

Plans to create a focus for the SLTER program, as well as for the thousands of children who tour the Jornada Basin LTER site each year have been long in the making. A recent turn of events has boosted the development on this project.

It all began on June 2, 2000. During a routine road grading, a Doña Ana County employee accidentally struck a buried pipeline, spraying more than 74,000 gallons of diesel fuel onto the Jornada Basin LTER site at the future location of the Chihuahuan Desert Nature Park (CDNP).

Chevron responded rapidly to the initial spill, removing much of the pooled diesel, while county employees built a berm to prevent diesel from flowing onto Jornada Road. Chevron employees also replaced the broken section of pipe, lowered a large section of the line deeper underground, and then covered the line. Soon after, county employees removed the affected soil and spread it along Jornada Road to allow for evaporation of the diesel. By that time, diesel had already penetrated to up to 14 feet in depth. After the diesel evaporated, treated soil was placed back in the original road or spread along Jornada Road. Chevron and Doña Ana County continue to discuss who will pay for clean up.

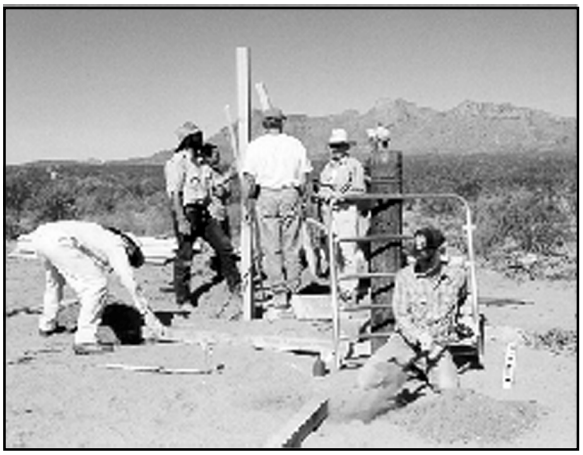
Most of the diesel was confined to the area of the Nature Park near the road. However, clean up efforts resulted in a new access road south of the original road, a large bare area where the pipeline was lowered, and a parking area southeast of the spill.

Through the interactions surrounding the spill, Chevron learned about the plans for the Chihuahuan Desert Nature Park. In turn, director Stephanie Bestlemeyer learned about the emphasis Chevron places on K-12 science education through their corporate giving program.

The spill also reinforces the importance of the CDNP's mission to help a growing population live successfully and sustainably in the Chihuahuan Desert, Stephanie says.

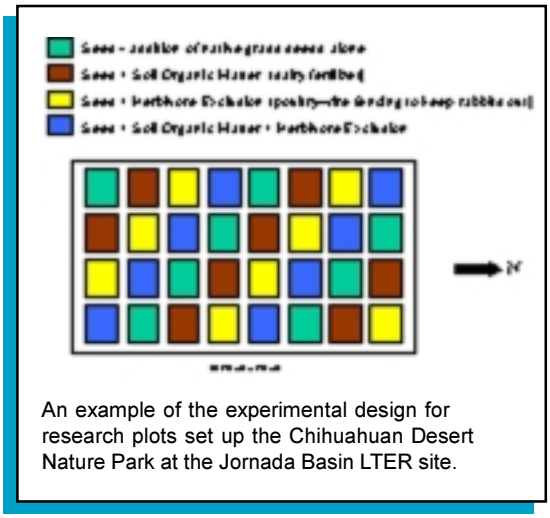
Site Development Begins

After many years of planning and with the assistance of many dedicated volunteers, the CDNP site development is underway.



Despite the June heat in the Chihuahuan desert, dozens of volunteers devoted their weekend to turning the dream of the Chihuahuan Desert Nature Park at the Jornada Experimental Range into a reality

The first day of labor yielded the installation of signs and of demonstration plots. The demonstration experiment focuses on some of the methods used by scientists at JRN to reestablish native grasses on areas that have been disturbed. The plots will serve three purposes: (1) revegetating a large area that was damaged during the cleanup of the diesel pipeline spill; (2) educating students about the scientific process and the unique aspects of working in deserts; and (3) establishing a presence for the Nature Park on the site.



An example of the experimental design for research plots set up the Chihuahuan Desert Nature Park at the Jornada Basin LTER site.

The experiment was designed by Nature Park Board member Mary Beth Harper, Jornada Experimental Range scientist Jeff Herrick, and Nature Park director Stephanie Bestelmeyer. Some plots serve as controls, while others have combinations of four different treatments: seed addition, fertilizer addition, tillage, and chicken wire installation to exclude herbivores.

Much of the funding for the project is being provided by Chevron.

"We've been able to turn a negative situation into a positive way to extend our mission of increasing scientific literacy and fostering an understanding of the Chihuahuan Desert," Stephanie says.

Original development of the Nature Park was outlined in a Master Planning process in 1996. The Park is seeking funding for additional development, including the installation of nature trails, interpretive signs, an outdoor amphitheater, visitor facilities, and exhibits featuring Chihuahuan Desert plants and animals.

Volunteer turnout for Site Development Day reflected the tremendous community support for the Chihuahuan Desert Nature Park's programs. Boy Scout Troop 179 was especially helpful in all phases of the project, and several troop members have expressed interest in carrying out their Eagle Scout projects at the Nature Park.

Supplies for the project and refreshments for the volunteers w ere provided by the Chevron Pipe Line Company. Considerable technical support in designing the experiment was received from the USDA/ARS Jornada Experimental Range. Bright Star Dairy donated the fertilizer for the project.

Phase II will include the installation of permanent signs explaining the experiment. Future phases include the installation of hiking trails, interpretive signs, an amphitheater and visitor facilities on the Nature Park site.

These news items originally appeared in Jornada Trails, newsletter of the Jornada Basin LTER site, online at: http://jornada.nmsu.edu/

FCE LTER Grad Student Research

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aimed at the effects on the carbon cycling in these estuaries. Therefore, spatial and temporal variations in organic matter quality and quantity, and its source, fate and transport to both of the estuaries will be investigated. The study is based on the analysis of transect samples from both estuaries, subject to GC/MS for molecular marker analysis, analysis of bulk sediment/soil parameters (C/N , TOC, TSS, solid state CP-MAS 13C NMR) and bulk and compound specific 13C stable isotope ratio monitoring mass spectrometry.

PILOTS-IN-COMMAND
GCE-LTER Pilots Its First Schoolyard Program

Patricia Hembree, facilitator
The University of Georgia, Athens, Georgia

This past July, ten educators, two facilitators and several LTER scientists worked together to pilot a model for the GCE-LTER Schoolyard Program. Dubbing themselves S.A.P.E.L.O—Scientists and Professional Educators Learning Outdoors—the team represented educators from both classroom and outdoor programs teaching students from age three to eighty-three across Georgia.

The model, proposed by the facilitators from the Department of Science Education of the University of Georgia and the Georgia Association of Marine Education, teamed educators and scientists for a week of research in the salt marshes and waters in and around Sapelo Island and the adjacent mainland—the focus site of the LTER. The unusual teams-teachers and researchers together—gathered data in the field, installed critical equipment, and analyzed and expounded upon lab results. The research and its place in the larger picture that is the mission of the GCE-LTER was the focus of many chats around the somewhat remote facilities.

For ten days, Dr. Carolyn Ruppel (Ga. Tech) and Dr. Steve Pennings (UGA) along with their graduate assistants had active research projects underway in the Sapelo area. The educators, acting as voluntary assistants, worked both in the field and in the laboratory. Here is a synopsis of their experiences:

- A third grade teacher and an outdoor educator could be heard laughing as they slogged their way through the marsh in search of just the right kind of grasshopper. "Just wait 'til my kids hear what I did!" was followed by the whoosh of the collection net. The "victims" were later taken back to the lab where the team conducted experiments in foraging habits and feeding rates.
- A middle school earth science teacher and a high school physical science teacher spent their days with Dr. Carolyn Ruppel and her team collecting continuous sediment cores and installing groundwater-monitoring wells to study freshwater flow beneath salt-water marshes. Despite winning the daily "dirtiest researcher award," the two gladly went back out with their team every day, wearing their new knowledge as proudly as they were wearing their muddy attire. From then on, their talk centered on the applications that they plan to transfer into their classroom with an occasional thought about a change of career-to that of hydrogeology under Dr. Ruppel!
- The task of catching, tagging, and radio tracking female blue crabs by another outdoor educator was made humorous by the Maryland native's "complaints." NOT having a pot of boiling water and some crab boil spice handy during the capturing phase was, to her, a travesty! "What a waste" she sighed...and I'm so hungry!" And off they went with their boat and receiver to see where the darlings had gone....
- Meanwhile, two high school teachers—one from biology and one in mathematics—assisted in the engineering, construction, and instalation of protective housings for Sondes used in the large-scale study of water temperature, salinity and water flow across the LTER site. Involving extended time in the LTER boat travelling to all the monitoring sites, these two had the chance to see the amazing diversity across the entire study area and shared the incredible sights they saw everyday. They also had the best tan!
- The last group consisted of two high school biology teachers with nearly sixty years of classroom experience between them and an elementary special education teacher whose research emphasis is teaching science to children with special needs—a rare person indeed. They, too, were able to see a great deal of the variety that makes up the LTER site as they collected massive amounts of data on plant size and zonation in the marshes. With their unique backgrounds and length of service, it was hard to tell who was learning from whom! The researcher frequently expounded on her growing knowledge while the teachers humbly proclaimed to simply be doing what they have always done...teach.
- As if that wasn't enough, during "off" hours, the educators helped build boardwalks leading to research sites in efforts to protect the incredibly sensitive life underfoot.
- Each evening, participants shared experiences/adventures, weaving together the bigger picture that is the view of Sapelo and the ongoing research of the GCE-LTER as well as brainstorming adaptations of that research into their own educational setting.

This pilot study served multiple roles. It provided a cohort of passionate volunteers a chance to be involved in active research, tested the feasibility of teacher/scientist interface under field research conditions, and capitalized on the diverse experience of this special group to fine tune a model for future workshops.

The consensus among both teacher and scientist alike was that the workshop design was an excellent experience but that the fragile nature of the salt marsh ecosystem precluded bringing large numbers of school-aged children to the island and the research sites within the LTER. It was concluded that the educational outreach of this schoolyard program ought to be designed around having educators use such a research experience as this to design and conduct parallel experiments within their educational setting.

With the advantage of the distance learning network in Georgia, the well designed web support of the GCE-LTER and with corroborating conference calls to the scientists, the ability of the educators to use the research as critically needed local examples of math/science application is seen to be immeasurable. Ultimately, the participating educators saw the research as a chance to meet the mandated standards of content and application with a "local" flavor they feel will increase their students' interest— and their own. The researchers, on the other hand, were amazed and impressed with the knowledge and abilities of the teachers. Quickly realizing that the quality of their future research assistants is dependent upon the quality of these teachers' emphasis on coastal ecology, a union of goals and ambitions occurred.

Finally, we leave you with a vision of a current "research project." The third grade teacher who claimed that the grasshopper study would be the basis of her new fall science curriculum, also said that it would be so easy to do the "same" experiments is using her new knowledge and the web pages associated with the LTER. She is now having her students download data from the grasshopper project to compare to their own data as they, too, swipe their little nets through the air. Watch out Dr. Pennings.... Your next graduate assistants are being made in a small elementary classroom in the middle of "nowhere" in Georgia!

Student-Teacher-Scientist Consortia Working at VCR LTER

The students in an environmental sciences class at Northampton High School in Eastville, Va., learned land navigation and ecology with the help of a new program that links them to the Virginia Coast Reserve Schoolyard LTER program

"U.Va. is providing equipment to the high school— from computers to handheld global positioning system (GPS) units—as well as expertise and training for both the students and their teachers," said Randy Carlson, LTER site manager.

"We instruct the high school students in the proper techniques for making meaningful observations of events occurring in the environment," Carlson said. "The students and their teachers are likewise helping U.Va. research by providing ecological observations that are scientifically useful for determining long-term changes in the environment."

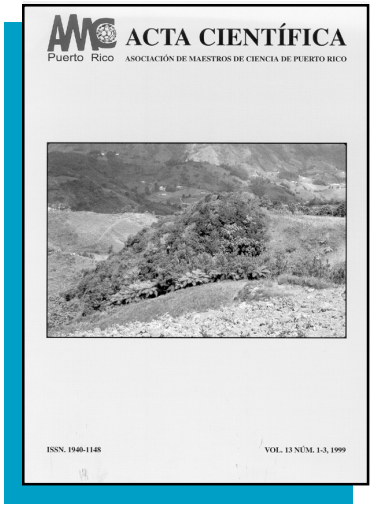
This summer, U.Va. faculty members also taught a graduate course in environmental sciences field methods for science teachers at Northampton. The teachers are able to apply those credits toward a graduate degree and are now better prepared to instruct their students in practical field science methods. "This kind of hands-on work can really charge up the students," said science teacher Tom Bonniwell.

Please find the full text of this article by Fariss Samarrai on the Inside U.Va. *website: http://www.virginia.edu/insideuva/2001/27/research.html*

Journal Issue Showcases Luquillo Schoolyard LTER Research

Jess Zimmerman and Ariel Lugo, Luquillo LTER

A special issue of *Acta Cientifica*, the journal of the association of science teachers in Puerto Rico, features products of research conducted by students supported in part by the Luquillo SLTER program. The funding from this and partnership programs (including UPR Institute for Tropical Ecosystem Studies and the USDA Forest Service International Institute of Tropical Forestry) allows participating schools to receive research equipment and supplies, as well as training of teachers and students in the art of long-term ecological research. Innovative teachers in the program have developed new curricula and original research at the participating high schools, and have formed a network of communication and data sharing, cross-site field trips, and research symposia to present results.

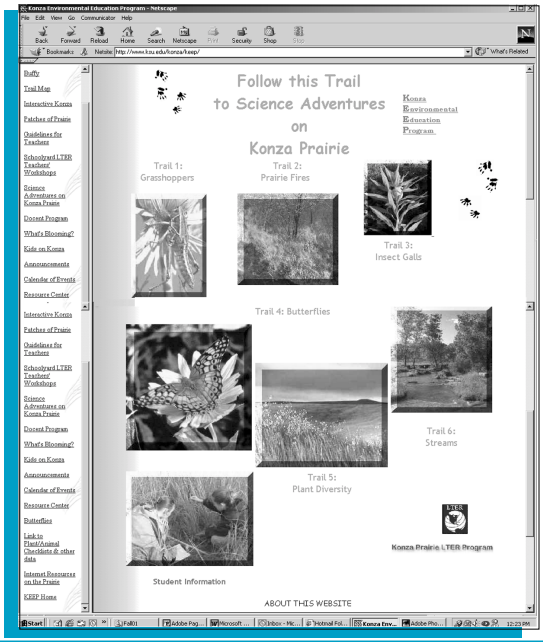


A special issue of *Acta Cientifica* published by the Asociacion de Maestros de Ciencea de Puerto Rico, features Luquillo SLTER research. Copies are available from the LTER Network Office.

The International Institute of Tropical Forestry, USDA Forest Service in Rio Piedras, Puerto Rico presented research equipment and materials purchased for schools participating in the Luquillo Schoolyard LTER, in Aug 2001. Purchase of equipment and materials for the six high schools participating in the Program were provided by State and Private Forestry, USDA Forest Service and the NSF.

New Website Features Student-collected Data

A new feature on the Konza LTER website features data collected and input by SLTER students. The students and their teachers participate in insect and plant inventories and input the data to a central location via the World Wide Web. The results are featured on the new "Science Adventures" section of the Konza web site (visit the website at: http://www.ksu.edu/konza/keep).



A 'screen shot' of the "Science Adventures on Konza" on the Konza KEEP website (www.ksu.edu/konza/keep). Students input data to the site with a password.

Funding for these additions to the web site is from a Dwight D. Eisenhower Professional Development Program administered by the Kansas Board of Regents.

Konza Prairie education coordinator Valerie Wright also is working with scientists to make LTER data available to the young researchers in the SLTER program. "We've done two LTER data sets so far—insect galls and grasshoppers," Valerie says. "It's a lot of work to go through the data and see how much –or how little–we can actually use. It has really made me consider the usefulness of data, and the importance of 'meta' data [data about data]. Sometimes it's impossible to understand the data, let alone make it usable for schoolteachers.

"But when we do, the teachers love it. They appreciate it so much. And they pass it on to math teachers and social studies teachers, too."

On the new website, each 'trail' represents a science activity. Valerie leads the teachers and students through the activities at the Prairie, and the students input the data they collect in the activities through the website.

The most recent data was collected during this fall's insect inventory, using sweep nets. "Each year the kids come up with a new specimen, and this year we caught one that has no common name, so they'll come up with their own common name," Valerie says.

The young scientists add their data remotely from classroom. "At times there are glitches with the online system, but it's getting better," Valerie says.

The project includes 17 teachers and their students. Teachers complete a training program before incorporating the activities into their curricula.

The teachers love it, Valerie says. "They love the hands on stuff, especially. So do the students, because they know we are interested in their data and they get to see what happens to it."

NET*Working*

Palmer LTER Outreach: A Diverse Group with Common Goals

Karen Baker, UCSD, Palmer LTER

A marine science technician, an Eagle Scout and an adult basic skills teacher have in common plans this season to participate in Antarctic science research efforts and to share their experiences through field journals.

This diverse group of individuals is united by the common quest to participate in Antarctic and long-term research, to explore ecosystem and partnership science, as well as understand and use technology to facilitate the integration of information across language, community and datasets. The Palmer Station LTER site through its schoolyard education outreach program (http://pal.lternet.edu/education) bridges these participants and their respective networks: the public schools, the Boys Scouts of America (BSA) and the Teachers Experiencing the Artic and Antarctic (TEA) Program.

Marine Science Technician Participates in LTER Ice Cruise

Richard Iannuzzi, a marine science technician and computer programmer with experience in physical oceanographic data collection and analysis, is participating in an ongoing Palmer LTER winter ice cruise West of the Antarctic Peninsula. The cruise focuses on sea ice because of its importance in the dynamics of the Antarctic ecosystem.

Rich's journal is sent home daily from the ship via satellite. The project developed from his outreach experiences on a previous cruise as well as from discussions with his father. His father, a fourth grade teacher, is coordinating journal communications with four New York elementary school classrooms as well as sharing the Antarctic connection in a variety of additional school forums.

Ice Drilling

Tim Brox displays his research project on bioremediation and oil spill clean up. This project won 3rd place in Environmental Science in the Intel International Science and Engineering Fair, 2001.

Scout Prepares for Antarctic Deployment

Tim Brox, a recent graduate of Clovis West High School (Fresno, CA) and an Eagle Scout, was selected in April by BSA to participate in an NSF Office of Polar Programs sponsored program. The precedence for this program which now sends a Boy Scout and Girl Scout to the Antarctic in alternate years, can be traced to Eagle Scout Paul Siple who joined an expedition in 1928 at the request of Admiral Byrd. Tim's selection is particularly appropriate given his interest in science and the marine environment.

Tim will visit the three US Antarctic research stations (Palmer Station, South Pole and McMurdo Station) in addition to a variety of field camps. Projects that he will interface with while in the US include the two Antarctic LTER sites (Palmer Station and the McMurdo Dry Valleys) as well the marine Santa Barbara Coastal LTER. As an introduction to Antarctic research and marine as well as information management and technology, Tim traveled to San Diego in September to begin his training. Hosted by Palmer LTER information manager and outreach coordinator Karen Baker, he met with researchers at Scripps Institution of Oceanography, the Stephen Birch Aquarium and the San Diego Supercomputer Center. Tim will deploy mid October via New Zealand to McMurdo Station and South Pole aboard a LC130 Hercules cargo plane and in February through Chile to Palmer station aboard the Research Vessel Laurence M. Gould.

Teacher Deploys for Antarctic Summer

Susan Cowles, a teacher of adult basic skills development and high school completion classes at Linn-Benton Community College, Corvallis Oregon, was selected by the NSF/OPP TEA Program (http://rice.tea.edu) to visit the Antarctic early next year. In preparation for her trip, she visited the laboratory of Dr. Hugh Ducklow, a Palmer LTER Principle Investigator at William and Mary College, Virginia Institute of Marine Sciences, this summer. Susan will conduct research alongside Dr. Ducklow and his team on the subject of microbial biology and persistent organic pollutants.

Participating in math instructional reform and the use of technology in adult literacy programs, her work incorporates use of the Internet as a teaching and learning tool; she now maintains an online special collection in science and numeracy resources for the National Institute of Literacy http://literacynet.org/sciencelincs). Susan will work at Palmer Station beginning in January-February 2002 with Dr. Ducklow and his team focusing on the role of airborne organic pollutants in Antarctic coastal seas.

The Antarctic ecosystem undergoes extremely large seasonal changes in both light and sea ice. While the Palmer LTER team has been working to understand the impacts of sea ice change on the Antarctic marine ecosystem since 1991, this season Rich, Tim and Susan will observe for themselves just how this unique ecosystem is dominated by the advance and retreat of sea ice. They will participate with researchers documenting and investigating the Antarctic ecosystem and its change over time. Through online journaling (http://pal.lternet.edu/field/0102season), they will share their insights and adventures with Scouts, students, teachers, and the public.

Susan Cowles, a participant in theTeachers Experiencing Antarctica program, models her new foul-weather parka.

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'Incubation' for a New Idea

Designing an Infrastructure for Heterogeneity of Ecosystem Data, Collaborators and Organizations

Karen Baker (UCSD, Palmer LTER) and Geoffrey Bowker (UCSD, Communications Department)

As more scientists exchange and post data digitally, the challenges of transforming data systems into knowledge systems come into sharper focus. As communities address issues of data availability, the understanding of data incompatibility issues deepens. The LTER integrative approach to science brings with it a familiarity with difficulties arising from technology with differences in hardware, software, and formats as well as from uniformity or standards with differences in collection units, classification categories, and methods.

There are a variety of challenges to data integration arising from creation of appropriate metadata, the descriptive documentation about the data. The 'context' of data is complex: one aspect of a dataset's metadata relates to the environment it describes while another aspect relates to its creator and is impacted by its association with a site, project, repository and network. As a result, in addition to the barriers of technology and uniformity, we identify within the multiple layers of metadata that there are barriers of social organization to consider.

A recent NSF report (Kinzig et al. 2001) focusing on priorities for interdisciplinary environmental research presents the human interface with the environment representing humans as agents within the environment as well as in its perception. The report calls for careful consideration of how scientists negotiate their data. How the environment or the data is reported with its attendant metadata impacts ultimately how it is perceived and reused. The realization that metadata are not socially or culturally neutral improves our ability to design knowledge systems. Techniques used in the structuring of information include classification schemas as well as attention to semantic vocabularies and domain maps to describe the context of the data.

We ask whether there are methods complementary to logic-based approaches to information retrieval that can include data collection practices, project summaries and research vignettes.

We were recently awarded a Biodiversity and Ecosystem Informatics (BDEI) cross-agency (NSF/USGS/NASA) (Maier et al. 2001) incubation grant to consider impacts on metadata and infrastructure of the heterogeneity of 1) data, 2) collaborators, and; 3) organizations. This project seeks new ways of grounding environmental data with metadata so that data can be used more flexibly today and also be available over the long-term in a form usable for unanticipated future queries. The goal of this project is twofold: to open up a new field of database enquiry tied to the specific challenges of biodiversity and ecosystem science and to initiate a cross-domain dialogue between LTER ecologists (Callahan 1984), information managers (Baker et al. 2000), and social scientists (Bowker 2001).

This BDEI incubation grant will support a postdoctoral fellow trained in participatory design techniques who will focus on a prototype project as well as a community forum. Work begins in January 2002 with arrival of Dr. Helena Karasti (2001) who recently finished her thesis work in the Department of Information Processing Science at Oulu University in Finland. With experience in collaborative design, she will work with selected data from the Palmer LTER while considering the data capture and metadata roles in transforming data into knowledge. This project will develop into a larger follow-on study of modes of packaging data. This work facilitates a timely dialogue focused on "data ecology" (the relationship between data and their multiple environments) and builds toward the concept of an "organizational ecology" (the relationship between data and participants and their networks). The potential impacts are high in terms of both network infrastructure and expert systems.

The LTER Network fosters an environment that engages research scientists in the process of preserving their data digitally for the long-term. The vision broadens and deepens with collaborative participation in metadata and knowledge system design. An active partnership spanning several communities (NCEAS/SDSC/LTER) currently is exploring a metadata-based framework and includes participation by the LTER Central Arizona-Phoenix site exploring structure and developing tools. Our BDEI project joins these informatics efforts. Given the many facets of human knowledge, it will take a team bridging data-creators and data-managers, working in collaboration with data-handlers as well as those familiar with data-perception and data-context to address data integration in the short-term and data reuse in the future.

The LTER Network is well suited to initiate studies on the use of technology and standards as well as on the impact of social organization on knowledge systems.

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Information Management Workshop for Scientists from the Middle East

David Blankman NET and Kristin Vanderbilt Sevilleta

Several members of the LTER Network information management team recently participated in a program dedicated to building regional cooperation among the governments of Egypt, Israel, Jordan, Tunisia, and the Palestinian Authority.

The Cooperative Monitoring Center (CMC) at Sandia National Laboratories in Albuquerque, New Mexico funded the LTER personnel to lead the workshop, which took place 9-15 September 2001 in Bonn, Germany. The participating scientists are involved in the CMC-sponsored "Regional Initiative for Drylands Management" program, which addresses environmental and sustainable production issues related to desertification.

A shorter workshop on Knowledge Management was conducted by the Cooperative Monitoring Center for agency heads. Three of the participants in this workshop had previously attended an LTER Ecoinformatics training held in October 2000 at the Sevilleta. Feedback from the participants indicated that the three graduates of the Ecoinformatics training were clearly the best prepared for the Knowledge Management workshop.

The Ecoinformatics workshop included the following topics: Overview of Ecoinformatics (Kristin Vanderbilt-SEV), Hardware and Networking Design (David Blankman-NET based on materials developed by James Brunt-NET), Remote Sensing and GIS Concepts and Software (John Vande Castle-NET), Web Page Design: HTML and XML Overview (Vanderbilt and Blankman), Metadata Concepts and Software Tools, Data Archiving, Data Synthesis (Bill Michener-NET). John Porter (VCR) was to have taught database modeling and SQL during the last few days of the workshop, but the events of September 11 precluded his trip to Germany. Blankman and Vanderbilt filled in using materials prepared by Porter.

A church near Linz, Germany, as viewed from the Rhine River.

Perhaps the most significant parts of the training were the small discussions on data modeling and barriers to effective data management and collaboration. Not surprisingly lack of resources—human and technical—was a common complaint. More importantly though was the description of a culture of information hoarding. Most of the participants complained about the difficulty of obtaining relevant data. For many of the participants data in any form was scarce. The Israelis said that there was lots of data available, but most of it was in paper form, which made it difficult to use (Vande Castle's Second Rule states "the only real data is digital data").

Often when digital data was available inside a country or even inside an agency, the participants' complained that barriers exist to sharing the data. The barriers came in various forms:

1. Financial (we will let you use the data, but it will cost you);
2. Proprietary attitudes (our data is ours and we don't want to share it);
3. Confidentiality/security concerns (revealing this data might be detrimental to national or ecological interests, e.g. endangered species lists, or water supply data);
4. Technical

a. Data might exist, but no mechanism exists to find out about it;

b. Even when the data was available for sharing, different software protocols made data sharing impractical.

It is important to note that these issues were raised when the participants were focused on barriers that existed within their own countries and institutions. These barriers get significantly higher when the context shifts to data sharing between countries. It is ironic that for countries participating in "The Regional Initiative for Drylands Management," water supply data is considered by many to be "classified." This is a region where terrorism was part of life well before September 11.

While the Ecoinformatics training was not able to deal directly with confidentiality and security concerns, the technical barriers were addressed fully. The financial constraints and proprietary attitudes were addressed to a lesser extent. Proprietary attitudes are not, of course, unique to the Middle East. The culture of data sharing, even in the LTER Network, is new and not of primary concern to most researchers in any country. David

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Workshop participant Nvart Taminian, Computer Assistant and Office Administrator, Ministry Of Agriculture, Jordan, Computers Systems Management

The participants' positions and main interests:

- Imad Al Baba, Senior Researcher and Director of Research and Development, Ministry Of Environmental Affairs, Palestinian Authority, Ecological Database And Wildlife Management
- Zaki Zoarob, Director, Protection Of Environmental Resources, Ministry Of Environmental Affairs, Palestinian Authority
- Mahmoud Al Jaloudi, Head Of Prime Section, Ministry Of Agriculture, Jordan, Forestry And Range Management
- Nvart Taminian, Computer Assistant and Office Administrator, Ministry Of Agriculture, Jordan, Computers Systems Management
- Lilia Ben Abdallah, Responsible for Quality Management, CITET, Tunisia

Tarek Ben Ali, Director Of Exploitation, ONAS, Tunisia, Treatment Of Waste Water

- Abdelrahman El Shemy, Assistant Research, Agriculture Research Center, Egypt, Soil Science
- Mohamed Sayed Ahmad, System Engineer, Ministry Of Agriculture, Egypt, Remote Sensing
- Regev Manor, Ph.D. Student, Ben-Gurion University, Israel, Biodiversity Conservation
- Lea Orlovsky, Researcher At The Remote Sensing Laboratory, Ben-Gurion University, Israel, Desertification Monitoring By Remote Sensing

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Betsill, of the Cooperative Monitoring Center, Sandia National Laboratories talked about funding sources and strategies.

During the course of the training, solutions to the technical barriers to data sharing were discussed at length. At many different parts of the training we talked about the importance of supplying metadata, "the more, the better." Bill Michener demonstrated Morpho, a metadata editor and query tool, developed by NCEAS as part of the Knowledge Network for Biocomplexity (KNB), KDI grant. We presented, in conceptual terms, how XML can be used to query multiple databases and transform the data into a common format. A number of different existing data archives were presented, including Metacat, a metadata catalog being developed as part of the KNB. We discussed, briefly, how a Metacat might be useful for the workshop participants and their institutions.

Dr. David Betsill of the Cooperative Monitoring Center at Sandia National Laboratories discusses the "The Regional Initiative for Drylands Management" in which all workshop participants are involved.

Our ten students reported that they had learned a great deal and would be able to implement portions of what they had been taught. A common theme among the participants was that this training was a good sampler, "this is like a good appetizer, and our appetite is whet for the main course." There was a strong demand for further training, especially in the areas of remote sensing and GIS. The participants' goal is to use technology to build bridges between scientists in the region studying the common issue of desertification, and they felt that this workshop brought them a step closer to cooperation through data sharing.

Information Management Outreach in the East Asia-Pacific Region (EAPR-ILTER)

Kristin Vanderbilt, Sevilleta LTER

EAPR-ILTER Information Management Workshop

Peter McCartney (CAP) and Kristin Vanderbilt (SEV) traveled to Ulaanbaatar, Mongolia in July 2001 to teach a three-day Information Management Workshop for scientists in the East Asia-Pacific Region ILTER. Travel and materials funds for the workshop were provided by a grant from NSF to Tony Fountain of the San Diego Supercomputer Center (SDSC). Tony Fountain organized the workshop with the assistance of Dr. Tsogtbaatar and Dr. Amarsaikhan of the Mongolian Academy of Sciences. The workshop was conducted immediately following the regional ILTER meeting that was held at Lake Hovsgol, Mongolia to encourage scientists attending the meeting to stay for the workshop. Participants from Mongolia, Taiwan, Korea and Thailand used the computer lab with Internet access at the Mongolian Technical University for the workshop.

The objective of the workshop was to give participants some training in ecological information management theory and techniques. Lecture and laboratory topics included Basic Concepts of Information Management, the Relationship Between Data and Research, Database Design and Modeling, SQL and Data Query, Ecological Metadata, Connecting Databases to the WWW, HTML and Web Page Design, XML, Data Archives, and Quality Control and Quality Assurance. Tony Fountain lectured on data mining.

Information Management Workshop participants and instructors (Kristin Vanderbilt, Peter McCartney and Tony Fountain). Pictured participants were from Mongolia and Taiwan. Photographer: Peter Arzberger (SDSC).

The participants enjoyed designing and authoring web pages about themselves. Many were initially unfamiliar with the structure and function of relational databases, but all did well with an exercise in which they were asked to model, create and query a database using Microsoft Access. The more advanced students successfully used ASP scripts to query their databases from the web. The workshop agenda is available at http://www.sdsc.edu/sdsc-lter/imw/index.html.

Several positive things have occurred as a result of the workshop. Shortly after the workshop, the Mongolian participants met with Dr. Galbaatar, the General Secretary of the Mongolian Academy of Sciences (MAS), and formed the Organizing Group for Databases in the MAS. The Mongolians have also resolved to create a Mongolian LTER web site. As a follow-up to the workshop, Tony Fountain is investigating opportunities for hosting a Mongolian scientist from the workshop at the SDSC for a year to study data mining.

Regional EAPR-ILTER Meeting

The 4th International Conference on Long-Term Ecological Research in the East-Asia Pacific Region (EAPR-ILTER) was held July 2-7, 2001 in Lake Hovsgol National Park, Mongolia. Dr. Peter Arzberger of the San Diego Supercomputer Center (SDSC) spearheaded the information management-related conference activities. His talk entitled "Information and Computing Infrastructure for Global Environmental Research: Examples and Requirements" explored information management needs for large-scale synthetic research. He specifically encouraged initiating long-term interactions between the regional EAPR LTER sites and regional information technology centers such as those in Korea, Taiwan and Japan. Peter also led a session in which scientists discussed mechanisms for developing expertise of information managers in the EAPR-ILTER. Proposed activities include: 1) creating a network of EAPR-ILTER information managers who attend an annual meeting and who participate in the steering groups of the national LTER efforts, 2) sending a representative from the EAPR information management community to the annual LTER information managers' meeting in the United States, 3) holding workshops to build the knowledge base of EAPR information managers, and 4) long-term stays by EAPR information managers at LTER sites or computer centers for training. Scientists in the EAPR-ILTER are initiating a cooperative multi-country decomposition study, and plan to make data management a key component of this research effort.

NETWorking

Making Data Useful: The History and Future of LTER Metadata

By John Porter, VCR/LTER and James W. Brunt, LTER Network Office

Since its inception, the LTER Network has been a leader in creating and managing ecological metadata and is on the threshold of making significant leaps that will greatly increase the utility of LTER data to ecological researchers.

History

The LTER program has long recognized the importance of long-term survivability of data and that one of the contributing factors determining that survivability is the documentation of data through metadata (data about data). Today, metadata is increasingly being recognized as the key to making scientifically useful data available to ecological researchers (see LTER Network News: Fall 1999).

LTER sites have always recognized the need to maintain documentation that will allow data files to be interpreted. A substantial portion of the "Research Data Management in the Ecological Sciences" book (Michener 1986), which resulted from a 1984 symposium sponsored by the LTER Network, was devoted to issues of "documentation" - then primarily in hard-copy (paper) forms. During the first decade of the LTER program, the emphasis was on site-specific metadata needed to maintain the long-term utility of data within a given site. However, with the growth of interest in cross-site and network-wide science in the late 1980s and early 1990s the interest in cross-site data and metadata exchange increased.

Early interest was primarily in metadata for cataloging LTER data sets. A cross-site data catalog was discussed at the 1988 LTER Data Managers' Meeting, put forward as a proposal at the 1989 meeting and by the 1990 meeting the "LTER Network Core Dataset Catalog" was "in press" (Michener, Miller and Nottrott 1990). The catalog presented a limited subset of all LTER data, focusing only on data deemed by the sites to be "core" data sets. It contained only 251 data sets represented network wide, compared to over 3,000 data sets in the current online catalog.

1990 was a banner year for LTER work on metadata. The Data Mangers' meeting also featured a discussion of the "InterSite" data file format (Conley and Brunt, 1991) pioneered by Walt Conley and a discussion of "meta-data." The meeting even included a proposal to the LTER Coordinating Committee for a network-wide standard for "a minimum set of standard information for data abstracts." This standard requested a title, keywords, list of parameters (variables) measured, site location, study purpose and goals, experimental design, methods and proprietary limits. It should be noted that prior to 1990, it was extremely difficult to find out what data was being included in the database of other LTER sites. This was not an aberration, but rather represented the culture of ecological science at the time.

Interest at improving data accessibility at the 1990 LTER All-Scientists' meeting led to creation of an ad-hoc working group (Judy Myers, John Hobbie, John Magnuson, Bill Michener, Susan Stafford and John Porter) that was charged to develop guidelines for site data management policies. The resulting guidelines called for each site to develop its own data management policy that guaranteed the availability of data, while protecting the rights of data contributors (Porter and Callahan 1994). These guidelines had broad influence on site policies and paved the way to the creation of an LTER-wide data policy in the late 1990s.

The 1991 Data Managers Meeting had an extensive discussion of "Interactive Data Access Systems." At that time, in the pre-WWW days, such systems were confined to "bulletin board" systems using modems within the LTER Network and only Hubbard Brook LTER had an on-line system in operation. Interestingly, the discussion had a strong emphasis on security, with an emphasis on releasing data only to selected users. In a separate discussion on data publication (largely revolving around CD-ROMs), a recommendation was to "Encourage professional societies to produce data publications in support of their journals." This recommendation preceded the establishment of the Ecological Society of America data journal "Ecological Archives" by nearly a decade.

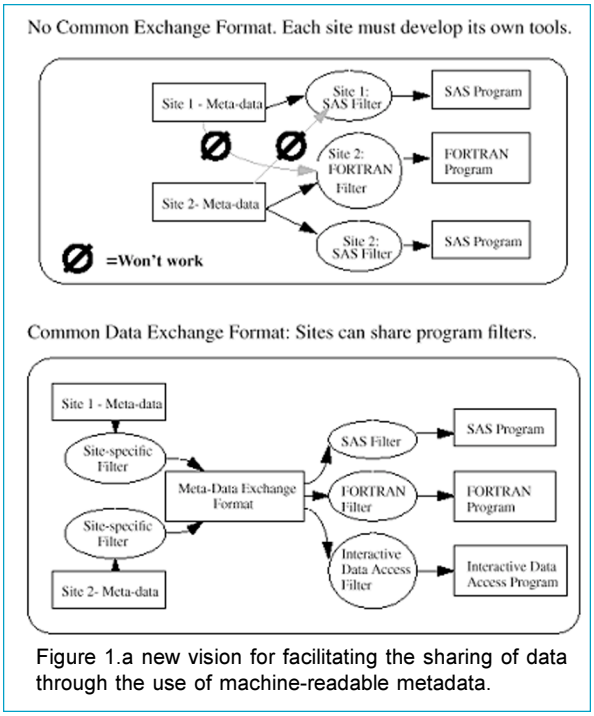

Figure 1.a new vision for facilitating the sharing of data through the use of machine-readable metadata.

The 1992 meeting included a new vision for facilitating the sharing of data through the use of machine-readable metadata. The Data Managers' report for that year included Figure 1.

The vision section of the report noted: "Importantly, the proposed format is for the exchange of data, not for the development and maintenance of meta-data within a site" thus avoiding a pitfall encountered in earlier efforts which failed to recognize that sites needed to maintain flexibility for dealing with their site-specific metadata and computational needs. By focusing on finding ways to transform site-specific metadata into general forms, it facilitated exchanges while maintaining needed autonomy and flexibility.

Based on that vision of sharing metadata, the sites committed to developing a "common exchange format" based on the minimum metadata standard defined at the 1990 workshop. Thomas Kirchner, then data manager at the Central Plains Experimental Range (now Shortgrass Steppe) LTER was charged with developing tools based on his concept of a flexible "attribute-value" syntax. By the fall of 1992, using software tools developed by Tom, the information manager at the Virginia Coast LTER was able to automatically create a SAS program by reading metadata stored in the "attribute-value" standard. Despite this demonstration of technical feasibility, the development of a usable metadata exchange media still needed cross-site consensus on minimum metadata for exchange.

In 1992 and 1993 a quiet revolution occurred. A simple to administer Internet information server called "Gopher" became available. By 1993 eight sites were running

Gopher systems and were well-positioned for the "Internet Revolution" when the World Wide Web became a practical option with the release of the first graphical web browser (NCSA Mosaic) in 1993-1994.

A greater revolution occurred in 1994 when the LTER Coordinating Committee first mandated that each LTER site should have "at least one" data set available on-line. This led to a vision for a network-wide information system aimed at providing scientists access to LTER data resources. In addition to developing that vision, the Data Managers' Committee also finalized a content standard for cross-site metadata exchanges. This standard did not specify the form the metadata would take, but rather focused on the types of information that would be required to interpret and use data for ecological research. The LTER adoption of metadata exchange standards coincided with the activities of the ESA "Future Long-term Ecological Data" (FLED) committee, chaired by Kay Gross (KBS LTER), and was incorporated into what is now considered a seminal paper on ecological metadata (Michener et al., 1997).

Future

As we enter the third decade of LTER research, LTER metadata efforts have continued and grown, with the development of partnerships with the National Center for Ecological Analysis and Synthesis (NCEAS), the Federal Geographic Data Committee (FGDC), the San Diego Supercomputing Center and others. Recent efforts to develop advanced systems for searching, accessing and using distributed data require both more extensive metadata content and more structured forms of encoding that information to allow more automated forms of use. The Ecological Metadata Language (EML) developed originally at NCEAS and jointly enhanced this year via collaboration with LTER and the "Knowledge Network for Biocomplexity (KNB) project (see LTER Network News: Spring 2001) " extends the past efforts aimed at exchanging metadata and carries them a giant leap forward. With the associated tools, it makes the vision developed by LTER information managers in the early 1990s a practical reality.

The LTER Information Managers now turn to the problem of implementing a common standard for metadata across the LTER network. Preliminary results indicate that sites vary from requiring major effort to create and input metadata to requiring assistance in developing software to translate existing metadata. The LTER metadata working group has identified several key components that need to be specified as part of a comprehensive plan for implementing metadata standards across the network. The most significant effort is migrating the structure of existing metadata to a schema based on, or compatible with, the recommended standard, EML 2.0. For some sites, this may also require expanding current content coverage to satisfy required content fields. Finally, technical developments will be required at many sites to enhance existing reporting tools to support the new XML structured metadata output formats.

Three metadata working groups have been formed around each of the 3 extant LTER metadata types. Each group is responsible for producing -

- A applicable plan of attack for that metadata type with cost estimates for implementation,
- A body of EML 2.0 compliant metadata from one or more sites with that metadata type deposited in the LTER metadata catalog,
- A contribution to general interest and training publications on 'implementing ecological metadata language' for that metadata type.

The LTER Network Office and the KNB project will provide coordination, programming, and database support to the working groups. This effort is made possible by supplemental funding from NSF to the Network Office. This activity will have broad impact beyond the LTER community in that we expect ecological metadata language to become the standard used by the entire ecological community.

This article made extensive use of the reports from LTER Information Managers' meetings, which are available on the WWW at: http://intranet.lternet.edu/cgi-bin/list.cgi?./reports/committee_reports/Data-management-committee

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Report from the Annual ILTER Meeting

Robert Waide (LTER Network Office)

The annual meeting of the International LTER Network was held in conjunction with a meeting on Detecting Environmental Change: Science and Society organized by the United Kingdom's Environmental Change Network (ECN) from July 17-20 2001. The ILTER meeting was held in Senate House, University of London, on July 16 and was attended by representatives of all seven regional networks and 12 of the existing 24 national networks. Bob Waide, John Vande Castle, and John Porter represented the U.S. LTER Network.

Highlights from Regional Reports

- The African regional network comprises one official national network (Namibia) and five other countries that are in the process of developing networks (Zambia, Tanzania, Mozambique, Botswana, and South Africa). Conditions for research are somewhat different in this region. There are no national science councils except in South Africa), and therefore government support is mostly in terms of recognition rather than funding. Interactions with researchers elsewhere are highly relevant to these networks.
- The Central and Eastern European regional network held a meeting in Prague in April. Topics included organization of regional networking, development of joint projects for coordination, a web page, perspectives of cooperation within common projects, and funding problems. A series of cross site activities were discussed, including the effects of forest health on biodiversity, ecosystem processes in alpine systems, effects of disturbances on semiarid grassland dynamics, detritus input, removal and transfer (DIRT) project, and GTOS. The next CEE regional meeting will be in Zvolen, Slovakia in 2002, linked to the IUFRO conference (International Union of Forest Research Organizations).
- The biannual meeting of the East Asia-Pacific region discussed a multinational experiment focusing on decomposition processes. The Taiwanese Ecological Research Network will organize, host and conduct additional meetings to coordinate this cross-site experiment. An information management workshop was just completed in Mongolia, and focused on building an information managers network in association with LTER and the San Diego Supercomputer Center.
- The web site for the Latin American Regional Network is at: http://ceimo.ing.ula.ve/LA-ECORED/ECORED. Meetings will be held annually, and an executive committee will govern the regional network. Topics currently under consideration include connectivity, educational programs, student exchanges, standardization of data bank, minimum standard installation, and creation of the Americas Regional Network. The Latin American Pilot Project is moving forward, with possibilities including a decomposition project in terrestrial ecosystems and possible relations between productivity and biological diversity.
- The Middle Eastern regional network participated in a workshop on information management held in Bonn along with scientists from a number of Middle Eastern countries. Israeli and Palestinian colleagues are cooperating to collect meteorological data along ecological gradient in rainfall.
- The North American Regional network is working on establishing listserv for all of North America. Next year the ILTER annual meeting will be at the annual meeting of EMAN in Ottawa and will provide a focus for training in information management and international scientific cooperation.
- Only two countries in Western Europe have LTER networks, but it is a fashionable idea and there is interest in a number of countries. There is a proposal in the offing for an EU-LTERNET with a strong social dimension. Strong links need to be established with Central and Eastern European network. There may be a need for a meeting to set guidelines to identify partners in each country.

The U.S. Network Office (NET) reported on several accomplishments of interest to the ILTER Network. Dr. Sonia Ortega will join NET in September on detail from NSF. Her specialty is graduate education, but she will work both with educational and international programs at NET. NET has requested and received supplemental funds from NSF for regional meetings. Each region must decide when they will have their meeting and what countries will be invited. NET is working on developing liaison groups for regional networks. These groups consist of US LTER scientists who will participate in ILTER activities in each region. The purpose of these liaison groups is to on scientific activities by engaging a broader group of people.

Highlights from the Business Meeting

Four main issues were discussed at the business meeting: 1) application for membership by Zambia, 2) possible interactions with ECOBAS, 3) possible interactions with GBIF, and 4) the GTNET-NPP project.

Zambia - Dr. Harry Chabwela presented a petition by the University of Zambia for recognition as an LTER national network. Because the petition by Zambia represented a new national model for LTER, considerable discussion focused on the criteria for recognizing and organizing a national network, that is national or government institution sponsorship. The discussion recognized that other potential ILTER members could advance models similar to that proposed by Zambia, and therefore clear definitions and criteria were needed. In particular, the developing Western European network already faces the need to embrace a common strategy. After this discussion, a motion to accept Zambia as an ILTER network passed unanimously.

ECOBAS - ECOBAS is a modeling database that provides standard documentation for ecological models. Dr. Joachim Benz described ECOBAS aims as 1) complete, consistent and correct documentation, 2) standardized documentation, 3) improve availability of the documentations, 4) coupling reliable documentation and source code, 5) improve transferability.

The ECOBAS WWW server provides two major information services, a registry of ecological models (REM), in which 600 models are documented and there are 200-300 users a day, and the ECOBAS database. The ECOBAS modeling assistant (EMA) can manage models and modules, check completeness, syntax and consistency, make database queries, is easily transferable to text documents and simulation systems (MATLAB, SCILAB, SIMUL), and provides for import and export of models. ECOBAS has asked for affiliation with LTER. Since ECOBAS is clearly not the same thing as a national network, the central question was whether we wanted to stretch our criteria to accommodate them or perhaps to develop a new category for affiliation. A motion was made and accepted to table the application of ECOBAS until criteria for a new class of affiliation could be developed.

GBIF - GBIF, the Global Biodiversity Information Facility (http://www.gbif.org & http://www.gbif.net) is based on a memorandum of understanding between governments and international organizations to develop a federation of biodiversity databases, in which individual members retain control. Criteria for member ship include: a) signing the MOU, b) making a financial commitment, c) sharing

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LTER Activity Grows in Southern Africa

Robert Parmenter (Sevilleta LTER) and Robert Waide (LTER Network Office)

A recent burst of activity among countries in southern Africa that are interested in establishing long-term research programs. Although there are only two formally constituted national networks in this region (Namibia and Zambia), several other countries are working toward establishing networks, and one (South Africa) has initiated cross-site research efforts with the Konza and Sevilleta sites. The African effort is organized under the rubric Environmental Long-Term Observatories of Southern Africa (ELTOSA), whose founding members are Namibia, Botswana, Mozambique, South Africa, Tanzania and Zambia.

Sevilleta LTER researcher Mike Friggens examines a small rodent trap that was visited by some mega fauna at the study site in Krueger Natl. Park

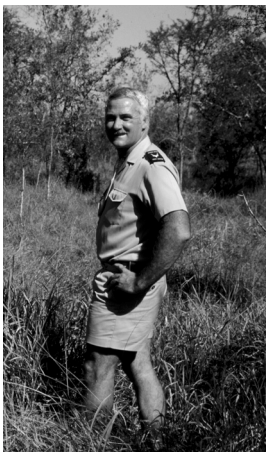
Recent Visit to U.S. LTER sites

During May of 2001, representatives of all of the founding ELTOSA countries except Zambia visited U.S. LTER sites and the Network Office. Participants included Feetham Banyikwa (Tanzania), Rui Brito, Luisa Santos, and Almeida Sitoe (Mozambique), Joh Henschel (Namibia), Susan Ringrose (Botswana), and a large group from South Africa. The trip was sponsored by the Africa, Near East, and South Asia program of NSF's Division of International Programs and organized by the Network Office. After an overview of the U.S. Network presented by James Brunt in the Network Office, the group spent their first few days at Sevilleta. From there, participants in the trip dispersed to various LTER sites, with the biggest group (from South Africa) going to Konza to complete a reciprocal visit (see below).

Various participants visited Harvard Forest, Jornada Basin, Shortgrass Steppe, Kellogg Biological Station, and Virginia Coast Reserve. After their visits, the group reunited at NSF to meet with program officers and chart out the future of the southern Africa LTER programs. Bob Waide represented the U.S. LTER at that meeting, at which the concept of ELTOSA was born.

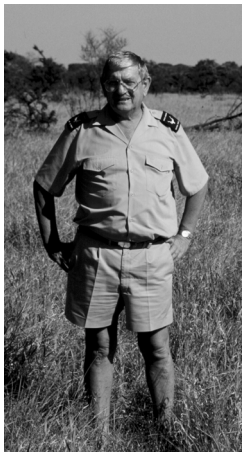
Cross-site ILTER study on grassland fire

A cross-site international study is being developed among the Konza Prairie and Sevilleta LTER sites and Kruger National Park in the Republic of South Africa. Fire ecology in the grasslands of these sites is the study theme, taking advantage of ongoing fire research programs in the African savanna, the tall grass prairie of Kansas, and the desert grasslands of New Mexico.



Two Krueger Natl Park researchers out standing in thier field: small vertebrate biologist Andrew Deacon (above), and fire ecologist Andrew Potgeiter (below).

In April 2000, eight ecologists from Kansas and New Mexico visited Kruger National Park, supported by NSF's International Program. Alan Knapp, Dave Hartnick, Melinda Smith and John Blair (Konza Prairie LTER), along with Bob Parmenter, Mike Friggens, Dave Lightfoot and Tim Lowrey (Sevilleta LTER), worked with South African ecologists to collect preliminary data on plant biomass, nutrient content, and rodent and grasshopper populations on a series of Kruger NP sites that had undergone 50 years of experimental fire regimes. A day-long symposium on fire ecology studies of the various sites was held at the Skukuza Conference Center in Kruger NP.



In May 2001, South African scientists visited the Sevilleta, Jornada and Konza LTER sites. Dr. Harry Biggs, Dr. Rina Grant, Dr. Tony Palmer, Dr. Andrew Deacon, Prof. Winston Trollope, Andre Potgieter, Andries Bronn, Anthony Mills, Size Nibe, and Nick Zambatis constituted the South African delegation. Two fire symposia were held (one each at Sevilleta and Konza), and the ecologists participated in numerous field trips to the respective field research sites.

The results of these exchange visits are leading to a formal cross-site research collaboration, being directed by Alan Knapp (Konza Prairie LTER) and Harry Biggs (Kruger NP). Plans are underway for a second LTER-group visit to Kruger to select study sites and continue collecting preliminary data for the project.

Winston Trollope (KNP), Tim Lowery (SEV LTER) and a Krueger Natl Park guard measure biomass for fuel load information. The height of the disk resting on top of the grass is measured to get fuel load information before prescribed burn research.

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scientific biodiversity data with GBIF, and; d) having at least one GBIF node. Dr. C.L. Hauser invited ILTER and national networks to join GBIF. Further discussion was postponed until more information could be obtained.

GTNET - John Vande Castle gave a presentation on the current status of the GTNET-NPP project. MODIS data products have been available since June of 2000. Several recent workshops have addressed issues important to the GTNET project. A workshop on carbon flux scaling addressed issues of scaling from ground observations to 1 km cells. A MODIS LAI validation workshop was also held recently. The BIGFOOT project has also developed a spatial sampling strategy for scaling up measurements (http://www.fsl.orst.edu/larse/bigfoot). Next steps include: 1) get precise coordinates for each site, 2) potential for FAO purchase of LANDSAT data for each sites, 3) get additional measurements from sites of LCC, LAI, NPP, and; 4) do peer-reviewed publication.

Publications:

Recent Publications of the LTER Community

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Recent Publications of the LTER Community

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Calendar

Coming events of interest to the LTER Community

Baltimore Ecosystem Study LTER annual mtng October 25 & 26, 2001

Palmer LTER annual meeting: November 12-16, 200
This is supplemented this year by a winter meeting at the Institute for Computational Earth System Science (ICESS) at University of California, Santa Barbara. The agenda includes data synthesis, program review, and proposal writing in preparation for the site's third renewal cycle. Contact information:
Charleen Johnson, PAL Logistics Coordinator, 858-534-2708, email charleen@icess.ucsb.edu.

Virgnina Coast Reserve LTER Annual Science Meeting: Jan 11-12

LTER Coordinating Committee meeting WITH SCIENCE MEETING (rescheduled from Sept 2001)
Science Theme: "Land – Water Linkages"
Apr 18-20 at the SEV LTER field station. For details, please see the website:http://intranet.lternet.edu/meetings/future/ScienceSymposiumTheme.html

The Fourth Symposium on the Urban Environment Sponsored by the American Meteorological Society and organized by the AMSBoard on the Urban Environment will be held 20-24 May 2002 in Norfolk, Virginia at the Sheraton Norfolk Hotel. The symposium is being held in conjunction with the 25th Conference on Agricultural and Forest Meteorology and the 12th Joint Conference on the Applications of Air Pollution Meteorology with the Air and Waste Management Association. A number of joint sessions are planned between the conferences. Further details: http://www.indiana.edu/~climate/grimmond/conference/

Coweeta LTER Annual Science Meeting: June 2002

Jornada Basin LTER Annual Science Meeting: July 2002

ESA meeting 87th annual Tucson AZ 4-8 Aug 2002 http://esa.sdsc.edu

FUTURE INTERNATIONAL LTER MEETINGS
2002 - Ottawa, Canada - April 9-13, in association with annual EMAN meeting: "Development of Coordinated Monitoring in Land and Seascapes" in Ottawa

2003 East Asia Pacific regional meeting in Xian, Shan-xi Province, China. This meeting is scheduled for September 10, 2003.

2004 and 2005 - Brazil and Mexico

Other meetings

2002 - INTECOL will be held in South Korea and ILTER is planning on having a presence there.

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