LTER
Network News
Newsletter of the Long Term Ecological Research Network
Vol. 22 No. 1 Spring 2009

A User's Guide to the 2009 LTER All Scientists Meeting

A panoramic view of the YMCA of the Rockies in Estes Park, Colorado, venue of the 2009 LTER All Scientists Meeting (photo by McOwiti Thomas).

The LTER All Scientists Meeting (ASM) will take place this September at the YMCA of the Rockies in Estes Park, Colorado, the same venue as the very successful 2006 meeting. The ASM Program Committee, working with the LTER Network Office (LNO), has developed a stimulating program that includes seven plenary speakers, seven working group sessions for as many as 100 working groups, space for 400 posters, four evening mixers, and pre-ASM meetings for information managers, graduate students, education representatives, international attendees, the LTER Executive Board and others.

Looking back

Some of the old-timers will remember the first ASM meeting held at Estes Park in 1990 before LNO contracted with professional help for the meeting as they do now with the Schneider Group. People waited in a long line as a busload of people arrived from the airport and Network Office staff scurried to find correct room reservations. Folks chipped in to help Caroline Bledsoe sort all the room keys from one large pile on the counter. Adrienne Whitener quickly pointed to a box of earplugs for people worried about snoring roommates.

Back then, Rudolf Nottrott set up the one portable workstation with a "high speed" modem link back to Seattle to provide email access for everyone to use during the meeting. Since the "Web" didn't exist, meeting information and program materials were only available in hard-copy. Wireless internet and portable cell phones didn't exist either. The social mixers were held in, of all places, the chapel—the largest room available back then.

The first morning of the meeting, the late Tom Callahan, who always encouraged these meetings, could be seen smiling with a cup of

See "ASM", p. 3

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 Prairie; 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.

In This Issue

The Network News

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LNO renewal nearly complete

The renewal of the six-year Cooperative Agreement that supports the LTER Network Office (LNO) is in the final stages of processing at the National Science Foundation (NSF). If all goes smoothly, we hope to have the agreement in place by the time this newsletter goes to press. The Cooperative Agreement will provide funds for activities in four operational areas: Research Synthesis (including Science Council Meetings); Development, Implementation, and Maintenance of Cyberinfrastructure (including further development of the Network Information System); Core Services to the Network and sites (such as facilitation of meetings); and Development and Outreach (such as the development of a Network Strategic Communication Plan). The scope and priority of activities in each of these operational areas is determined with input from the Executive Board, the National Advisory Board, and LTER standing committees.

The Cooperative Agreement is based on a proposal submitted from the University of New Mexico in March, 2008. After a very successful site visit last September that resulted in a recommendation for full funding, the LNO responded to requests from NSF for adjustments to the proposal budget to match available funds. The Cooperative Agreement will continue LNO operations at current funding levels for the next six years. Additional funding requested in the proposal to support new Decadal Plan activities is still under discussion.

Hard work and careful preparation by LNO staff resulted in this successful renewal of the Cooperative Agreement and the continuation of core services to the LTER Network for another six years. I'd like to extend my appreciation to my colleagues in the LNO for their excellent work and for the many sacrifices that they make in support of the LTER Network. The LNO is dedicated to supporting the collective goals of the LTER Network as effectively as possible. To that end, the Executive Board conducts an annual survey of LTER sites to evaluate the performance of the LNO. This year, the survey will be open to all LTER scientists and students. I look forward to sharing the results of that survey in the next newsletter.

By Robert B. Waide, Executive Director, LNO

The LTER Network Office is dedicated to supporting the collective goals of the LTER Network, including education and training (photo by McOwiti Thomas).

ASM (continued from p. 1)

coffee at breakfast, even though his flight had been diverted to Colorado Springs due to bad weather and he had to travel the rest of the way late at night by bus. Jerry Franklin welcomed everybody at the first plenary, struggling to read his notes as the lights were turned down; "PowerPoint" was almost unknown and LCD projectors did not exist yet.

The plenaries lasted all morning, and in the afternoons there were six workshops held in the back of the auditorium. Posters were taped to every available space on the walls and foyers of the auditorium. Jokers even put some in the restrooms. Even with the short socials before dinner, all the kegs in the town of Estes Park were consumed by the end of the meeting. Committee meetings and plenaries to report the workshop results took place after the dinners. Almost 250 people attended the meeting, very few of them graduate students; there was no Graduate Student Committee and the International LTER program did not exist yet.

L-R: An ASM working group found a unique way to bond during the 2006 ASM (photo by Don Henshaw); a plenary sessions during the 2006 ASM (photo by McOwiti Thomas); elk are a familiar sight at Estes Park in the fall (photo by John Magnuson).

Looking forward

This year's ASM will start for most people on Sunday, September 13, with the anticipated jolt of the wheels hitting the runway at Denver International Airport. You want to arrive early and plan three to four hours to get to Estes Park. (It will take the same three to four hours to get back to the airport, so you want to book your return flights later in the day after the meeting ends.) From your plane, take the short train ride to the main terminal and retrieve your baggage from the carousel on level-5. Staying on the same level, go to the Estes Park Shuttle booth and confirm your reservation for your trip to Estes Park, and then continue outside to the van.

On the way to Estes Park you will probably see vans sporting university logos and government license plates distinct from the green and white plates on the other vehicles. These will probably be packed full of overly enthusiastic-looking students, with luggage and gear of all types piled on top, including bicycles and maybe even skis. Upon arriving at the YMCA, proceed to the main Administration building to receive your registration packet and information for your lodging.

Although most people arrive on Sunday, some international participants in the Ecosystems Services workshop will already have been at the YMCA two days, arriving the previous Friday. The Information Managers, Education representatives, and participants in the LTER Graduate Student workshop arrive on Saturday, and have their dinner and mixers that evening. The Graduate Students, Education Representatives, and Information Managers have full-day meetings on Sunday, and the Executive Board meets the same afternoon. The first plenary will be in the auditorium Sunday evening, with Dave Coleman talking about the early days of LTER as probably only he can do, followed by a social mixer.

The formal meeting begins in the auditorium on Monday morning, and Bob has promised to refrain from playing anything from the "Village People" during his opening remarks. The first plenary talks will get everybody thinking about why we are all at the meeting. The plenary will be followed by a group picture before everybody heads to lunch, which will be followed by two working group sessions, dinner, and the evening poster session and mixer. The schedules for Tuesday and Wednesday are similar. After dinner on Wednesday, there will be a social and entertainment to mark the end of the meeting.

You want to remember that you will be at 8,000 feet, so you should drink plenty of water to help get used to the altitude. Alcohol contributes to altitude sickness, so moderation is the watchword. Consider yourself warned anyway... All meals for your stay are at posted times in the cafeteria, and lines may be long. You will likely share the line with a host of other visitors, including retirees on vacation, attendees at family reunions, and grade-school students.

The agenda for the meeting is planned to occupy all your time, but you may want to fit in walks, maybe a hike or two with friends, and perhaps a meal in town if you need a break from cafeteria food. A road trip or shuttle bus ride up to Rocky Mountain National Park can be pretty spectacular, too. The weather will be "variable"; it could be warm or it could be snowing. You can take advantage of the facilities at the YMCA, including the gym, swimming pool, climbing wall, and games like horseshoes, or putt-putt and frisbee golf. For the more sedentary, there are always plenty of elk to watch. There will be an on-line photo contest, a trivia contest, and other events during the meetings.

The YMCA has all the necessary amenities for a successful stay, including a shop to buy sundries, an ATM machine, wireless internet, and plenty of places for LTER scientists to put their heads together and come up with the next great idea.

There have been many changes at Estes Park since our first meeting there in 1990. Most recently, the new Long's Peak and Emerald Lodges are under construction and a new conference center will be ready for our meeting. But much has stayed the same, too, particularly the magnificent views and the many opportunities to enjoy surrounding Rocky Mountain National Park. Please plan on attending the 2009 ASM and enjoying the premiere activity of the LTER Network.

By John Vande Castle, & Robert Waide, LNO

How the Arctic LTER helped me prepare to be a mom

By Laura Gough, ARC,
University of Texas at Arlington*

Being a mother and conducting field research at a remote site have a lot in common. Many summers at the Arctic LTER helped me develop relevant skills that I put to use every day with my three children. But it was Marilyn Walker who inspired me to have children more than a decade ago as she taught me about arctic botany while serving homemade cloudberry cobbler to her 5-year-old son, me, and her students at Toolik Field Station. Here are some of the lessons I learned.

Laura Gough with her first REU-in-training for Toolik, 2003 (photo provided by Laura Gough).

1. Acceptance of tedium is crucial in both arenas. In the midst of tedious and exhausting field work, you lose track of the whole purpose of the exercise, especially during dismal weather. How many more plots are left to sample before dark (which, conveniently, doesn't happen for much of the arctic summer)? How many times will my 2-year-old ask to hear the "Elmo Song"? Why do these children not understand what bedtime means? Some level of acceptance is needed for sanity.

2. Flexibility is essential. If you're trying to measure photosynthetic rates and the sun hasn't come out for six days, you need to make good use of that newly freed up time, especially when you're at a remote site. Similarly, when you have prepared for a full day at work and your son's school calls because he is coughing like he has tuberculosis or just threw up all over his shoes, you have to be flexible as well. Think on the fly, and always have a backup plan.

3. Prepare for every contingency. There is no way to really prepare to have children. But once a child has arrived, preparation becomes a crucial key to sanity and success, just like with field work. At Toolik, when something breaks or goes missing, you have to press on, no matter how much you might like to throw in the towel; so you plan and prepare for as many contingencies as possible. This is quite similar to preparing a diaper bag to go on an errand—for example, to go on a 3-hour plane flight; you just don't know what's going to happen. (And I pack the diaper bag for plane trips as I would for 3 days away from civilization.) Also see #2.

4. Occasionally stop, take a deep breath, and get your bearings. That feeling of not really knowing what you're seeing because you've collected so much data for so many days is a lot like watching a child blow up at something that normally is not upsetting to her. You have to step back and figure out what has changed, check for fever, read the baby book, talk to your "village" that's helping you raise your children, and adapt as needed.

5. Take each day as it comes. Enjoy the rewards (a rainbow across the tundra, the squeal of a small child when he picks up a wriggling earthworm), and store them away to get through the tough times. Luckily, such wonderful moments do come—often.

**Laura Gough is serving as temporary Program Director in the Division of Environmental Biology at NSF until August 2009.*

This is the first of what we hope will become a regular column featuring humor, personal experiences, and reminiscences about life as an LTER researcher.

LTER Network embarks on Strategic Communication Planning

The LTER Network represents a vibrant scientific community and a vital national resource. Among other discoveries, LTER scientists have unraveled complex problems associated with emergent diseases, invasive species, climate change, and natural and anthropogenic disturbances. Yet, "LTER" is not yet branded (i.e., a household word) in the mind of the public. Clear opportunities exist for better coordinating public communication and outreach across the Network and for improving the dissemination of information to LTER clients and the public.

To enable more effective communication with the public, the LTER Executive Board has asked the Network Office to develop a Strategic Communication Plan for the LTER Network. The plan will incorporate input from all LTER sites as well as advice from the broader community of communication experts. The end product will be a "living" Strategic Communication Plan for the LTER Network. The plan will address: (1) who LTER wishes to communicate with; (2) why LTER wants to communicate with them; (3) what LTER desires to communicate; (4) how the information can be communicated most effectively; and (5) when and how often LTER needs to communicate with its stakeholders. The plan will include suggested public communication and outreach tools and products; proposed activities and tasks (e.g., development of an LTER media kit); and timelines, metrics and milestones.

It is envisioned that the strategic plan will achieve several outcomes. First, the plan will encourage LTER sites and the Network to become more proactive in seeking publicity for achievements by LTER scientists and educators. Second, findings attributable to LTER site scientists will be increasingly cited in important media outlets (both professional and public), and LTER scientists will increasingly be invited to participate in public decision-making (e.g., providing expert testimony). Third, LTER will achieve greater name recognition throughout the world for the quality of site and Network science. Fourth, the strategic plan will specifically address new ways to employ information technology to engage underserved groups in the research and education activities proposed in the LTER Decadal Plan.

The strategic planning effort will include virtual and face-to-face planning meetings whereby participants assess LTER strengths, barriers and opportunities; identify and prioritize strategies, tactics, and actions; develop timelines, metrics and milestones; and assign responsibilities. The Executive Board and Science Council will review the plan, and it will be revised accordingly. The final plan will be published and broadly disseminated to sites, scientists, and educators where it can serve as a reference and a road map for action.

At this stage, we welcome your engagement in the process. We are especially interested in forming a planning committee that includes LTER communication experts and other stakeholders, as well as nationally recognized experts in both traditional and non-traditional (e.g., podcasts, social networking) communication mechanisms. If you are interested in possibly participating in the planning effort, or you know someone who would make an ideal participant, please send your nominations and/or self-nomination to *wmichener@LTERnet.edu*.

By William Michener & McOwiti Thomas, LNO

Final NEON Observatory Design released

In February 2009, a review team appointed by the National Science Foundation (NSF) and led by Dr. Alan P. Covich completed a rigorous assessment of the National Ecological Observatory Network (NEON)'s science and education implementation plan, including a formal merit review of the NEON Observatory Design (NOD) document. The review appraised the network and informatics designs against the goals of advancing theory and developing new ecological forecasting capability. The panel concluded that NOD will meet these challenges and is on course for the NSF Preliminary Design Review (PDR) of NEON in June 2009. The NOD has also been discussed with NEON's internal Science, Technology, and Education Advisory Committee and the LTER steering committee, and draws on input from many scientific colleagues. The PDR will evaluate the scope and baseline budget for the Observatory and is a major step in NSF's Large Facility process.

The peer-reviewed NOD is now available to the ecological research community. To download a copy, visit *www.neoninc.org*. The NOD defines NEON's top level science and education requirements, the Observatory sampling strategy in space and time, and analyzes how NEON data could enable ecological forecasting in the future. The document includes a complete list of the 20 NEON candidate core sites (showing latitude and longitude) as well as the list of 40 candidate relocatable sites (with site names and science themes). It also shows where NEON proposes to co-locate its instruments with existing LTER research facilities.

NSF and NEON, Inc. look to the LTER community to be early adopters and key users of the NEON facility. NEON, Inc. invites feedback and discussion of the ideas contained in the NOD. Feel free to contact Dave Schimel (NEON Chief Executive Officer) or Michael Keller (NEON Chief of Science) directly.

By Dan Johnson, Public Information Representative, NEON

View from DC

Science and Policy: Washington, DC., in the Obama era

To say the presidential elections of 2008 were historic is an understatement. The election was significant for more than the obvious reasons, however. Science, rarely an issue in political campaigns, was an issue in the 2008 election cycle.

Robert Gropp

Arguably, science became a campaign issue because scientists grew weary of an expanding list of reports chronicling situations where politics trumped science. From climate change to environmental protection and species conservation to evolution education, the early years of the 21st century have been witness to tense times between science and politicians. Within this environment, a growing number of scientists came to realize that science does and must operate within a political system.

Leading into the 2008 elections, many scientific societies and individual scientists began to organize so that the scientific community could ask questions and demand answers of candidates for public office. Groups such as Scientists and Engineers for America reorganized following less than successful efforts in prior elections, and encouraged scientists to engage in the process. Working through scientific societies and other coalitions, scientists sought to know how the potential presidents would approach science if elected.

Because calls for an articulated science policy came from respected organizations such as the American Institute of Biological Sciences (AIBS), American Chemical Society, American Physical Society, American Association for the Advancement of Science, and from rank and file scientists, the candidates responded. The eventual winner, Barack Obama, pledged to "return science to its rightful place." Happily for science supporters, this has translated thus far to a reversal of President Bush's prohibition on federal funding for stem cell research, pledges to support sustainable energy and agriculture research, new investments in science education, a goal of doubling federal funding for research and development, and a commitment to use science to inform policy decisions.

Even if individuals disagree with specific actions, most scientists should appreciate the attention that science has received in the first months of the Obama administration. Following his inauguration, President Obama quickly sought to name top scientists to key administration posts. Among these, Dr. John Holdren was tapped to head the White House Office of Science and Technology Policy and serve as the President's science adviser, Dr. Steven Chu, a Noble Laureate, was picked to serve as Secretary of Energy, and Dr. Jane Lubchenco, an ecologist, was selected to take the helm of the National Oceanic and Atmospheric Administration.

These quick appointments were a few of the President's early actions on science. He also worked with Congressional leaders, particularly House Speaker Nancy Pelosi (D-CA) and Senate Majority Leader Reid (D-NV), to ensure that science agencies were included in the American Recovery and Reinvestment Act (i.e., the economic stimulus package). Within this legislative package, the National Science Foundation received a $3 billion infusion of capital. Although some of this money is directed to science education and workforce programs, the majority will be applied to infrastructure projects and funding competitive grants received since the start of the fiscal year (October 1, 2008) that otherwise would not have been funded because of insufficient resources. Moreover, with the likely prodding of former Republican Senator Arlen Specter (PA), the National Institutes of Health (NIH) received an additional $10 billion in stimulus funds. Specter, a long-time champion for the NIH, was at the time one of three Republicans whose vote was required for Senate passage of the stimulus legislation.

The early days of the Obama administration have also included a Presidential Executive Order lifting restrictions on stem cell research, the White House has requested public comment on a draft Executive Order that would guide the application of science in the federal regulatory process, and Congress has granted the Departments of Interior and Commerce authority to expeditiously reverse Bush Administration environmental regulations.

In addition to these actions, the White House has pledged to work to respond to climate change. On April 17, 2009, the United States Environmental Protection Agency (EPA) announced that "after a thorough scientific review ordered in 2007 by the U.S. Supreme Court, the Environmental Protection Agency issued a proposed finding Friday that greenhouse gases contribute to air pollution that may endanger public health or welfare." The proposed finding, which now undergoes a period of public comment, identified six greenhouse gases that pose a potential threat. This is the final step in the deliberative process that the EPA must follow prior to issuing a final finding. Before taking any steps to reduce greenhouse gases under the Clean Air Act, EPA would conduct an appropriate process and consider stakeholder input. Yet, despite this step, President Obama and EPA Administrator Jackson have repeatedly indicated their preference for comprehensive legislation to address this issue and create the framework for a clean energy economy.

Meanwhile, Representatives Waxman (D-CA) and Markey (D-MA) released a 600-plus page draft bill to respond to climate change. The plan, released prior to the Easter Congressional recess, is expected to begin working its way through the House's committee process in April and May. Reports indicate that House Democratic leaders have set an aggressive schedule for climate change legislation, hoping to have the House consider legislation prior to Memorial Day. Many policy experts now think that the House will have to move climate change legislation forward to prompt action in the Senate, where the Environment and Public Works Committee has moved slowly on the issue in the 111th Congress, and where it is expected that a separate bill dealing with energy policy will emerge from the Committee on Energy and Natural Resources, chaired by Senator Jeff Bingamen (D-NM).

See "DC", p. 7

DC (continued from p. 6)

The new administration has not steered away from what have traditionally been controversial political issues. Addressing the National Science Teachers Association conference in New Orleans, Louisiana, Secretary of Education Arne Duncan told gathered science teachers on March 20, 2009: "Science education is central to our broader effort to restore American leadership in education worldwide." He continued, "[President Obama] understands that a nation not only needs its poets and scholars to give us words and wisdom, but also its inventors and engineers to design new cell phones, rebuild the levees of New Orleans, and find new sources of energy and new treatments for disease. Moreover, he is a president who will not allow scientific research to be held hostage to a political agenda. Whether it's global warming, evolution, or stem cell research, science will be honored, respected, and supported by this administration." Duncan further challenged teachers to "move the curriculum beyond dinosaurs and volcanoes" and take the best ideas "to scale in tough inner-city districts as well as rural areas that cannot find qualified teachers in every subject." Duncan challenged teachers, stating that "together, we need to change the national dialogue about science, to prepare our kids to be both honestly critical and technically competent."

How much more energy is there for science? Only time will answer this question, but scientists should recognize that science enjoys a degree of favor in Washington, DC, at this time in history. It is now incumbent on members of the scientific community to stay, or become, engaged with their political leaders. It is when scientists become removed from the process that science becomes relegated to the sidelines and risks being manipulated for political gain.

Importantly, many scientific societies maintain a strong science public policy presence in Washington, DC. AIBS is one of these organizations. Through the Public Policy Office, AIBS works to bridge the communication gaps that arise between scientists and policymakers, and work to provide scientists with tools and resources to be effective advocates for science. Recently, AIBS launched a new online resource, the *AIBS Legislative Action Center* (visit *www.aibs.org* for details). This unique tool allows scientists to quickly and effectively communicate with members of Congress and senior executive branch officials. In just a few seconds, you can visit this site and send a prepared letter to your member of Congress asking that he/she support federal investments in research, or thank your Representative or Senator for a specific vote. Spend a few minutes on the site and you can personalize a letter to further increase its impact. It is that easy—all you need to know is your zip code.

By Robert Gropp, Director of Public Policy,
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NSF announces ULTRA-Ex

Urban Long Term Research Area Exploratory Awards

The National Science Foundation (NSF) has announced the first program solicitation for Urban Long-Term Research Area (ULTRA) Exploratory Awards—or ULTRA-Ex. The solicitation is co-sponsored by the U. S. Forest Service. The NSF and Forest Service, as a result of strategic planning in both agencies, have recognized the need to expand the knowledge of urban natural resource and human interactions, with the goals of sustaining these critical resources while creating productive and livable human environments. The new program is expected to provide $4.8 million over two years, for up to 16 awards across the United States. The announcement and request for proposals can be found at: *http://www.nsf.gov/dir/index.jsp?org=bio*.

"ULTRA-Ex will provide support to enable teams of scientists and practitioners to conduct interdisciplinary research on the dynamic interactions between people and natural ecosystems in urban settings in ways that will advance both fundamental and applied knowledge," said Henry Gholz, NSF Program Director in the Division of Environmental Biology. Teams will require the involvement of researchers from the social and behavioral, ecological, and technical sciences, as well as partnerships with communities.

According to the solicitation, this unique new partnership will enable employees of the Forest Service and other federal agencies to participate as Principal Investigators (PIs) or co-PIs of proposals, if permitted by the organization submitting the proposal. But any support for activities at the federal agency must be provided through sub-awards. A limited amount of funding may be used to support Forest Service researcher salaries using Forest Service-contributed funds to the program, up to $50,000 for any ULTRA exploratory award. Salary support cannot be provided for other federal agency employees.

NSF has supported the Long-Term Ecological Research (LTER) program for three decades, with 26 projects currently existing, including two urban sites in Phoenix and Baltimore. Over this time, the Forest Service has collaborated in supporting seven of the LTER sites, including the Baltimore Ecosystem Study (BES) site.

Recent strategic planning by the LTER community has highlighted the need for greater integration of the social and ecological sciences across the LTER network, as evidenced in its decadal plan and the strategic research initiative titled "Integrative Science for Society and the Environment." LTER planning efforts, the success of the urban LTER programs, and the success of the Dynamics of Coupled Natural and Human Systems Program (also co-funded and coordinated by NSF and the Forest Service) have led NSF and Forest Service leaders to jointly explore possibilities for development of a network of large-scale ULTRA projects.

Although ULTRA-Ex projects should enable research teams to develop more cohesiveness in anticipation of future ULTRA competitions, the primary products of ULTRA-Ex projects are expected to be publications and presentations for scholarly and practitioner audiences that disseminate research results, especially in peer-reviewed journals. Any potential competitions for ULTRA in the future would be open to all interested research teams, regardless of whether they have previously received an ULTRA-Ex project award.

Compiled by McOwiti Thomas, LNO
& Henry Gholz ,NSF

Cedar Creek holds first

It was getting quite embarrassing – during our scheduled summer tours, concerned citizens would get excited about our work at Cedar Creek Ecosystem Science Reserve (CDR) and offer to help. "What can we do to volunteer? What can we do to help?" I was often at a loss. As a research facility, most scientific work is handled by scientists and student interns. Trail maintenance is a function of our capable building and grounds team. A few students from a local community college cleared a few areas of old experiment hardware, what we affectionately call "ecotrash". But even that task wasn't suitable for families or other civic groups. How could we help this body of willing and interested citizens stay engaged?

Then a truly interesting thing happened—a case of "BudBurst to the rescue!" Purely by chance I learned about Project Budburst through Jeff Corney, CDR's associate director. Looking at the postcard he gave me, I wondered whether it would make a nice program for teachers to use with their students. Thus, the seeds for an outreach possibility were planted in my mind. But it was a list of citizen science projects compiled by Barry Jones, Visitor Services Specialist at the USFWS Minnesota Valley NWR, that caused the idea to blossom.

From Barry's list of 52 citizen science projects, I selected five that were either local in scope or easy to conduct. I then contacted members of each project and proposed that

Citizen scientist LuAnn Marotte practices using a secchi disk, an instrument used in the Minnesota Pollution Control Agency's Citizen Lake Monitoring Program (photo by Mary A. Spivey).

Andrews LTER partners ONRE

The Andrews Forest LTER Program has teamed up with the Oregon Natural Resources Education (ONRE) Program to connect Oregon K-12 educators with Andrews Forest LTER research. The main activity of the partnership is the "Teachers as Researchers" project.

In 2008, 13 high school teachers from around Oregon participated in the project, which began with a 2-day workshop at the Andrews Forest. This workshop was the first in a series of three workshops connecting teachers to researchers, and the foundation for subsequent workshops. The overall goal of the project was to increase teachers' understanding of environmental science research and to expand their capacity to design relevant field-based science inquiry projects for their students.

Data from final project evaluations, teacher reflection papers, and follow-up surveys indicate that the inaugural project was a success. Consequently, the Oregon Watershed Enhancement Board will provide funding for the ONRE Program to continue the "Teachers as Researchers" project, with a watershed focus for 2009-10. Teachers will interact with scientists, teacher mentors from the Andrews LTER Research Experience for Teachers (RET) program, and watershed council coordinators in three watersheds along a gradient from the forest to the sea--the Andrews Forest's McKenzie River Watershed; the Mary's River Watershed, which spans the Newton Creek Wetland and the Oregon State University Campus; and the Oregon Hatchery Research Center in the Alsea River Watershed.

Top: Andrews Research Experience for Teachers (RET) fellow Kurt Cox shows teachers the field investigations he does with students at the Andrews. (Photo by Susan Sahnow). ***Left:*** Teachers weigh a snake at field site of former Andrews LTER RET fellow, Jeff Mitchell. (Photo by Kari O'Connell). ***Bottom:*** Teachers learn about tree canopy research at the Wind River Canopy Crane near Carson, WA. (Photo by Kari O'Connell).

By Kari O'Connel, AND

Citizen Science Field Day

they come to CDR for a Citizen Science Field Day to present their projects. Every single one enthusiastically agreed.

The final agenda comprised the following projects: the Minnesota Odonata Survey Project, Minnesota Pollution Control Agency Citizen Lake and Citizen Stream Monitoring Programs, Monarch Larvae Monitoring Project, Project BudBurst, and the CDR-based Red-Headed Woodpecker Recovery Project. The target audience included the general public, teachers, families, 4-H, and Scout groups. The coordinator of Project WILD, which is sponsored by the Minnesota State Department of Natural Resources, donated posters to give away, while refreshments were augmented by a bake sale provided by our local Junior Master Gardener group.

Speakers delivered 15-minute presentations, after which the audience visited each project's display. Topics during the question and answer sessions ranged from sampling techniques for butterfly larvae, to the use of a transparency tube in stream monitoring, to the purpose of fire in maintaining red-headed woodpecker habitat.

The final event of the morning involved participants taking nature walks to see the Red-Headed Woodpeckers in their natural habitat and accompanying Barry to identify trees to use in Project BudBurst. The goal was to empower people with the tools to begin their observations right away.

At the end of the day, 21 participants had attended this first Citizen Science Field Day. The nine presenters each signed on at least one new volunteer and are looking forward to returning to speak next year.

Participants reported being pleased with the level of information given in the presentations, the opportunity to learn and volunteer for the projects, and the chance to get outside and practice some new skills. With minimal input, the event enabled citizens to participate in and contribute to science as well as improve the perception of CDR as a viable, approachable community member.

By Mary A. Spivey, Education Coordinator, CDR

Warmer climate causing increase in tree mortality

A new study published in the journal Science documents an increase in tree mortality rate in old-growth forests across the West during the past 50 years. The increase in mortality affects all sizes and common species of trees. The documented doubling of mortality rates over the past few decades could significantly change forest composition and structure.

The authors considered several possible causes of the increase in mortality, including competition and aging of older trees, and concluded that stress related to climate warming is the best explanation. This increase in so-called background mortality is not as obvious as large fire or insect killed stands of trees, but given the large areas of "undisturbed" forests, it could have equivalent impact on the carbon cycle. As more trees die the forests will absorb less carbon dioxide from the atmosphere.

This work is based on long-term forest plots established decades ago, many by Jerry Franklin and associates, at the HJ Andrews LTER, Cascade Head, and Wind River Experimental Forests and several National Parks in Washington and California. The study highlights the importance of maintaining long-term experiments and observation programs.

Mark Harmon, Andrews Forest LTER Scientist and Professor at Oregon State University, measures trees as part of a long-term permanent plot study on vegetation. Plots are located at the Andrews Forest LTER and other sites across the Pacific Northwest (photo by Lina DiGregorio).

Andrews LTER scientist Mark Harmon, one of the paper's authors and professor of forest science at Oregon State University, observed, "This exploratory analysis points us in the direction of new studies of the existing long-term data. For example, we need to examine records for trees in the 100–200 year age class and probe the mechanisms of mortality. We also need to examine what is happening to these dead trees—are there enough to turn the stands into carbon sources for the atmosphere? It is essential to keep these and similar observations going."

The article, "Widespread Increase of Tree Mortality Rates in the Western United States", is available online at *http://www.sciencemag.org/cgi/content/full/323/5913/521*.

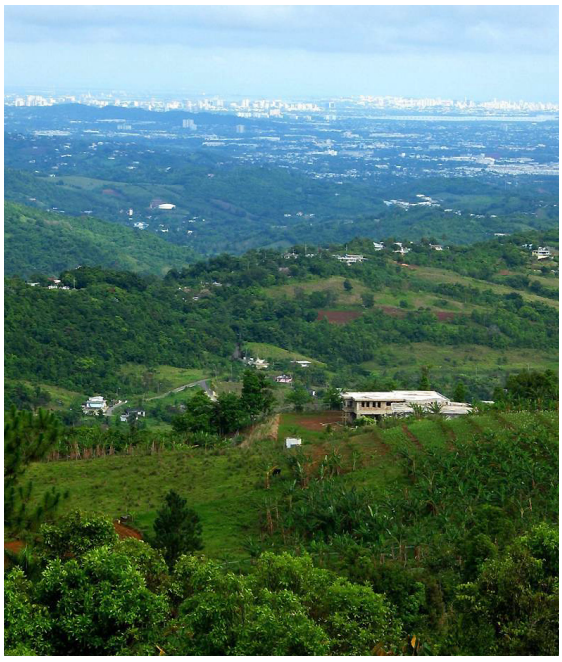
By Lina DiGregorio, AND

Luquillo LTER studying recent environmental changes

Tropical environments are changing fast due to deforestation and regrowth, urbanization, climate change, and other forces. The consequences are immense for the whole array of ecosystem services that people require. The Luquillo Long-Term Ecological Research Program (LUQ) is tackling these issues in Puerto Rico. LUQ began in 1988 and focused on natural disturbances (hurricanes, landslides, droughts, floods) and ecosystem responses to them. That work revealed patterns of resistance and resilience to cycles of natural disturbance. But how will the tropics respond to directional changes in land use and climate?

The LUQ study region is well-suited to answering this question. First, urbanization has been rapid, and there is a strong gradient of land use from El Yunque National Forest to the city of San Juan with 1.3 million people. Along this gradient, for example, LUQ is studying how urbanization affects stream chemistry and organisms. Second, there is also a strong gradient in climate, from the coast to the peaks of the Luquillo Mountains at 1075 meters. Along this gradient, for example, LUQ is studying how trends in climate apparently affect the distribution of tree species. Understanding these stream and forest changes in space helps us predict changes in time.

LUQ takes four approaches to understanding environmental change: long-term observations to describe change in time, gradient analyses to describe change in space, experiments to understand mechanisms of change, and modeling to conceptualize and extend our results. Some examples follow.



View from the Luquillo Mountains toward San Juan, Puerto Rico (photo by Jess Zimmerman).

Our long-term observations have shown how the Luquillo Mountains area has undergone deforestation, reforestation, and urbanization. By 2002, 19 per cent of the mountain area was urban. Over the past few decades, rainfall in the mountains has decreased between 1 and 2 mm a year whereas the amount of water extracted by humans from Luquillo streams has increased by 190 mm/yr. Air temperatures have increased in nearby urban areas and may be changing in the Luquillo Mountains. The supply of water for humans and healthy streams is threatened.

Our gradient analyses have shown that tree communities change significantly at about 500, 700, and 900 m elevation, probably due to such factors as mean nighttime cloud level. At higher elevation there are restricted, endemic tree and other species. With drying or warming, these boundaries may shift upwards, and endemics may be literally driven off the top of the mountain.

A core LUQ project is the Canopy Trimming Experiment (CTE). The hurricanes that strike Puerto Rico have two big impacts that affect forest response—canopy damage, and resulting debris deposition on the forest floor. How do we distinguish the light and temperature impacts due to canopy damage versus the soil and nutrient impacts due to debris? By trimming the canopy of forest plots and creating different combinations of canopy removal, debris addition, and controls, the CTE separates the effects of these factors on plant, animal, microbe, and biogeochemical responses. We are repeating the trimming to simulate the effects of increased hurricane frequency. Treatment results are preliminary, but one result so far is that a slight, seasonal temperature increase elevates carbon dioxide (CO_2) emission from the soil.

Forest damaged by Hurricane Georges in the Luquillo Mountains, Puerto Rico (photo courtesy of Luquillo LTER).

See "Luquillo", p. 11

Luquillo (continued from p. 10)

This result connects with the final example of LUQ's research approach—modeling. The CTE will test predictions of the Century Soil Organic Matter Model (CENTURY) of soil organic matter accumulation and nutrient dynamics, as parameterized for the study site under different hurricane disturbance regimes. The model indicates lower levels of aboveground carbon and higher levels of soil carbon, nitrogen and phosphorous mineralization, and organic soil phosphorous under a regime of frequent hurricanes. CTE results will test these predictions and have implications for ecosystems subject to a changing regime of cyclonic storms.

These examples show how LUQ science relates to environmental issues in Puerto Rico, similar tropical areas, and the globe. While its research addresses these issues, LUQ's education program produces scientists (many minority) to tackle them. The LUQ education program includes high school students who gather climate and vegetation data, undergraduates doing original research with LUQ mentors, and graduate students with LUQ advisors, including PhD students working in a new IGERT program focusing on natural-human ecosystems in the urbanizing tropics. LUQ also has designed a web-based middle school curriculum for teaching ecology. With both its research and training LUQ is addressing the challenge of changing environments in the tropics.

Right: Meteorological station in the Luquillo Mountains, Puerto Rico. ***Above:*** Census of trees in forest of the Luquillo Mountains, Puerto Rico (photos courtesy of Luquillo LTER).

By Nick Brokaw, LUQ.

Reinvigorating the LTER Climate Committee

In 2007, Doug Goodin stepped down as Chair of the LTER Climate Committee. Having worked for the Network for more than a decade, Doug decided to move on to other endeavors. Doug, thanks for your service! At the behest of LTER leadership I have agreed to chair the Climate Committee.

In his report to the LTER Executive Committee dated 11 June 2007, Doug, outlined the purpose of the Climate Committee and offered arguments for its continued existence. He also outlined how the structure and composition of the committee could be changed to better serve the needs of the LTER community. Offering such advice is surely the duty of those who serve as committee chairs for more than a decade.

In his analysis, Doug noted that there were more committee members than there were LTER sites. How could a committee be more successful than that? This demographic statistic reminded me of my University's academic procession committee. When I took over the chair of that committee, I found that it was populated in part by people who had died in the previous decade. Similarly, the current Climate Committee roster lists "members" whom we might call retired. Doug recommended one committee member per site. To facilitate the Committee's work, he suggested the formation of an executive committee of dedicated colleagues, and that the position of committee chair be term-limited. This is a somewhat problematic proposition because we are a "long-term" network with a history of taking on activities that are never finished or require a protracted and dedicated effort. Like the sites, the Climate Committee needs to plan for the orderly transfer of leadership. Discovery and training of the next chair should be one of the tasks of the Climate Committee.

Doug also recommended that the Committee be constituted in such a way that both climatological and hydrological sciences are adequately represented.

The lifeblood of a network is membership participation. Without communication, participation falters. The glue that holds it all together is an agenda of shared values and activities. That is why the Climate Committee has a long history of completing activities valued by the network.

The proposed reinvention of the Climate Committee must include the crafting of an agenda for the coming decade. This agenda should be completed at the All Scientists Meeting this fall. To that end a roster of Committee activities needs to be built this summer. That will require the help of LTER site representatives.

To get the ball rolling, I am asking committee members to think about a proposed thematic follow up to David Greenland, Douglas G. Goodin, and Raymond C. Smith's 2003 Oxford University Press synthesis volume, "Climate Variability and Ecosystem Response at Long-Term Ecological Research Sites". For such a long-term project, a planning horizon somewhere around 2013 might be appropriate. As we get ourselves reorganized, I will put out the call for suggestions and pester sites for ideas to reinvent the Climate Committee, and get ready for the All Scientist Meeting.

The Goodin report may be found at *http://intranet.lternet.edu/modules.php?name=UpDownload&req=viewsdownload&sid=3*

By Bruce Hayden, VCR,
Chair, LTER Climate Committee

Harvard Forest hosts workshop with an eye to the future

A diverse group of social and ecological scientists gathered at the Harvard Forest late this March through early April to ponder potential ecological futures around Long Term Ecological Research (LTER) sites. They were participants in the "Scenarios of Future Landscape Change Workshop," which was designed to encourage prescient thinking in coupled human-natural systems where true prediction is not possible. The workshop was funded by the National Science Foundation through the LTER Network Office and participants represented 16 LTER sites and all were involved in some stage of scenario planning for the region surrounding their site.

Left to right: Scott Ollinger, Michaela Buenemann, Ted Gragson, Morgan Grove, Patrick Bourgeron, Stan Gregory, Thomas Spies, Dunbar Carpenter, Mei Yu, Nancy Grimm, David Foster, Teresa Hollingsworth, David Mladenoff, Laura Schneider, Scott Collins, Chuck Hopkinson, Robert Scheller, Craig Harris, Tom Stone, Peter Groffman, Sherri Johnson, Mary Martin, John Harrington, Robert Pontius, Julian Jenkins, Charles Redman, Dave Kittredge , Kenneth Sylvester, Jonathan Thompson, Richard Forman (photo by Audry Barker-Plotkin).

The scenarios focused on a diverse range of potential drivers and responses: from homeowner lawn-care decisions and the impact on water quality around the Plum Island site in Massachusetts, to the changing fire regimes and their impact on moose habitat around the Bonanza Creek site in Alaska. Yet, despite the range of viewpoints, participants found plenty of common ground. For example, all sites are trying to understand how different suites of assumptions about the future would play-out along logical trajectories. In addition, they all struggle with crafting scenarios that bound the range of plausible futures. More practically, most sites expect that climate and land use change will be the dominant drivers of future landscape dynamics and are interested in scenarios describing how these drivers might affect carbon storage and water quality.

After a couple days of spirited discussion in Harvard's Fisher Museum, surrounded by dioramas depicting past landscape change, two points became clear: first, that the LTER network, with its focus on long term ecological change, is uniquely suited to this line of research, and second, that Yogi Berra was on to something when he said: "The future ain't what it used to be."

By Jonathan Thompson, HFR

Participants at the "Scenarios of Future Landscape Change Workshop" at Harvard Forest ponder future ecological scenarios (photo by David Foster).

Culturally relevant ecology

Learning progressions key to environmental literacy within LTER

Standardized test scores for middle school and high school students indicate a need for improvement in basic environmental science and related mathematical content. Surveys of teachers and science educators indicate a desire for more content-based, focused, and locally relevant professional development. The participation rates in environmental science fields do not reflect the demographics of society as a whole. Each of the preceding statements contributes to the broader dialogue on the need for an environmental science literacy framework. "Environmental science literacy"—the capacity to participate in and make decisions through evidence-based discussions of socio-ecological systems—is essential for many STEM (Science, Technology, Engineering and Mathematics) careers and for responsible citizenship. Environmental science literacy requires citizens to understand, evaluate, and respond to multiple sources of information.

In 2008, the National Science Foundation (NSF) awarded a group of scientists and STEM educators within the NSF-funded Long Term Ecological Research (LTER) Network a Targeted Mathematics and Science Partnership grant to enhance environmental science literacy. The group is building its environmental science literacy framework around learning progressions within core science and mathematics concepts. The project connects the research and education prowess in the environmental sciences of universities and sites within LTER with teacher professional development in science and mathematics of partner middle schools and high schools. It extends across the nation and involves four LTER research sites—the Shortgrass Steppe, Baltimore Ecosystems Study, Kellogg Biological Station, and Santa Barbara Coastal–and their partnering institutions, the LTER Network Office, and a group of 22 K-12 schools and districts that will directly impact over 250 science and mathematics teachers and 70,000 students from diverse backgrounds.

The work focuses on the scientific and educational challenges and approaches that have emerged from within the LTER community and are invoked in the LTER Decadal Plan—coupled human-ecosystem interactions in the context of socio-ecological systems as a framework to develop a culturally relevant ecology from both a scientific and educational perspective. The partnership is ideally suited for addressing three broad challenges facing science education that are aligned with the grand challenges identified by the LTER scientific community: biodiversity, carbon, and water.

Water: Population growth has and will continue to put pressure on our finite fresh water resources. Yet students are only exposed to rudimentary basics that lend themselves to engaging indoor experimentation (e.g. water phase changes and the water cycle) and fact-based assessments. Consequently, the majority of citizens hold on to inaccurate conceptions of where freshwater exists, how it moves, how it gets renewed, and how it relates to biodiversity and climate change. These more critical concepts, unfortunately, do not appear in state content standards or assessments. The goal of the water strand of this project is to develop effective teaching strategies and assessments that are culturally engaging to serve as a model for what could be adopted at state and national levels.

Carbon: Carbon is integral to key biogeochemical processes in socio-ecological systems at multiple scales, including cellular and organismal metabolism, ecosystem energetics and carbon cycling, carbon sequestration, and combustion of fossil fuels. These processes: (a) create organic carbon (photosynthesis), (b) transform organic carbon (biosynthesis, digestion, food webs, carbon sequestration), and (c) oxidize organic carbon (cellular respiration, combustion). The primary cause of global climate change is the current worldwide imbalance among these processes.

The immediate goals of the carbon strand will be to develop a framework of learning progression that monitors achievement on several progress variables (such as processes and principles), leading to assessments that measure students' progress along this path. The assessments will include interviews and written assessments followed by calibration and validation studies that establish the reliability and validity of the framework and assessments. These products will provide the foundation for further work in the years 2010–13, including a second round of validation studies, materials for K-12 teaching and teachers' professional development, and research on teaching, professional development, and student learning. The assessments will also provide data for program evaluation.

Biodiversity: The earth's biodiversity has experienced unprecedented changes in past centuries, largely due to human activities. Yet, evidence suggests that graduating students are not able to draw upon their science education background in ways that lead to accurate understanding of biodiversity, even though much of the science content relevant to biodiversity is already listed in national and state standard documents and school curricula. In the Biodiversity strand of this project, we are working with a range of learners from middle school up through science teachers, focusing on several key elements of biodiversity at multiple scales (e.g. genomes through ecosystems) including: a) structure and function of systems, b) tracing information within and between systems and c) changes in time and space.

There are three components to the project. First, the research component focuses on determining the learning progressions or the descriptions of increasing sophistication in thinking about or understanding these concepts. Students and teachers from within the partnership are being interviewed and assessed using multiple approaches in order to gain a clearer understanding of their progress, and using this to improve on the professional development approaches.

Second, the project will develop models of teacher professional development that engage teachers in the content and research practices of LTER. This will include traditional workshops on biodiversity, carbon, and water, research experiences patterned after the NSF Research Experiences for Teachers program, and a teacher-in-residence program. Finally, the project aims to institutionalize elements of the research and professional development programs.

As members of the LTER community, the project leadership is looking for ways to partner with other sites in the research and professional development activities. If interested in collaborating or if you would like more information, please contact John Moore (SGS), Alan Berkowitz (BES), Charles Anderson (KBS), Ali Whitmer (SBC), or Bob Waide (LNO).

By John Moore, SGS

Graduate students take stock of year's activities

The past year has been very busy for LTER graduate students. In May 2008, John Kominoski (formerly CWT) rotated out of his position as Graduate Student Committee co-chair and headed up north to the University of British Columbia as a post-doctoral research fellow. Chelse Prather (LUQ) took over John's role as co-chair alongside Amber Hardison (VCR). She came in with great energy and ideas to help improve the LTER graduate student experience and really hit the ground running! But we certainly miss working with John and thank him for his dedication to and leadership within the LTER network.

Highlights of graduate student activities during the past year

John and Chelse co-hosted a graduate student mixer at the Ecological Society of America (ESA) annual meeting in Milwaukee, WI, in August 2008. Twelve graduate students and two postdocs attended the mixer where students learned about the LTER Network Office (LNO) and the services it provides, and also had opportunity to talk with graduate students from other sites. Please look for these mixers at ESA meetings every year.

Earlier, in June 2008, a survey was sent to the graduate students to gauge their satisfaction with and knowledge of LTER and LNO, and to solicit comments and suggestions for improvements. Of the 93 students who responded to the survey, 74 per cent said they were satisfied with their overall experience as LTER graduate students. In general, students could be divided into three categories: 1) those who were very happy with the LTER program, 2) those who were happy with LTER but had little knowledge of LNO and/or did not utilize services provided by LNO, and 3) those who had no idea what was going on in the network. We received a lot of helpful suggestions and will take them into account as we move forward with improving the LTER graduate student experience. We invite you to send any further comments or suggestions about LTER grad student activities to Amber (*amber@vims.edu*) or Chelse (*cprather@nd.edu*).

During the year, students made an outstanding effort to network across sites and outside the network. In May 2008, grad students from the California Current Ecosystem (CCE), Moorea Coral Reef (MCR), and Santa Barbara Coastal (SBC) LTER sites participated in the first University of California-LTER Graduate Student and Post-doc Symposium at the Scripps Institution of Oceanography. The event was organized by grad students Ryan Rykaczewski (CCE), Nichole Price (MCR), and faculty member Jenny Dugan (SBC). About 20 students and post-docs presented their work in a series of short talks and posters. The symposium was open to the public and was well attended by researchers not affiliated with LTER, giving participants the opportunity to share LTER-related research with other scientists.

Collaboration between the CCE, MCR, and SBC sites is natural, since each site focuses on marine ecosystems and has members based at the University of California (UC) schools in the

See "Students", p. 15

A portion of the presenters at the UC-LTER Graduate Student & Post-doc symposium. From left to right: Andrew Taylor, Jesse Powell, Nichole Price, Kristen Buck, Alison Cawood, Ty Samo, Darcy Taniguci, Ally Pasulka, Mike Stukel, Moira Decima, Pete Davison, Kyle Cavanaugh, Ryan Rykaczewski, Kate Hanson, and James Watson (photo by Karen Baker).

Students (continued from p. 14)

Left: Graduate Student co-Chair Chelse Prather (LUQ) takes soil cores in experimental plots looking at the effect of consumers on ecosystem processes in the rainforest in Puerto Rico (photo by Rick Prather). ***Right***: (L-R) Kirby Webster, Laura Reynolds, Luke Cole (all VCR) collect Zostera marina (seagrass) for DNA analysis to track the genetic spreading rate of the seagrass colony (photo by Captain Chris 'Puzzles' Buck).

Southern California region. The sites share several topics that are unique to long term research in the marine environment (e.g. population connectivity by advective and biological processes, flexibility in the size structure of primary producers and grazers, carbon flow through the marine ecosystem, close relationships between physical forcing and ecosystem structure). Rykaczewski noted that knowledge of the research conducted by other students at marine sites could facilitate future cooperation and discussion, and the students from each of the UC-based LTER sites plan to continue meeting to share their research experiences on an annual basis.

Similarly, students at the Central Arizona–Phoenix (CAP) LTER worked with faculty and administrators to organize an academic conference called "Dynamic Deserts: Resource Uncertainty in Arid Environments." The conference, co-sponsored by Arizona State University (ASU)'s School of Life Sciences, focused on a variety of ecological and social approaches to understanding how organisms, ecosystems, and human systems respond to both variability and uncertainty in arid environments. The student researchers discussed diverse topics, including bird and koala behavioral changes during heat waves in Australia, positive effects of Arizona's golf courses on the Gila monster physiology, changes in pinyon pine seed availability in pre-historic human settlements in the southwestern UnitedStates, and gerbil foraging dynamics under predation pressure and heat stress in Israel. The students formed four teams to develop synthetic papers that cut across the range of research methods, approaches, and perspectives to identify gaps in current research agendas. The group looks forward to working with senior researchers to develop manuscripts for a special section in Oecologia.

The CAP LTER and ASU grad students also used the workshop as a platform to develop interactions between the arts and sciences. Several CAP graduate students have been working to understand the ways in which the sciences and arts visualize pattern and process. Guided by CAP-affiliated faculty and staff, the students submitted a grant proposal to NSF's "Communicating Science to Public Audiences" program. If funded, the grant will be used to develop an exhibit of artistic and scientific interpretations of urban ecology that will be displayed to local audiences.

In the meantime, several innovative partnerships have started to take shape. A photographic narrative titled: "Deserted: Forgetting Nature, Humanity, and History in the Salt River Bed" has been accepted for the Millennium Conference of the Ecological Society of America in November. Other students have started to develop creative metaphorical parallels between fungal endophytes' relationships with their host and the social relationships among a group of women who work from home. Bethany Cutts, CAP grad student representative, finds these conversations fascinating. She observes that several students have acknowledged reconfiguring their way of thinking about their artistic/scientific work as a result of the questions and information offered through these alternative perspectives. For more information on either project, please visit *http://sols.asu.edu/frontiers/2009/index.php*

These symposia are great examples of grad student meetings that reach beyond their LTER site. We encourage an annual meeting of students at each site or across sites to present research, share ideas, and facilitate interaction among students. Currently, we are planning the 3rd Graduate Student Symposium (GSS), to be held on Sunday, September 13, during the 2009 LTER All Scientists Meeting in Estes Park, CO. We encourage grad students to attend and to consider writing a proposal for a working group at this meeting. Working group proposals for the GSS are due July 1. We have recruited an energetic planning committee, which includes Jessica Savage (CDR), Kristen Schwarz (BES), Michelle Romolini (BES) and Luke Cole (VCR) and hope to see many of you in September. Please email us if you have any questions.

By Amber Hardison, VCR & Chelse Prather LUQ, Graduate Student Committee co-Chairs

SEEDS holds 4th Annual Leadership Meeting at Sevilleta

Never before has the conversation been clearer on what the culture of ecology actually means and the role of culture in the future of our science. That was the conclusion of participants at the 4th annual SEEDS Leadership Meeting held Feb. 26 to March 1 at the Sevilleta LTER in New Mexico.

SEEDS—Strategies for Ecology Education, Diversity and Sustainability—is an education program of the Ecological Society of America (ESA) whose mission is to diversify and advance the profession of ecology through opportunities that stimulate and nurture the interest of underrepresented students.

The theme of the meeting was *"The Culture and Future of Ecology."* In true SEEDS spirit, participants shared the stories behind their ecology pursuits, and the clear diversity among these stories wove a strong web of support that encouraged rich thinking. The meeting was a great success, with 23 SEEDS student and alumni leaders participating in all aspects of the SEEDS program. Workshops, discussions, breakout groups, and a field trip were led by the students themselves, with full participation and support of collaborators from the National Center for Ecological Analysis and Synthesis (NCEAS), National Ecological Observatory Network (NEON), Long Term Ecological Research (LTER) Network, and ESA President Sunny Power.

Above: Christina Wong, Arizona State University, Sunny Power, Cornell University and ESA President; Sarah Renteria, University of Texas at El Paso (photo by Erin Vinson).

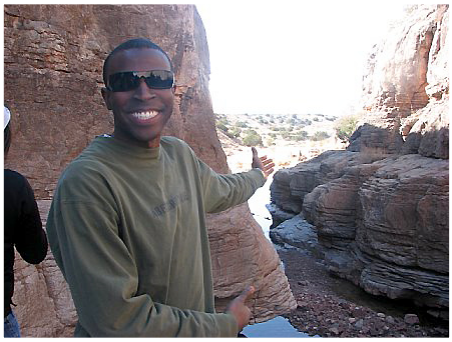
Left: The 2009 SEEDS Leadership Meeting group photo during the Forum held at the Sevilleta LTER site in New Mexico (photo by Erin Vinson).

As the meeting progressed, it provided various opportunities for the leadership torch to be passed and shared among SEEDS participants, local, and national collaborators. We began with an introduction to New Mexico and the Sevilleta LTER by Jolene Trujillo (Arizona State University—ASU), Will Pockman (University of New Mexico—UNM), and Jennifer Johnson (UNM). Excellent and engaging workshops were given by SEEDS students and alumni, including: "The Millennium Ecosystem Assessment: what it is and why every ecologist should know about it" by Christina Wong (ASU) and Jolene Trujillo; "Combining ecological research and community outreach" by Ana Elisa Perez (University of Puerto Rico, Rio Piedras) and Raynelle Rino (San Francisco State University); and a virtual workshop on "Opportunities that take you far from home" by Andrea Rivera (University of Plymouth/ University of Cadiz) and Jorge Ramos (University of Washington).

In addition, several ESA members attended the meeting and shared their ideas about the culture and future of ecology. Margaret Connors and Carlos Melian of NCEAS illuminated the complexity of the concept of synthesis, and discussed opportunities available through NCEAS to connect researchers who

See "SEEDS", p. 17

SEEDS (continued from p. 16)



Jarrod Blue, Master's student, University of Tennessee at Knoxville, showing his study site at Cibola Springs (photo by Melissa Armstrong).

tackle large-scale ecological questions. Debra Peters (Jornada LTER) discussed the role of LTER and NEON in the future of the ecology profession. ESA President Sunny Power of Cornell University participated in our SEEDS leadership forum, shared her personal insights on leadership, and even went on a sunset hike with SEEDS students.

The meeting was rounded out with a career panel discussion with Sevilleta scientists Robert Sinsabaugh and Andrea Porras-Alfaro, NCEAS post-doc Carlos Melian, and SEEDS Advisory Board member Christina Wong. An afternoon field trip to Cibola Springs to tour the field research site of SEEDS fellow Jarrod Blue (University of Tennessee, Knoxville) helped focus our thoughts on the high desert ecosystem hosting our meeting.

A big contributor to the success of the meeting, in addition to the student-generated itinerary, was the fact that every single person shared their thoughts and ideas during our discussions. This conscious effort was made by staff and students alike, and the assurance that the ideas of all were welcome encouraged tremendous participation in resulting discussions. The SEEDS students are preparing a written summary of the proceedings of the meeting, which we hope to publish in the July issue of the ESA Bulletin.

By Melissa J. Armstrong, Diversity Programs Manager, ESA

Online course to teach science of Climate Change

The LTER Education Committee is pleased to announce a completely online graduate-level course this summer on the science of climate change. Partial scholarships are available. Please share this announcement broadly.

Earth Sciences 580Y is a three quarter credit (not semester) grad level course that will run from June 15 to July 24, 2009. The course is offered under a contract between The Ohio State University (OSU)'s School of Earth Sciences, in the College of Mathematics and Physical Sciences, and the OSU Office of Continuing Education. As a result, the fees are the same for everyone, including non-residents.

A DVD entitled "Understanding Global Climate Change", produced by teachers in collaboration with the National Science Foundation's Science & Technology Center for the Remote Sensing of Ice Sheets (CReSIS), will serve as the primary basis for content. The disc will be mailed to participants who are selected to take this course. Additional online readings will be selected based on news releases and other timely events. This course is an online grad-level course only, requiring full participation in the chat sessions and completing a lesson or communication strategy about the content. Note also that no face-to-face session will be required, reducing our carbon footprint for this course.

Also, this summer only, 10 applicants will receive a partial scholarship to participate in the course. The scholarship recipients will pay only the $40 application fee to the Office of Continuing Education, plus $25 per credit, for a total of $115 for the 3-credit course. Their participation will enable us to receive critical feedback to help us refine the content and delivery, if necessary. Other participants (including non-residents of Ohio) will pay the full cost of the course: $575. Course costs may be adjusted slightly in future course offerings.

Please share this information with your colleagues and friends everywhere. We hope to draw a diverse participant pool from the United States and around the world. We are capping the course at 20 participants this summer, but plan to offer multiple sections of the course throughout the 2009-2010 academic year. We also plan to offer a modification of the course for Continuing Education (or Professional Development) Units beginning in autumn quarter, 2009.

Three important notes:

1) We plan to run the course every quarter for awhile, but this is the only quarter for which we will have scholarship support. The cost will remain as low as possible to encourage participation.

2) It is important for graduate students at other institutions to discuss the course content with their advisers, to learn in advance whether or not credit for the course can be applied at their institution.

3) We hope the course will be valued by librarians, park naturalists, soldiers, economists, lawyers, youth groups, homeschoolers, environmental groups, and other citizens who want to speak knowledgeably about the scientific aspects of climate change.

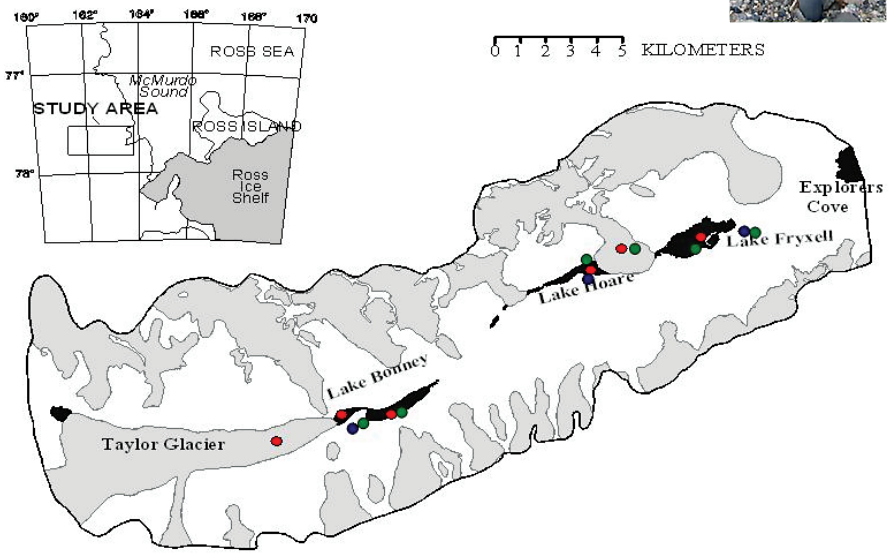
Please go to the BPRC website (http://bprc.osu.edu/) to download the course description and application materials (remember to check the box for the scholarship application).

By Carol Landis, MCM, Education Outreach Specialist, Byrd Polar Research Center, Ohio State University

Tracking wind in the McMurdo Dry Valleys

The landscape of the McMurdo Dry Valleys (MCM) Long Term Ecological Research site is dominated by bare soils, perennially frozen lakes, ephemeral streams, and glaciers—all of which harbor viable microbial communities. As a consequence of strong and persistent winds in the Dry Valleys, aeolian (airborne) transport is believed to be the main process responsible for redistribution of microorganisms throughout the MCM landscape. Freeze-dried microbial mats found in stream and on lake ice surface, sediments on the glacier and lake ice surfaces as well as soils can all readily be dispersed by wind over great distances. Studies have shown that microbial assemblages inhabiting lake ice are very similar to those found in sediments on glacier surfaces, which would imply airborne transport of microorganisms between the lakes and the glaciers.

To study the role of wind on the distribution of microorganisms in the MCM, we deployed a series of aeolian traps at nine locations within the Taylor Valley, our primary site of research in the MCM (Fig. 1). The traps consist of bundt pans placed in three transects, perpendicular to the south shore of each of the three lakes (Fryxell, Hoare and Bonney). Additional traps are deployed on the permanent ice cover of each lake and on the top of major glaciers. Each pan is mounted approximately 30 cm off the ground on a PVC post and contain a layer of marbles to create a boundary layer so that airborne particles are more likely to be deposited, and once deposited, they are less likely to be blown away (Fig 2). Material from the bundt pans is collected annually and is analyzed for various physical, chemical and biological properties. The traps have proved effective in collecting a wide range of soil particles and organisms ranging from nematodes to bacteria.



Clockwise from top: H11B Sensit Sensor mounted 30 cm above the ground; a bundt pan -passive aeolian sediment trap mounted 30 cm above the ground; map of Taylor Valley (Red – location of single bundt pans; blue – location of an elevation transect of bundt pans (nine each); green – location of Sensit sensors).

The airborne material found in the sediment traps has similar physical and chemical characteristics as nearby soils—slightly alkaline with very coarse texture and very low water, organic matter and nutrient content. Both bacterial and cyanobacterial DNA have been successfully isolated from the sampled material. We are now able to calculate the flux of major nutrients as well as microorganisms that are transported throughout the Taylor Valley via wind.

Furthermore, to obtain temporal data on wind dispersion events, nine Sensit Model H11B particle counters (*http://www.sensit.com/*) were purchased and installed at each bundt pan site during the 2007 field season (Figure 3). The sensors were mounted to the stands of existing meteorological stations at 30 and 100 cm above the ground. When a particle impacts the sensor, a charge is produced by a crystal within the sensor; one pulse represents a fixed amount of kinetic energy. This response has empirically been found to correlate significantly to mass flux by several independent researchers. The sensors are, therefore, giving us information about the amount and size of particles that are transported at each locality.

Hence, data from the H11B particle counters can be used, in concert with the bundt pan collections and meteorological network, to determine the timing, direction, and magnitude of significant particle movement throughout the Taylor Valley.

Preliminary data indicates that material in the Taylor Valley is predominantly transported near the soil surface. Most sediment is transported from South South West and South West (from the Antarctic continent toward the McMurdo Sound) and a little bit from the North East (from the ocean inland). This is happening during katabatic events when the wind speed is well above 10 meters per second.

By Marie Sabacka, MCM, Priscu Research Group, Department of Land Resources and Environmental Sciences, Montana State University, Bozeman, MT

Measuring history...but which history?

Time lags surround us. Want a house? Put a payment down today and the house is built in a couple years. Infected with bacteria? Take penicillin today and the infection should subside in days. Want an education? Begin today and the undergraduate diploma arrives in 16 years.

Unintended time lags abound in rivers and streams. Want to move the Piedmont to production agriculture? Deforest today and tend to your crop for the next decade to earn a nice profit. However, you'll also increase sediment flux for the next centuries. Want even more yield? Over apply cheap nitrogen fertilizers for decades and earn a nice profit. The fertilization safety margin lingers in groundwater, and eventually streams, that may persist for centuries.

Twenty-one scientists discussed these time lags, or legacies, from February 9–11, 2009, at the University of New Hampshire. Our focus was legacies in material fluxes, including water and biogeochemical constituents, from the Long Term Ecological Research (LTER) Network (BES, CWT, HBR, HFR, PIE) and other long-term research sites (Smithsonian Environmental Research Center and US Forest Service experimental forests) in the eastern United States. The meeting, funded by the National Science Foundation (NSF) through the LTER Network Office and the Northeast Consortium for Hydrologic Synthesis, was driven by the need to understand our contemporary measurements. Are stream samples measuring landscape dynamics from the last year, decade, century, or millennium? Realistic management targets require an understanding of the variety of characteristic time scales and the relative dominance of each on fluxes from the landscape.

The eastern United States has a rich history of human interactions with the landscape. Since European settlement, the sequence of fur and timber harvesting, agricultural production, industrial development, land abandonment, reforestation, and suburbanization provides many permutations of accumulated legacies that we are measuring today. Can we separate responses to the last century and the last decade in our contemporary signal? This question, or its variants, has persisted amongst ecologists, hydrologists, and geomorphologists. Our meeting sought to synthesize existing ideas about legacies and test these ideas in the eastern U.S.

One highlight from the discussion in New Hampshire was that while a strict definition of 'legacy' may be possible, a metric to directly compare legacies is more desirable. The metric we are proposing is the ratio of the time of disturbance to the time of persistence. For example, Compton and Boone (2000) showed how a century of agriculture in central Massachusetts depleted soil nitrogen and altered the soil biogeochemistry for a century or more. Thus, the ratio of disturbance to persistence is at least 1:1. Discussions developing this metric made apparent the tendency of long-term research sites to measure within the time scale of persistence and sometimes neglect the time scale of disturbance. In other words, we know we are measuring a signal from historical dynamics, but have not constructed a solid inventory of historical dynamics to understand which history we are measuring today.

We are currently compiling a cross-site history of the eastern U.S. LTER sites and other long-term sites. By comparing and contrasting the history and material flux measurements across sites, we hope to gain a better understanding of which history we are measuring in our streams and rivers.

By Mark Green, City University of New York & Dan Bain, BES

Front row, L - R: John Chamblee (CWT), Jon Duncan (BES, CWT), John Campbell (HBR); ***Sitting, L - R:*** Caroline Hermans (City Univ. of New York—CUNY)), Sherry Martin (Michigan State Univ.), Mark Green (CUNY), Tom Jordan (Smithsonian Environmental Research Center—SERC), Jen Fraterrigo (CWT), Sayo Chaoka (Univ. of Illinois); ***Standing, L - R:*** Gretchen Gettel (PIE), Bill Sobczak (HFR), Don Weller (SERC), Dan Bain (BES), Emery Boose (HFR), Tony Parolari (Massachussetts Inst. of Technology), Brian Hall (HFR), Sujay Kaushal (BES), Jonathan Thompson (HFR), Jim Vose (CWT); (Not Pictured): Praveen Kumar (U. Illinois), Wil Wolheim (PIE) (photo by Shelley Burch).

Virtual Water Cooler keeps LTER Information Managers in the loop

The LTER Information Managers have been showing up at the Virtual Water Cooler (VWC). The VWC sessions are informal meetings of the Information Management Committee (IMC) using video teleconferencing (VTC). The sessions encourage information sharing, discussion, and collaboration among participants. The main focus has been to improve communications while advancing IMC network-wide projects (i.e., working group meetings, specific project discussions, current issues, etc.). The session schedule and a library of notes from past sessions are available online at ***http://intranet.lternet.edu/im/news/virtualupdates***

In June 2007, the LTER Network Office (LNO) provided each site information manager with desktop VTC systems—a Logitech camera, Polycom PVX software, and a site license. These desktop systems work in conjunction with a Polycom bridge system, hosted by LNO, and allow all information managers to participate. The intent of these systems was to promote VTC technology for holding working group meetings across the network and to save on travel time and costs. In June 2008, the IMC decided to actively take advantage of this technology and the notion of a 'Virtual Water Cooler' was born.

Currently, VWC sessions are held monthly with special sessions added as needed. Session topics are centered on network and working group activities. The schedule has been set in advance with a list of potential future updates being continually updated based on current happenings or suggested topics. Topics are typically brainstormed in Information Manager Executive Committee (IMEXEC) meetings, but any information manager can suggest a topic. The frequency of the sessions has led to some informal VTC etiquette or "best practices" among participants, like the role of the moderator, introduction of participants, assignment of a note taker, hand signals to alert moderator of desire to talk, and muting while listening.

VWC sessions are held on two consecutive days at different time slots to enable maximum participation. Generally, half of the sites participate in each topical session (see figure 1). Participation has never reached maximum capacity but the IMC would benefit by increased attendance. Most sites are able to participate by VTC; however some sites have not been able to negotiate their firewall, but connect via telephone.

In addition to using the VTC technology to increase communication between the information managers, the group has been using Doodle, a free online coordination tool, to sign up for sessions and Dimdim, a free web service that allows media communication in real time (e.g., sharing a PowerPoint presentation). The IMC uses Drupal, an open-source content management system, as their website platform to make it easy for members to add, edit, and share VTC information and notes.

The IMC has been bold in experimenting with various technologies to increase the effectiveness of communication across the sites. Overall, gatherings at the VWC have been successful in disseminating knowledge as demonstrated by the ability of the IMC to facilitate a more focused annual meeting in Albuquerque, New Mexico, last September. The sessions enabled IMC members to come to the annual meeting better prepared as they were more aware of the status of these activities, thus less time was wasted on general updates. As the next annual meeting approaches, the IMC is again poised to run frequent VTC sessions as a means of preparation to assure an efficient and effective meeting.

See you around the water cooler!

By Suzanne Remillard
Information Manager, AND

VTC Discussion Topic	Site Participation
General discussion about using VTC technology; etiquette and best practices	17
Information Management Executive Committee (IMEXEC) Activities	15
Network Information Systems Advisory Committee (NISAC) Activities	8
Geographic Information System (GIS) Working Group Activities	15
LNO Activities	8
Controlled Vocabulary Working Group Activities	8
EcoTrends Update	15
LTER Cyber-Infrastructure Assessment and Needs Survey	12
Data Access Issues as reported by the LTER Coordinating Committee (CC)	19
Planning ASM Workshops for September 2009	13
ILTER update	11
Data Access Server (DAS) Update	16
Governance Working Group Activities	12
Controlled Vocabulary Working Group Update	13

Figure 1: List of Virtual Water Cooler sessions with total number of sites represented at each topical session. Note, some sites have multiple people that participate, but this chart lists only the number of sites that participated. Sites include the 26 LTER sites and the LNO.

Don't forget to read DataBits, the Information Managers' newsletter, online at www.lternet.edu.

Recommendations for LTER remote sensing data and coordination efforts

The LTER Executive Board recently formed an Ad-hoc Remote Sensing Committee to review the LTER remote sensing data archive, the data requirements, and coordination and support from the LTER Network Office (LNO). The Committee consisted of Andrew Fountain (MCM) as chair, Morgan Grove (BES), Mark Williams (NWT), Dave Verbyla (BNZ), and John Vande Castle (LNO) as an ex-officio member. The committee made a number of recommendations on ways to improve access to remote sensing data and information for the Network:

» that LTER form a "Spatial Data and Analysis Committee" to focus coordination by LNO and the LTER sites, and enhance top-down and bottom-up information flow within the LTER Network. To assess the specific needs for remote sensing data and coordination by the sites and the Network, LNO should survey all sites on their current remote sensing data holdings and spatial data needs. Although the Committee focused primarily on site needs, the LNO survey could include needs for data that contribute to needs of the LTER Decadal Plan and Integrative Science for Society and the Environment (ISSE) research. The past and planned cyberinfrastructure needs and assessment surveys provide some background information for this, although not in the detail suggested by the Committee.

» that LNO continue to facilitate communication on spatial data and analysis at several levels between LTER sites, key investigators, and agencies. For example, LNO should continue coordinating planning efforts for proposed future NASA satellite missions—such as the DESDynyl spacecraft to provide LIDAR (Light Detection and Ranging) and Synthetic Aperture Radar remote sensing data, and the HyspIRI (Hyperspectral Infrared Imager) mission to provide space-borne hyperspectral and multispectral thermal imaging data for ecological research.

» that LNO lead in developing cooperative agreements to acquire LIDAR data for sites, and arrange for hyperspectral imagery (such as AVIRIS -Airborne Visible/Infrared Imaging Spectrometer data) for all sites on repeated intervals and during special disturbance events. Access to LIDAR data from the NSF-funded NCALM (NSF Center for Airborne Laser Mapping) program would also be an excellent contribution for Decadal Plan/ISSE research. LNO should also continue to provide links to data from other agencies, such as MODIS direct broadcast imagery, MODIS time series data subsets, imagery of LTER sites from the International Space Station, and the Global Fiducial reconnaissance data for LTER sites awaiting future declassification.

» that LNO act as a clearinghouse for information related to new and emerging technologies, for new spatial data, and for data available in historic archives. With the help of the LTER Information Management and NISAC Committees, this information could include aerial photographic imagery available for and acquired by LTER sites, as well as data from the National Agricultural Imagery Program, the US Department of Agriculture's Forest Service, and individual State governments. Another example would be information on the availability of data from the National Aerial Photography Program (NAPP) and National High Altitude Photography (NHAP) aerial collections, which are available at no charge for online download. The committee also suggested a common access through LNO to online and offline information on the remote sensing holdings already acquired by each LTER site.

» that LNO review and obtain cloud-free Landsat images for all LTER sites. The Committee focused on the Landsat-5 record, whose data is available from 1984 to the present. Although previous Technology Committee meetings have made a similar recommendation, such an archive has not been practical because of licensing and costs issues. However, that is no longer the case because, for the first time in history, the data are available at no cost and without license restrictions. So reviewing the entire Landsat record and obtaining cloud-free images would be an excellent service that LNO could provide the Network. The Committee considered the Landsat archive very valuable to individual LTER sites, but it can also provide a powerful database to support Decadal Plan and ISSE research. Data from Landsat-4 and Landsat-7 could also be considered because that would improve and extend the record from 1982 to the present. The Landsat-7 data was far superior to that of Landsat-5 until technical problems degraded the data in 2003. Landsat -7 also contains a 15 m panchromatic band that is quite valuable for LTER spatial analysis. An archive of the best Landsat data in practice translates to about four to five images per year for most LTER sites. The Arctic, Antarctic, and tropical sites might have only four or five usable scenes in the entire Landsat record because of acquisition difficulties, while sites in the southwestern United States might have as many as 14 cloud-free scenes per year. Some sites might also require more than one Landsat scene to cover the entire site. It is clear that further discussion is required on the number of scenes, length of the archive record, and how the data are stored since these issues are important to the feasibility and costs associated with the archive.

By Andrew Fountain, MCM, & John Vande Castle, LNO

New tools for MODIS data

Remote sensing for LTER sites

The MODIS (Moderate Resolution Imaging Spectroradiometer) sensor aboard NASA's Terra and Aqua satellites provides information about Earth's ecosystem characteristics and dynamics on a near-daily basis. The MODIS sensor acquires data in 36 spectral bands, which are used to produce standardized products, including phenology, land cover, primary production, vegetation characteristics (leaf area index and vegetation indices), radiation, and albedo. However, these products are generally distributed as data files covering a 1200 km square area of the earth in a data format intended for regional analysis and modeling. These large data files are not optimal for use in field investigations at individual sites (100 km x 100 km or smaller).

In order to provide MODIS data for field investigations, the Oak Ridge National Laboratory (ORNL) Distributed Active Archive Center (DAAC) has developed a tool that prepares and distributes subsets of selected Land Products (such as leaf area index, photosynthesis, or land cover) in a scale and format useful for field researchers. The subsets are offered in both tabular ASCII format and in Geographic Information System (GIS) compatible GeoTIFF formats. Time series plots and grid visualizations, along with quality assurance indicators, are also provided. An example of this is shown in Figures 1, 2, and 3. These MODIS subsets are produced automatically for more than 1,000 sites across the globe, including sites of the Long Term Ecological Research (LTER) program.

LTER research scientists have collaborated with NASA in the ground validation of NASA data products. The locations of LTER research sites were registered with the ORNL DAAC so that these data are now available to researchers from the beginning of MODIS data acquisition in the year 2000 to the present.

In addition to offering subsets for fixed locations, the ORNL DAAC also offers the capability to create user-defined subsets for any location worldwide. The DACC's MODIS Global subsetting tool provides data subsets from a single pixel up to a 201 km x 201 km area for any user-defined time range. Product statistics, time series plots, and

See "MODIS", p. 23

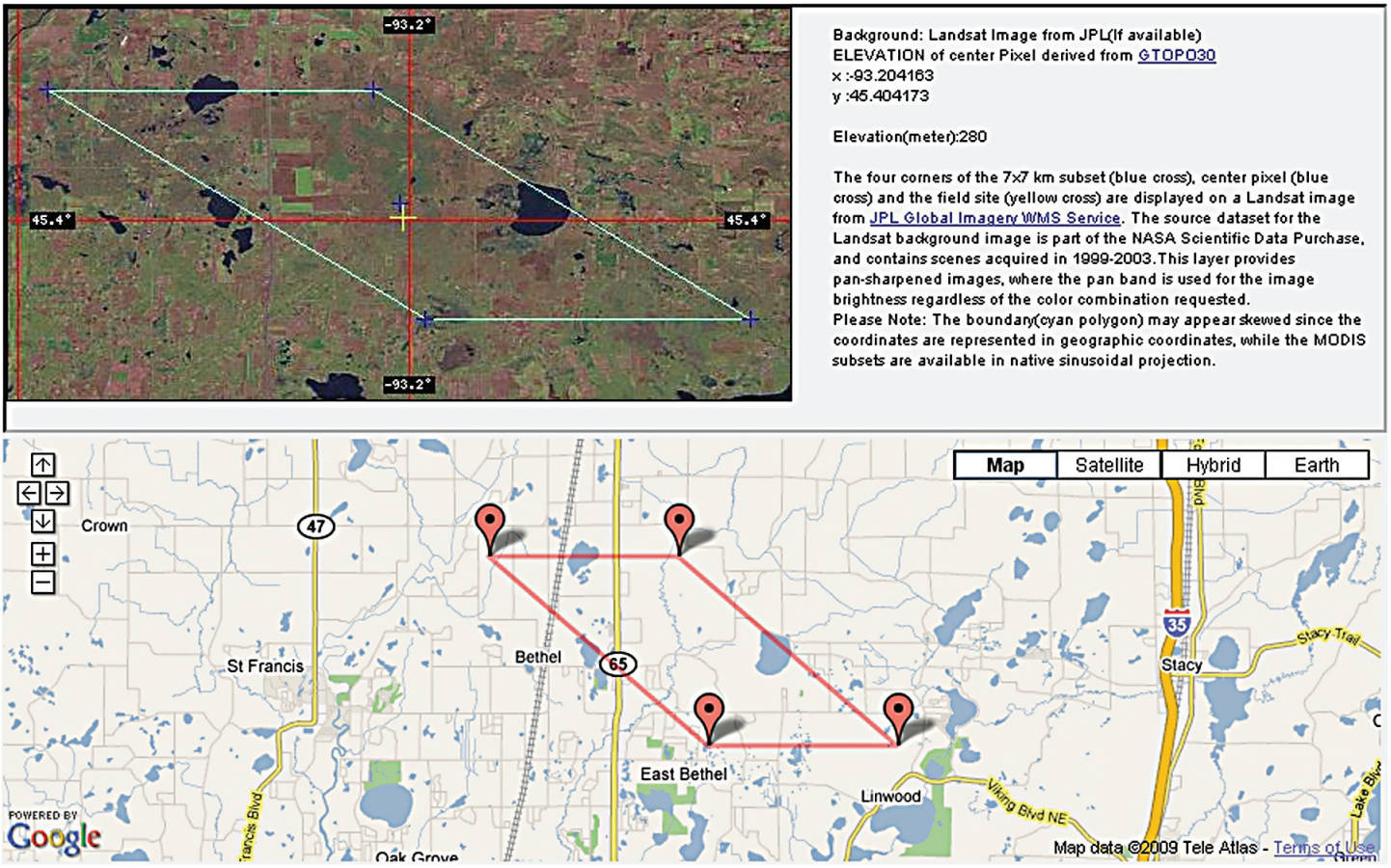


Fig. 1: Location information for Cedar Creek Natural Resources Area LTER site available from the MODIS Subsetting Tool. Image includes a LandSat image served from NASA's Jet Propulsion Lab to the ORNL DAAC's Web Site, along with a Google Map of the Cedar Creek area.

MODIS (continued from p. 22)

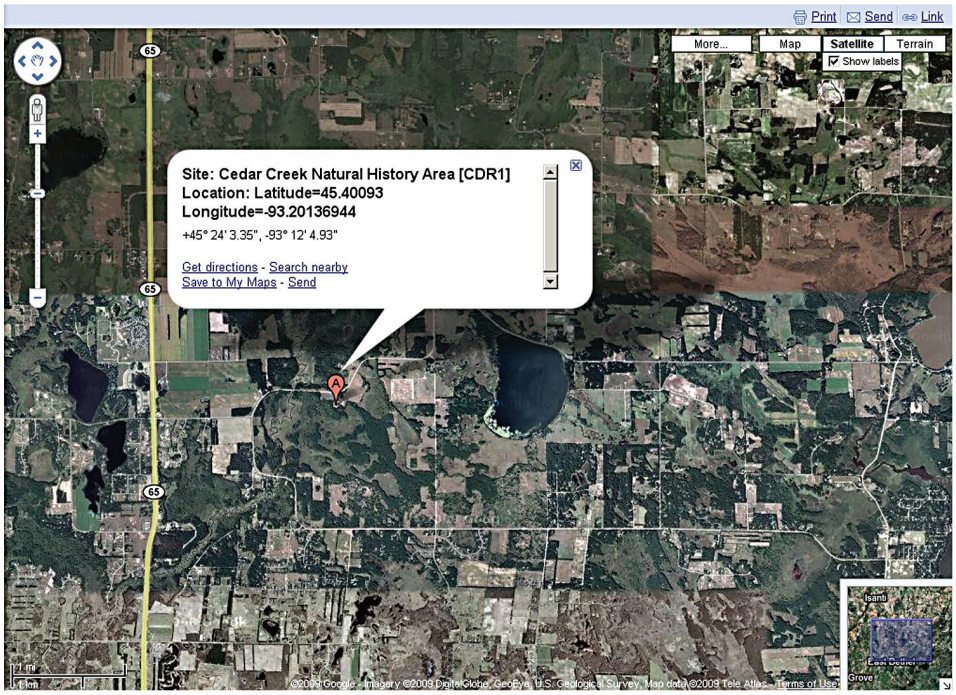


Fig. 2: Location information for Cedar Creek Natural Resources Area LTER site available from the MODIS Subsetting Tool, showing the Google Earth search screen.

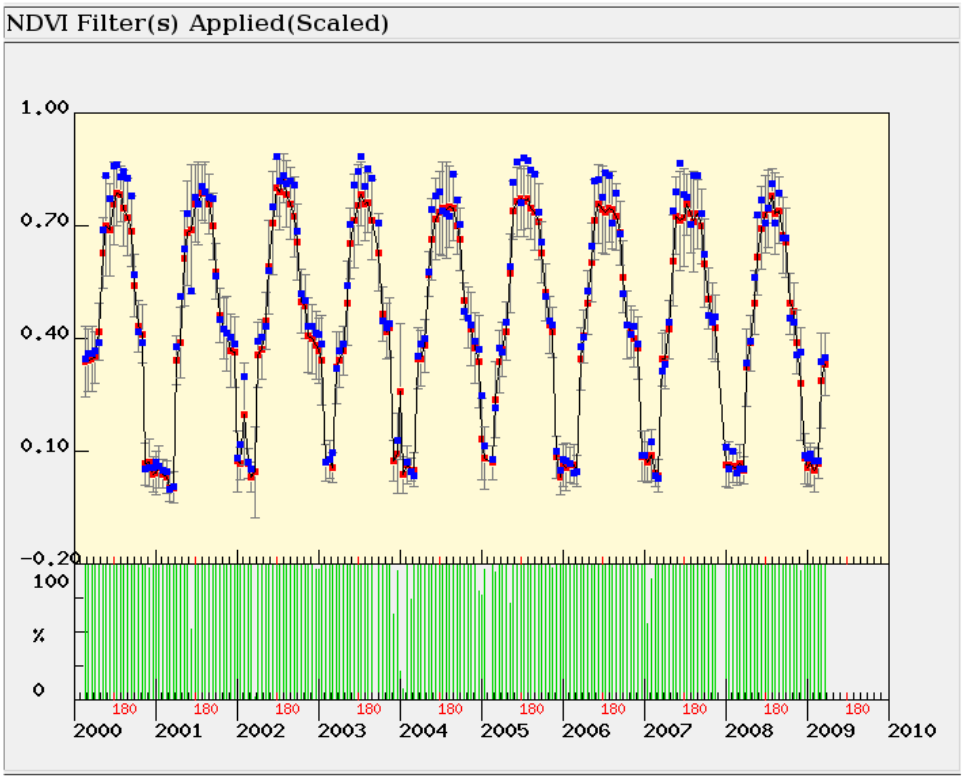


Fig. 3: An example MODIS data subset visualization from 2000 to 2009 of a Normalized Difference Vegetation Index (NDVI) product for the Cedar Creek LTER site. The data include the site center pixel value, the average data value of pixels and standard deviation in a 7 x 7 km grid having valid data and a timeline showing the percentage of pixels in the grid that have acceptable quality.

GIS compatible data files for the customized subsets are also distributed through this tool. Users place an order for a MODIS data subset with the subsetting tool online and the subset is typically produced within 60 minutes. An email is sent to the user with the necessary information to access the custom data product.

Users can also use Web Services, a software system designed to support machine-to-machine interaction, to access these MODIS data products. Web Services facilitate data processing directly on the user's local computer, providing access functions to retrieve subsets through command line operations, import them into software such as Kepler or Matlab, integrate the data into workflows on their computer, and write custom code to use the subsets for visualization or data reformatting.

More information about the MODIS subsets and tools to access them can be found at the link for "MODIS Subsets for LTER Sites" on the LTER Remote Sensing/GIS webpage (*http://www.lternet.edu/technology/ltergis/*) or directly at the NASA ORNL DAAC site at *http://daac.ornl.gov/MODIS/*

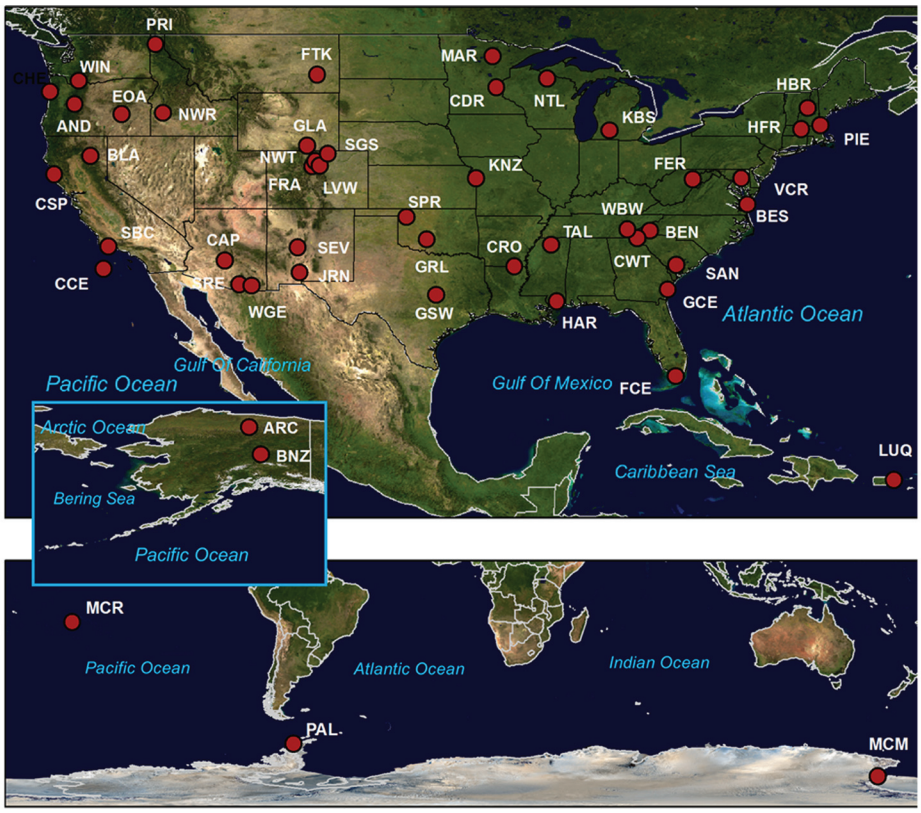
By Robert Cook, Suresh K. Santhana Vannan, & Tammy Beaty, Environmental Sciences Division, ORNL & John Vande Castle, LNO

EcoTrends project update

The EcoTrends Project began in 2004 as a casual conversation about the need for easy access to many long-term data sets to allow cross-site comparisons. This conversation between Deb Peters (Jornada LTER, United States Department of Agriculture's Agricultural Research Service (USDA-ARS)) and Ariel Lugo (Luquillo LTER, USDA-Forest Service (USDA-FS)) has resulted in the synthesis of more than 20,000 datasets from 50 sites (including LTER, USDA-ARS, USDA-FS, and other agencies) (Fig. 1) that will be available soon on the EcoTrends web site (**http://www.ecotrends.info**). Many of these datasets will be included in a book to be submitted for publication in the next few months.

At the core of EcoTrends are two key aspects: (1) a focus on derived data whereby complicated datasets are condensed into annually, monthly, or seasonally derived values, and (2) attribution to the original data source. Both the book and the web site will be invaluable as the LTER Network proceeds in its development of network-level synthetic research for the next decade. Funding for the project is through National Science Foundation (NSF) supplements to the Jornada LTER and the LTER Network Office (LNO), and support from the USDA ARS.

The EcoTrends book illustrates through detailed examples the value and importance of comparing long-term data (in most cases greater than 10 years) from different ecosystem types (e.g., forests, grasslands, deserts, freshwater lakes and streams, near coastal marine and estuaries, urban, Arctic, and Antarctic). The book shows the power of a geographically-distributed network of sites studying long-term phenomenon on similar themes (e.g., response to climate and disturbances, patterns through time in biogeochemistry, biotic structure, and human populations). The book format is designed to enable users to view patterns in data from many sites, and to easily understand the lessons learned from long-term data (Fig. 2).



Site Abbreviations:

AND: H.J. Andrews Exp. Forest
ARC: Arctic LTER
BEN: Bent Creek Exp. Forest
BES: Baltimore Ecosystem Study LTER
BLA: Blacks Mountain Exp. Forest
BNZ: Bonanza Creek
CAP: Central Arizona – Phoenix Urban LTER
CCE: California Current Ecosystem
CDR: Cedar Creek Natural History Area
CHE: Cascade Head Exp. Forest
CRO: Crossett Exp. Forest
CSP: Caspar Creek Exp. Watershed
CWT: Coweeta Hydrologic Laboratory
EOA: Eastern Oregon Agricultural Research Center
FCE: Florida Coastal Everglades
FER: Fernow Exp. Forest
FRA: Fraser Exp. Forest
FTK: Fort Keogh
GCE: Georgia Coastal Ecosystems
GLA: Glacier Exp. Forest
GRL: Grazinglands Research Laboratory
GSW: Grassland Soil and Water Research Laboratory ARS
HAR: Harrison Exp. Forest
HBR: Hubbard Brook
HFR: Harvard Forest
JRN: Jornada Basin LTER/Jornada Exp. Range
KBS: Kellogg Biological Station
KNZ: Konza Prairie
LUQ: Luquillo Exp. Forest
LVW: Loch Vale Watershed
MAR: Marcell Exp. Forest
MCM: McMurdo Dry Valleys LTER
MCR: Moorea Coral Reef LTER
NTL: Northern Temperate Lakes LTER
NWR: Northwest Watershed Research Center
NWT: Niwot Ridge LTER
PAL: Palmer Station LTER
PIE: Plum Island Ecosystem LTER
PRI: Priest River Exp. Forest
SAN: Santee Exp. Forest
SBC: Santa Barbara Coastal LTER
SEV: Sevilleta LTER
SGS: Shortgrass Steppe LTER
SPR: Southern Plains Range Research Station
SRE: Santa Rita Exp. Range
TAL: Tallahatchie Exp. Forest
VCR: Virginia Coast Reserve LTER
WBW: Walker Branch Watershed
WGE: Walnut Gulch Exp. Watershed
WIN: Wind River Exp. Forest

Fig. 1: Sites currently participating in the EcoTrends project.

After a thorough analysis of publishers, the EcoTrends Editorial Committee selected the USDA-ARS publish the book. Using a federal government agency will promote a wide distribution by keeping the cost of the book reasonable, and USDA-ARS will allow free downloads of the online version of the book.

The accompanying EcoTrends website will contain all of the derived data in the book and additional datasets with their associated metadata along with links to the original data sources. Users will be able to search and query the database, create new graphs and combinations of variables, and save graphs and data locally. Future modifications, pending additional funding, include the automatic harvesting of data to keep the derived database up-to-date, and the inclusion of more sites and datasets. Development of the website application has occurred primarily through efforts by Mark Servilla and Duane Costa at the LNO, with input from the Editorial Committee.

The success of this project depends heavily on an active Editorial

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TRENDS (continued from p. 24)

Committee, comprising S. Collins (SEV), C. Driscoll (HBR), P. Groffman (HBR), M. Grove (BES), T. Kratz (NTL), A. Lugo (LUQ), M. Ohman (CCE), D. Peters (JRN), R. Waide (LNO), interacting closely with the project coordinator (C. Laney, JRN), technical staff at the LNO (M. Servilla; D. Costa, J. Brunt, I. San Gil), members of LTER committees (K. Ramsey and D. Henshaw [Information Management Committee]; W. Sheldon [NISAC]; Charlene d'Avanzo [Education]), and site-based Information Managers and scientists as well as collaborations with the National Center for Ecological Analysis and Synthesis, (M. Schildhauer). C. Boone (BES), T. Gragson (CWT), and N. Rosamilia (CWT) compiled the human population and economy data for all 23 LTER sites where data were collected. These data currently reside on the Coweeta website (*http://coweeta.ecology.uga.edu/trends/catalog_trends_base2.php*), and are being incorporated into the EcoTrends website.

The next steps in the project are threefold. First, we will continue to populate the EcoTrends database. To ensure the quality of the data, the lead PI and IM of each site are checking the quality of their data prior to its publication and posting. Second, we plan to complete the text and figures for the book within the next few months. At that time, we will request reviews from within the network to ensure that a high quality product is obtained. Finally, we will continue to promote EcoTrends to broader audiences. For example, the EcoTrends project was endorsed by the Ecological Society of America, with each website now providing a link to the other.

In addition, six working groups are meeting between April and July (2009) to take advantage of the wealth of comparable data in the EcoTrends database. These working groups consist of scientists nominated by each site for their expertise in one of the themes (Disturbance, NPP_Biodiversity, Biogeochemistry, Human Populations and Economy, and Animal Populations). Working groups are developing synthesis products and providing input on the database and website functionality.

Although it is widely recognized that the Earth's environment is changing, and that long-term data are needed to assess the rate and direction of change, to distinguish directional trends from short-term variability, and to forecast future responses, the accessibility of long-term data beyond the original user has historically been limited. The EcoTrends project, now nearing completion of an important step in its development, is a network-level resource that will allow cross-site and network-wide comparisons that are critical to addressing ecological problems relevant to the LTER Decadal Plan.

For additional information please contact Debra Peters, Project Leader (*debpeter@nmsu.edu*) or Christine Laney, Project Coordinator (*chrlaney@nmsu.edu*).

By Debra Peters, JRN

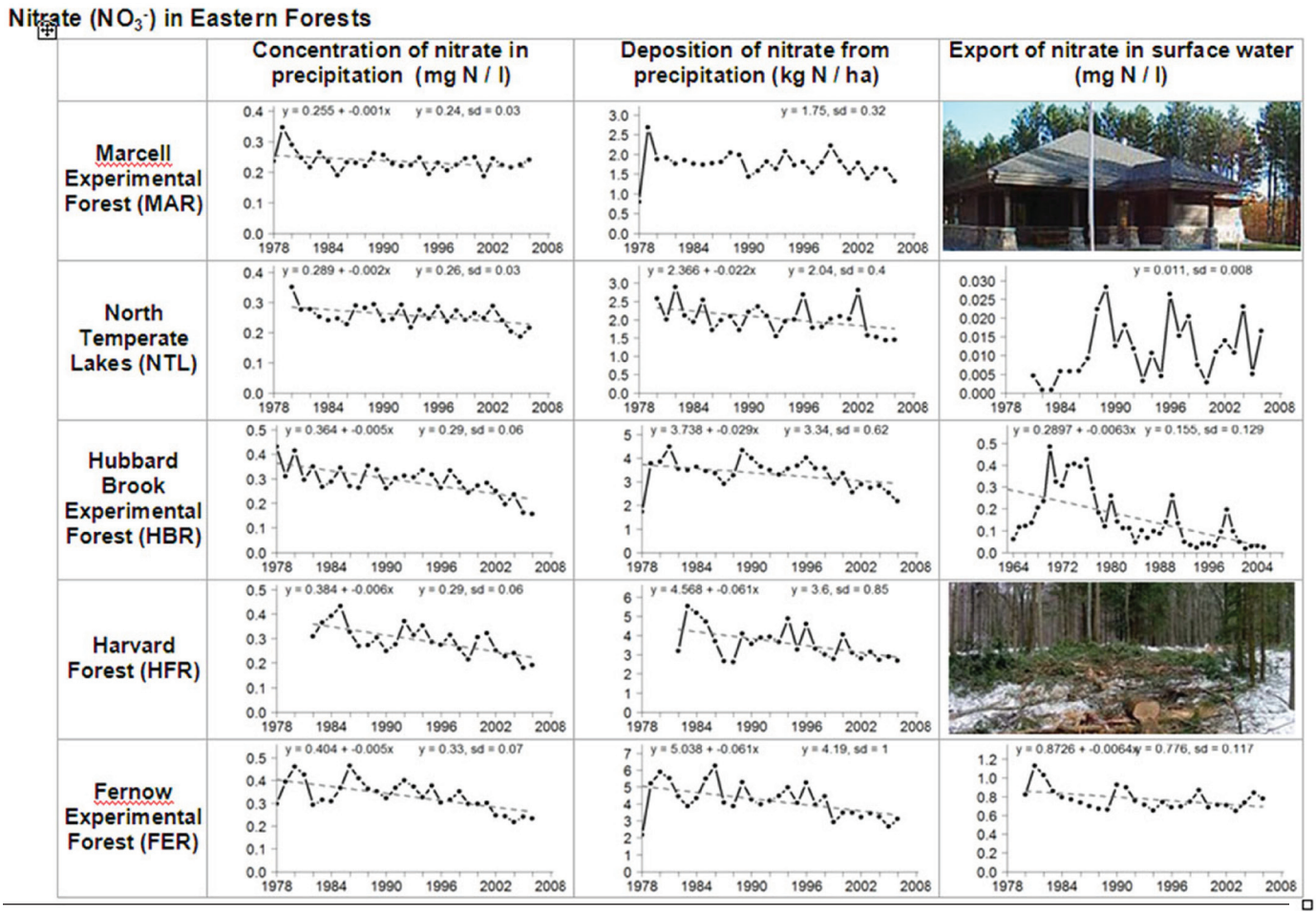

Fig. 2: An example page from the EcoTrends book showing atmospheric nitrate and export of nitrate in surface water for five eastern forest sites.

Establishing hurricane network in the Greater Caribbean Region

A joint US-LTER/Mex-LTER meeting

In January, 2009, the Ecosistemas Costeros de la Peninsula de Yucatan (ECOPEY) Mex-Long Term Ecological Research (LTER) site and both the US LTER and RED MEX LTER Network offices hosted a workshop in Mérida, Yucatán, Mexico to address the ecological role of hurricanes. With 22 scientists attending from the US and the Mexican LTER programs, and other research institutions, the workshop discussed mechanisms for developing a coordinated network of sites to address hurricane effects and responses on a variety of coastal and terrestrial ecosystems in the wider Caribbean region.

Participants in the Mérida meeting. From left to right, bottom row: M. Willig, M. Maass, L. Porter Bolland, N. Brokaw, J. Zimmerman, A. Covich, E. Gaiser, S. Van Bloem , U. Berger. Top row: J. Euan, L. Calderon, S. Davis, J. Herrera-Silveira, E. Castañeda, D. Imbert, D. Pérez Salicrup, V. H. Rivera-Monroy, M. Martnez. Not shown: J. Lopez-Portillo, J. Holm, R. Waide (photo courtesy of Robert Waide).

As part of the discussions researchers analyzed comparative results from sites in the Caribbean, Mexico, and the southern U.S., and addressed the proposition that coordination of future measurements and experiments across the Greater Caribbean Basin would result in significant advances of our understanding of systems structured by hurricanes and other kinds of disturbance.

Having obtained supplemental funding from the National Science Foundation (NSF) to hold the workshop, organizers were hopeful that it would be an excellent initiative to not only build close interactions between the US and Mexico LTER programs, but also to engage other international LTER sites throughout Latin America. Since 1989, the relative frequency of hurricanes in the Greater Caribbean Basin has resulted in numerous studies on hurricane disturbance and response in forested ecosystems (NSB 2007; Figure 1). These studies have produced significant amounts of site-specific data on the effects of hurricanes with different characteristics and on the responses of a wide range of ecosystem components, including terrestrial and aquatic animal and plant populations, carbon flux and storage, nutrient cycling, forest structure, and microclimate (Lugo 1997). Some studies have used simulation models to understand the responses of forested systems to disturbance. However, the studies have not been coordinated and comparisons of patterns are infrequent.

Figure 1: Several of the participants study sites are shown on this map of the Greater Caribbean Basin. Numbers in the map refer to: 1. Los Tuxtlas; 10. Guánica Forest; 11. Luquillo Experimental Forest LTER; 12. Florida Coastal Everglades LTER; 13. ECOPEY and Yucatan Project

The participants in the Mérida meeting represented a cross section of researchers on disturbance ecology in the Greater Caribbean Basin (including hurricane-prone areas of western Mexico for comparison). Although funding constrained the size of this

See "Hurricane", p. 27

Hurricane (continued from p. 26)

meeting, it was widely recognized that there are at least an equal number of other investigators whose research merits inclusion in future planning. Therefore, there is strong potential to develop an extensive network of research sites and investigators focusing on the effect of hurricanes on natural ecosystems. Such a network would complement existing research networks, such as the US and Mexican LTER programs, as well as developing networks like NEON (National Ecological Observatory Network) and the conceptual framework outlined in Rivera-Monroy et al. (2004).

The Mérida workshop recognized three pre-requisites for a functional network: 1) identifying potential investigators and sites that could contribute to a network, 2) evaluating potential sources of long-term funding and planning to tap those funding sources, and 3) reaching a consensus on an underlying scientific theme that would animate the participants to commit to a research partnership. As products of this first meeting the participants initiated two documents that outline (1) a conceptual framework for integrating hurricane science across the Caribbean region through a formal research network and (2) a manuscript that reviews the status, distribution, and needs for ecological research on tropical storm disturbance in the Caribbean. In addition, the participants settled on a plan of action to seek future funding to develop a coordinated network of investigators and to organize a second meeting during the annual 2009 Ecological Society of America meeting in Albuquerque, New Mexico.

Literature Cited

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Rivera-Monroy, V. H et al. 2004. A conceptual framework to develop long-term ecological research and management objectives in the wider Caribbean region. BioScience 54: 843-856.

By Victor H. Rivera-Monroy, Robert B. Waide, Jorge Herrera-Silveira, Manuel Maass.

ILTER meeting fosters collaboration between Northern Patagonia and northwestern United States

In January 2009, researchers from North and South America gathered in Bariloche, Argentina, to discuss how to establish a program of research and scientific interaction focused on long-term ecological questions in northern Patagonia. The purpose of the workshop was to stimulate the development of a long-term ecological research program in western Argentina that would function in collaboration with long-term ecological research in the northwestern United States. The climatic similarities between the two regions offer many opportunities for collaboration, comparison, and contrast in ecological research.

The workshop brought together some of Argentina's most respected environmental scientists with their counterparts from the western United States, including researchers from the HJ Andrews Forest Long Term Ecological Research (LTER) site led by Barbara Bond (Lead PI and Professor of Forest Ecosystems and Society at Oregon State University (OSU)). Others were Mark Harmon (Professor, Forest Ecosystems and Society); Matthew Betts (Assistant Professor of Landscape Ecology and Wildlife Biology, Department of Forest Ecosystems and Society); Elizabeth Borer (Assistant Professor, Department of Zoology); and Carlos Sierra (PhD student, Department of Forest Ecosystems and Society), all from OSU.

The workshop was the first of several meetings and conferences designed to develop an interdisciplinary, long-term ecological research program in western Argentina and enhance collaborations with U.S. scientists. The meeting served as a rare opportunity to bring together high-caliber scientists, ranging from ecosystem, population and community ecologists to plant physiologists and hydrologists, with a keen interest in developing an integrated research program in the northern Patagonian region. In 2010 the group plans to submit a proposal to the National Science Foundation (NSF)'s Partnerships in International Research and Education (PIRE) program to develop this collaboration further.

The workshop was funded jointly by the NSF and local scientific agencies– the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) and the Agencia Nacional de Promoción Científica y Tecnológica (ANPCyT). It was chaired by Bond, Claudio Ghersa (Universidad

See "Patagonia", p. 28

Attendees of the meeting in Bariloche, Argentina (photo by Barbara Bond).

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Calendar

Coming Events of Interest to the LTER Community

Patagonia (continued from p. 27)

de Buenos Aires, Argentina), and Tomás Schlichter (Instituto Nacional de Tecnología Agropecuaria, Argentina).

A detailed article about the workshop was published in the journal, *New Phytologist* (see Austin, Amy T. Planning for connections in the long-term in Patagonia. New Phytologist. 182: 299–302).

By Lina DiGregorio, AND

MAY 2009

May 7-8, 14-15, 21-22, 28-29: University of Oregon Environmental Leadership Program, Canopy Connections field trips with local middle and high school students, HJ Andrews Experimental Forest, Blue River, OR. Contact Katie Lynch (*klynch@uoregon.edu*), director of the Environmental Leadership Program for details.

May 12-14: Science Council and Executive Board meeting, La Jolla Shores Hotel, San Diego, CA. Contact George Garcia (*gcarcia@LTERnet.edu*) at the LTER Network Office for details.

JUNE 2009

June 19 - July 1: Shortgrass Steppe LTER will host a two week workshop called "From the Ground UP: Pathways Connecting Earth Systems". Contact Kim Melville-Smith (*kimberly.melville-smith@colostate.edu*) for details.

AUGUST 2009

August 2-7: Ecological Society of America Annual Meeting, Albuquerque Convention Center, Albuquerque, NM.

August 12-14: Sevilleta LTER site visit, Sevilleta Field Research Station. Contact Scott Collins (*scollins@sevilleta.unm.edu*) for more information.

SEPTEMBER 2009

September 14-16: LTER All Scientists Meeting, YMCA of the Rockies, Estes Park, CO. Contact George Garcia (*gcarcia@lternet.edu*) for details.

OCTOBER 2009

October 15-16: Florida Coastal Everglades LTER Mid-Term Site Review, Miami, FL. Contact Mike Rugge (*ruggem@fiu.edu*) for more information.