

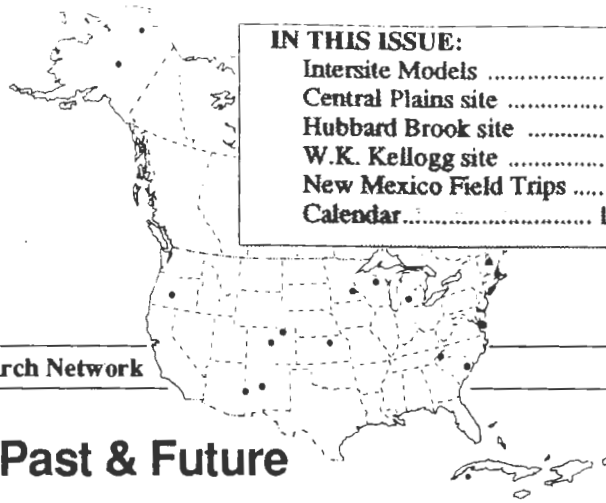
# LTER NETWORK NEWS

Newsletter of the Long-Term Ecological Research Network

Fall 1989, Issue 6

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## Parting Thoughts: LTER Past & Future

By John L. Brooks

Retirement from the National Science Foundation at the end of June brought to a close nearly 20 demanding and rewarding years of helping provide support for the most promising research activities in environmental biology in this country. One of the most satisfying aspects has been my association with what we all now refer to as LTER (Long-Term Ecological Research Network). LTER had its genesis in responsibilities I assumed when I first arrived at NSF.

THE GENERAL ECOLOGY program, of which I became rotating Program Director in September 1969, had been formed the previous year when the responsibilities formerly borne by the Environmental Biology Program were divided between two new programs, Ecosystem Analysis and General Ecology. In actuality, the new program was Ecosystem Analysis (now Ecosystem Studies) for its responsibility was principally the administration of the National



Dr. Brooks, outgoing Director of Biotic Systems and Resources Division of the National Science Foundation, was a key developer and supporter of the Long-Term Ecological Research Network.

Science Foundation's funding of the U.S. International Biological Program (IBP). General Ecology managed the core of what had been the Environmental Biology Program. Dr. Charles Cooper arrived to become the first Program Director of Ecosystem Analysis.

Among the responsibilities of the General Ecology Program was the support of research at field stations. In earlier years, the Environmental Biology Program had provided training grants to field stations to facilitate graduate research training in field biology. But training grants were being phased out at NSF and, in my first year there, attention was given to the consequences of this phase-out. An ill-defined concept of a "traditional" field station shaped my initial thinking about field stations and their role in ecological research. But growing acquaintance with the IBP biome projects funded in Ecosystem Analysis, and discussions with Charles Cooper and others led to a broadening of my perception of the array of potential sites for field research.

While I have no recollection of the timing and exact sequence of the development of the LTER concepts, [Chair] Jerry Franklin remembers that this subject was discussed at the first staff meeting he attended after he arrived at NSF in late summer of 1973 as Program Director in Ecosystem Analysis. Further developments profited greatly from Franklin's viewpoint and experience with research natural areas. The Institute of Ecology (TIE) was funded to prepare a report on the current status of facilities for experimental field research, to include all potential sites from traditional field stations to the sites,

for example, of the biome projects where large-scale field experimentation could be undertaken. A large committee under the wise and able leadership of George Lauff prepared an excellent report, entitled "Experimental Ecological Reserves."

During this period when the first focus had been on facilities for experimental research at protected sites, there was growing appreciation both among NSF staff and some members of the ecological community that NSF needed to find a mechanism to provide funds for research into field phenomena on a longer time scale than the usual two- or three-year NSF grant. There was a

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**'the prevailing short-term funding pattern was inducing ecologists to focus on what were essentially snapshots of long-term processes'**

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growing consensus that the prevailing short-term funding pattern was inducing ecologists to focus on what were essentially snapshots of continuing processes. Evidence was available even then that this short-term approach often provided a distorted view of long-term processes.

Reflection on the requirements for long-term ecological research projects immediately indicated the necessity of a suite of conditions, such as dedicated sites, and data storage and information retrieval systems. Tom Callahan's article in *BioScience* (June 1984, Vol. 34, No. 6) on the history of the LTER activity

See "Brooks," page 11

## Strategic Planning for an Expanding Network

*How can the LTER Network avoid being viewed by the larger community of scientists interested in long-term ecological research as the proverbial 600-pound gorilla?*

**By Jerry F. Franklin**

THE EXPANDING EFFORTS of the LTER Coordinating Committee to develop an effective and scientifically productive network include a challenging job this fall—the development of a strategic plan for the LTER Network. Strategic planning will be the major agenda item at the Committee's semi-annual meeting to be held at Harvard Forest, Petersham, Massachusetts, and Hubbard Brook Experimental Forest, Durham, New Hampshire, from October 11-15, 1989. This planning is a major effort to define the collective objectives of the LTER Network and to identify the activities and resources that are needed to achieve them.

How do we view the future? Where would we like our individual and Network programs to be in five years? What are some of the collective scientific goals—issues

that need to be addressed at the multi-site level? What kind of organizational arrangements and resources would be necessary to achieve these goals? How can the LTER Network assist in the development of the larger network of sites and scientists interested in long-term research?

Strategic planning is essential to the long-term future of the LTER program. The Coordinating Committee has conducted several exercises during the last 18 months aimed at identifying goals, but their further development remains the most important and difficult task ahead because they will provide the focus for all our activities.

THE RELATIONSHIP OF THE LTER Network to the far larger network of sites and scientists interested in long-term ecological research is an extremely important

part of this planning effort. How can the LTER program facilitate improved communication and collaboration within this larger community without being viewed as the proverbial 600-pound gorilla? We have already been doing many things toward this goal as a part of our LTER activities; for example, we have consistently included participants from non-LTER sites in our workshops, and have developed and disseminated standards for measurement and data management programs.

Much more could be done, but we need suggestions from both LTER and non-LTER scientists as to what and how. I hope the new section of the Ecological Society of America on Long-Term Studies will be an important arena for some of this cooperation. Your ideas on this issue are urgently solicited. □

## LTER May Be Featured In *BioScience*

An upcoming issue of *BioScience* magazine may be devoted to the LTER Network. Three feature articles have been submitted for publication: one co-authored by LTER Chair Jerry Franklin, Caroline Bledsoe (Network Office/NSF) and Tom Callahan (NSF), and two others authored by John Magnuson (NTL) and Fred Swanson (AND) and Richard Sparks. The articles outline LTER's contribution to ecological science and the potential for an expanded network of scientists and sites, as well as the temporal and spatial scales of the program. □



LTER Network Office \*staff:  
Rudolf Nottrott, Network Data Manager, 206-543-8492; Stephanie Martin, Network News Editor/Administrative Assistant, and Adrienne Whitener, Office Assistant, 206-543-4853; Office hours: 8:30 a.m. to 5:30 p.m. weekdays

\*A Network Manager will be hired in September.

## Chinese Delegation-LTER Exchange Cancelled

The previously announced visit by Chinese ecologists to several LTER sites this fall, with an exchange visit of LTER representatives to Chinese sites in fall 1990, has been cancelled until further notice. Soon after the summer's political upheaval in Beijing, the U.S. State Department issued an advisory against travel to China for NSF grantees. That advisory remains in effect and, until

### THE CHINESE CONNECTION

The Chinese Ecological Research Network (CERN), which has 52 research stations, is now publishing a periodic newsletter in Chinese and English. To be added to the mailing list, write Mr. Zhao Guang, Editor, CERN Newsletter, Institute of Applied Ecology, Chinese Academy of Sciences (CAS), P.O. Box 417, Shenyang, Peoples Republic of China. □

further notice, new awards will not include funds for such travel.

Should this policy change, grantees whose research would have included a visit to China may submit supplemental requests for travel funds. Grantees holding current grants including travel to China should heed the advisories until further notice. Travel of Chinese scientists to the United States is not affected by the policy.

In the case of the LTER program, the Chinese government would have provided roundtrip airfare for the nine representatives of the Chinese Ecological Research Network (CERN), but there was no provision for their expenses while in the United States. When the advisory was issued, Network Office staff were exploring the possibility of obtaining in-country travel support from NSF. Funds for LTER Network representatives' China trip were requested in the second-year LTER collaboration grant proposal to NSF. □

## 1990 Center for Field Research Grants

The Center for Field Research, a program sponsored by the nonprofit organization Earthwatch, is launching an initiative to develop a coherent program of physical and ecological science research.

In 1990 Earthwatch will award grants of \$10,000 to \$100,000 with funds primarily derived from the contributions of participating volunteers selected from Earthwatch membership. Non-specialist volunteers must be integrated effectively into the research design.

The research supported spans many of the physical and biological sciences, and proposals are considered from scholars of any nationality for any geographical region. Projects have been funded in botany, ichthyology, herpetology, ornithology,

terrestrial and marine mammalogy, primatology, conservation biology, population biology, animal behavior, sociobiology, entomology, and terrestrial and marine ecology.

Preliminary proposals (reviewed monthly) may be made by telephone or detailed letter to The Center. Upon favorable review, full proposals will be invited for submission 12 months before the proposed project fielding date. Full proposals will be peer-reviewed, and awards are announced quarterly.

Contact: David S. Silverberg, Associate Director, Physical & Ecological Sciences, The Center for Field Research, 680 Mount Auburn Street, P.O. Box 403, Watertown MA 02272. (617) 926-8200. □

### LTER Network News

The *Network News* is published twice a year and is distributed in limited quantities at no cost. Address submissions, comments and queries to the editor, University of

Editor: Stephanie Martin

Washington, College of Forest Resources, Anderson Hall, AR-10, Seattle WA 98195 (206) 543-4853.

Advisors: Jerry F. Franklin  
John L. Magnuson

## Acting BSR Director

Dr. James L. Edwards, Program Director of NSF's Biological Research Resources Program, Division of Biotic Systems and Resources (BSR), was named Acting Division Director while the national search for Dr. Brooks' replacement is being conducted. The position closed in July and is projected to be filled by January 1990.

### 1989 NSF CALENDAR

SEPT 29	Deadline: Proposals, Basic Research, Conservation & Restoration Biology
OCT 1	Deadline: Postdoc research fellowship applications
4-6	Ecology Panel
5-6	Ecosystems Panel
15	Deadline: Doctoral dissertation research proposals
NOV 1	Deadline: Fellowships, new PhD's, Environmental Biology
15	Deadline: Supplemental funding requests, BSR awardees
DEC 15	Target date: Proposals, Ecology, Systematics, Ecosystems & Population Biology/Physical Ecology
1990	
FEB 1	Deadline: LTER renewal proposals

## LTER Poster Display Available For Loan

A poster display developed by the Sevilleta site for its 1988 LTER dedication ceremony is now available for other sites to borrow. There are 18 posters in the group. One (36" x 36") provides an introduction to the Network and its objectives and features a map showing the locations of the sites. The other 17 (18" x 24") provide both textual and visual information on the individual sites.

To schedule the set for an upcoming presentation or event, contact Stephanie Martin in the Network Office (206-543-4853) several weeks in advance. □

### By Rudolf Nottrott, Network Data Manager

Since joining the LTER staff in mid-April, Rudolf has been busy expanding the Network Office's computer services to enhance the "connectivity" of the Network.



THE DATA MANAGEMENT function of the Network Office is developing rapidly. A VAX- station 2000 was acquired in April and, by May, was connected to the national Internet via NorthWestNet, a regional network funded by NSF and connected to the NSFnet high-speed Internet backbone. (The VAX's Internet domain name is "lternet.washington.edu"). A modem connection was also set up to enable users to connect to the LTERNET VAX over a telephone via the number (206) 543-2115.

During the recent wide-area networking (WAN) workshop in Champaign-Urbana, IL (see page 10), it was suggested that a mail forwarding system be established for the LTER Network. A system has since been set up on the Network Office VAX and was tested networkwide in August during preparations for the Toronto data managers meeting (see page 10), when it was used to send electronic mail to the groups and individuals taking part. All names and electronic mail addresses from the LTER Personnel Directory have been transferred to the mail forwarding database, and a complete text file is now available on-line.

THIS FORWARDING system greatly simplifies the sending of electronic

mail messages by creating a uniform address for everyone in the Network. The address format is "username@lternet.cfr.washington.edu"; the 'username'—which can also be a group name—is formed according to a simple rule (described below). Mail addressed to a group name will be forwarded to all individuals on the group list. Additional individuals or groups can be added to the directory at any time.

TO FORM THE USERNAME for an individual, concatenate the first letter of his or her first name with the last name. For example, James (Tom) Callahan's forwarding address is "jcallahan@lternet.washington.edu" ('tcallahan' will also work). The idea behind the scheme is that as long as you know someone's name and the domain name you can create his or her forwarding address.

The Network Office also has a Bitnet system address. Bitnet mail sent to the forwarding system has the format "username@lternet". Unfortunately, Bitnet limits usernames to eight characters. To form a valid username for a Bitnet address, follow the Internet rule above and simply truncate the result. Tom Callahan's Bitnet address, for example, would be "jcallaha@lternet" or "tcallaha@lternet". □

### 'White Pages'

In addition to the on-line mail forwarding directory available through the Network Office, an interactive on-line directory, providing LTER Network members' names, addresses, phone numbers and research areas (now only in printed form) will be implemented by the end of the year. This capability, sometimes referred to as "white pages," is part of the EXPRES System developed with NSF funding at Carnegie Mellon and Michigan State universities with the aim of improving the generation and communication of multi-media documents among different computing environments.

### Bulletin Board

With the implementation of the EXPRES System at the Network Office, a multi-media bulletin board will be available, capable of receiving and posting messages, including graphic images. Since EXPRES was developed for use in an environment characterized by hardware from a variety of vendors (including workstations and PCs), the bulletin board can accommodate a heterogeneous computing environment. Users on systems without graphic capabilities will still be able to read the sections containing text only.

## Complete Connectivity

Over the past few months, NSF and Network Office personnel have been discussing the value of LTER sites achieving "full connectivity" on the Internet computer.

In July, NSF appointed a committee to (1) develop a plan to assess the current status of LTER computer connectivity; (2) contact or visit all sites during the summer and fall of 1989; (3) collect information on existing equipment; (4) propose

options to improve site connections; (5) estimate the costs of implementation; and (6) submit a preliminary report to the LTER/CC by this October and a final report by December.

The committee: James Brunt (Chair, Sevilleta LTER), Rudolf Nottrott (LTER Network Office), John Porter (Virginia Coast Reserve LTER), Robert Robbins (NSF advisor).

Following the first meeting of the committee in Seattle in July, equipment assessment survey forms were mailed to all 17 sites. Currently, the team is visiting sites and completing connectivity assessments.

For more information contact James Brunt (505) 277-9342 or Rudolf Nottrott (206) 543-8492, or both @ "lternet.cfr.washington.edu".

# CENTRAL PLAINS EXPERIMENTAL RANGE

By Bill Lauenroth

In July, the Central Plains Experimental Range celebrated its 50th anniversary with a weekend of field programs for both professional ecologists and the general public. Speakers included officials from the Agricultural Research Service and Colorado State University. Congressman Hank Brown spoke at lunch on the field day for the general public.

Research at the Central Plains Experimental Range was begun in 1939 by the U.S. Forest Service. Most of the exclosures and several of the ongoing experiments were initiated at that time. In 1953 administration and research at Central Plains was taken over by the Agricultural Research Service (ARS), which along with faculty at Colorado State University has since conducted most of the research. The Central Plains Experimental Range was a U.S. International Biological Program (IBP) site from 1969-1974 and became an LTER project in 1982.

Current activity under LTER includes the initiation of a landscape-level <sup>15</sup>N experiment, the completion of the first phase of a regional modeling project, and the initiation of an intersite simulation modeling project.

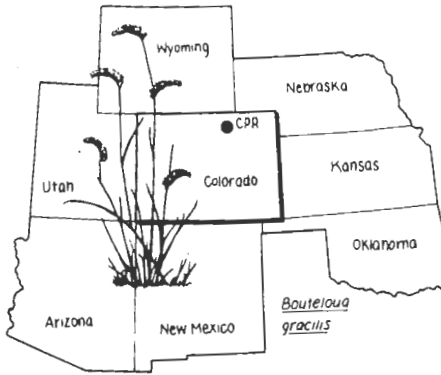


ILLUSTRATION BY CYNTHIA CASSELL

database of model output for the region. The results of this work are in press with the journal *Landscape Ecology*.

## Intersite Modeling Project

An intersite modeling project has been begun as a result of a supplement to a NSF grant awarded to Bill Lauenroth at Colorado State University and to Hank Shugart at the University of Virginia. The objective of this work is to utilize a single modeling paradigm and a similar model structure to compare ecosystems. Comparisons will be made among three grassland sites, Central Plains, Konza, and Niwot; and among three forested sites, H.J. Andrews, Coweeta, and Hubbard Brook.

In addition to the principal investigators, participants include Debra Coffin, Tom Kirchner, and Bill Parton at Colorado State University and Tom Smith, Dean Urban, and George Hornberger at the University of Virginia.

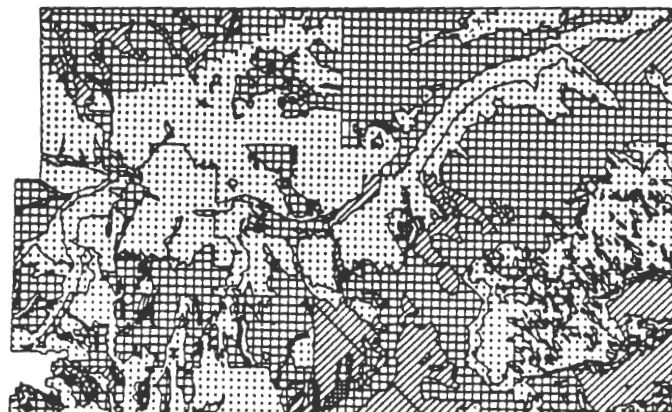
For additional information contact Bill Lauenroth, Range Science Department, Colorado State University, Fort Collins, CO 80523. □

## Landscape-Level Experiment

The initiation of a landscape-level <sup>15</sup>N experiment to investigate interactions among grazing, landscape position, soil organic matter and nitrogen was completed during the summer of 1989. The plots, located on replicated uplands and swales in a 50-year heavily grazed pasture and a 50-year exclosure, were located in 1988 and sampled to determine initial conditions. Applications of <sup>15</sup>N were begun in the fall of 1988 and completed in 1989. This experiment is planned to run for 20 years.

## Regional Modeling Project

Under the direction of Indy Burke, phase I of a regional modeling project has been completed under LTER supplemental funding. This first phase involved constructing a GIS database of driving variables for the northeastern quarter of Colorado, running a simulation model for classes of driving variable polygons, and constructing a complementary



Simulation output from the CENTURY ecosystem model for steady state soil organic carbon (g/m<sup>2</sup>) in northeastern Colorado. The Central Plains LTER site is in the upper lefthand corner.

# HUBBARD BROOK EXPERIMENTAL FOREST

By Charles T. Driscoll &  
Timothy J. Fahey

The USDA Forest Service established the Hubbard Brook Experimental Forest (HBR) as a research laboratory in 1955. Hubbard Brook is currently managed by the Forest Service, Northeastern Forest Experiment Station, Durham, New Hampshire, and is used to study watershed management problems by scientists from the Forest Service and cooperating institutions such as Cornell University, Dartmouth College, the Institute of Ecosystem Studies from the New York Botanical Garden, Syracuse University and Yale University.

The Hubbard Brook Ecosystem Study (HBES) was initiated in 1963 in an effort to improve the understanding of the structure and dynamics of northern hardwood forests and their interconnected aquatic systems. An important resource resulting from this research is a long-term record of physical, chemical and biological parameters. The Hubbard Brook LTER is building upon this ongoing program and the extensive base of research results. Besides contributing to the continued monitoring of climate, hydrology, biogeochemistry, and plant and heterotroph populations in the HBR catchments, LTER researchers are utilizing field manipulations and simulation modeling to help reveal internal mechanisms regulating the large-scale behavior of the watershed study unit.

## Precipitation Record

The long-term record of precipitation chemistry from HBR has been an extremely valuable source of information on acid rain. Recently, coupled declines in the deposition of sulfate and  $H^+$  have been documented at the site. Driscoll et al (1989) have examined long-term trends in streamwater chemistry in

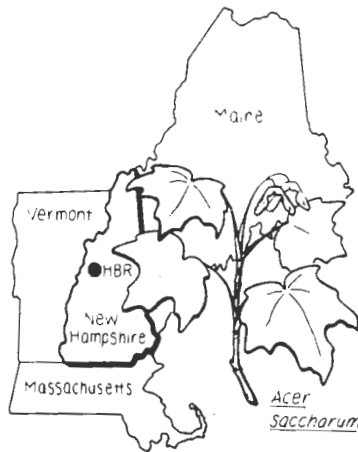


ILLUSTRATION BY CYNTHIA CASSELL

response to changes in atmospheric deposition. Stream sulfate in watershed 6 (W6) shows declines which are consistent with decreasing precipitation inputs of sulfate. However, this decline has not resulted in any change in stream acidity. Rather, decreases in sulfate have been offset by near stoichiometric decreases in basic cations. The decline in stream concentrations of basic cations may be due to reduced leaching from soil cation exchange sites and/or decreases in atmospheric deposition of basic cations. The contribution of atmospheric inputs of basic cations in regulating the acid-base status of soil and drainage water was unexpected and could have important policy implications for air pollution control.

Continued analysis of acid-base balances is a central focus of our LTER project; for example, we are attempting to refine estimates of dry deposition by comparing three methods: watershed mass balances, aerodynamic approaches, and throughfall regression estimates. Repeated remeasurements of the vegetation of W6 indicate that the biomass of the approximately 75 year-old forest has unexpectedly stabilized during the most recent five-year interval (1982-1987). This result does not match predictions of a forest growth simulator developed in part at HBR.

## Large-Scale Disturbance

A recurring theme at HBR has been large-scale disturbance and the biotic regulation of ecosystem element cycles. Most recently, ecosystem recovery was characterized following a whole-tree clearcut of Watershed 5, in an effort to quantify the mechanisms influencing the watershed-level behavior observed in previous disturbance experiments.

Currently, these studies are being integrated in a synthesis volume.

Among the new observations and insights this research has contributed are: (1) the strong longitudinal trends in acidity and trace metal concentrations along the course of streams, resulting from spatial variation in soils and source-areas for streamflow; (2) the rapid but brief transition of the stream from a detritus to an algal food base; (3) the large potential contribution of decaying fine roots to the loss of some nutrient elements during the first two years after forest harvest; (4) the high spatial variation in nutrient accumulation by vegetation and, conversely, in nutrient leaching from upper soil horizons; (5) the large amounts of mixing and burial of forest floor horizons during logging operation and the fate of this buried organic matter; and (6) the contribution of "hot-spots" of gaseous emissions to nitrogen losses from the disturbed watershed. Synthesis volume seeks to integrate this information in both scientific and management contexts.

## Long-Term Monitoring

Long-term monitoring efforts at HBR have not been limited to biogeochemical measurements, but include detailed observations of nesting birds and their food sources. LTER funding has allowed us to improve the sampling program for insect populations and thereby help understand the factors regulating changes in bird population sizes. Following a steady, long-term decline in population sizes in the Hubbard Brook region, the total number of breeding birds appears to have stabilized in the last few years.

## Other Research Areas

Other active areas of research include: (1) a detailed study and modeling of hydrologic flow paths within forested watersheds; (2) nutritional dynamics of small mammals and deer on the recovering clearcut watersheds; (3) interactions of the ubiquitous fungal groups, *Armillaria* and *Trichoderma*, (4) long-term changes in the forest floor and mineral soil horizons following

See "Hubbard Brook," page 1

# W.K. KELLOGG BIOLOGICAL STATION

By G. Philip Robertson

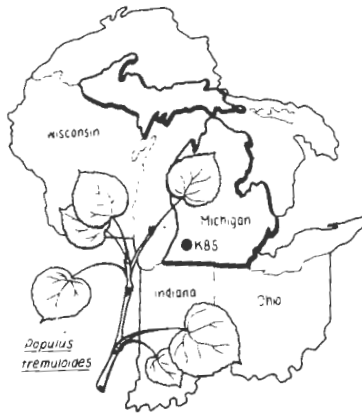
The 1989 field season at the Kellogg Biological Station's LTER site in agricultural ecology has seen the first full set of main experimental plots installed, the start of baseline sampling activities, and the continued development of sub- and spinoff projects. Investigators at the site have also been busy analyzing results from a massive year 1 spatial variability study.

All LTER-associated projects at KBS fall under the global hypothesis that agronomic management based on ecological concepts can effectively substitute for the current reliance on chemical subsidies in production-level agronomic systems. One of the corollaries that falls out of this hypothesis is that herbicide subsidies can be minimized by manipulating crop-weed interactions, pesticide subsidies by manipulating plant-insect-pathogen interactions, and nutrient subsidies by manipulating plant-microbe-soil interactions.

The approximately 30 Ph.D.-level researchers actively associated with the project are organized into three working groups centered on these topic areas: plant competition, herbivory and pathogenesis, nutrient availability—plus a fourth centered on systemwide outputs and modeling. Working group leaders coordinate activities among the groups.

## Main Field Plots

The main field plots, in which specific hypotheses that follow from the global hypothesis are addressed, are located on a 40-hectare site that has been in high-input, continuous corn production for the past several decades. This spring seven types of treatment plots were established on this site, each 1 hectare and replicated in one of six blocks. Treatments 1 and 2, both corn-soybean rotations, represent conventional, high-input grain production; one treatment is conventionally tilled (moldboard plowed) and the other is "no-tilled."



Treatments 3 and 4 represent low-chemical-input and zero-chemical-input treatments; both are corn-soybean-wheat rotations with a legume (hairy vetch) cover crop. Treatments 5 and 6 are the perennial biomass plots; one is planted in alfalfa, the other in fast-growing *Populus* trees. Treatment 7 is a native succession, abandoned after plowing last spring.

## Process-Level Subplots

Within each of the main treatment plots are subplots established to address specific process-level hypotheses. In all of the grain treatments, for example, are subplots with and without fertilizer and with and without herbicide to test hypotheses about resource allocation and competitive interactions among crop and weed species.

In the *Populus* plots are subplots planted to different stem densities and microplots treated with radioisotopes to examine within-plant C/N allocation, root turnover, and decomposition dynamics. In ancillary till/no-till subplots, 4 m<sup>3</sup> in-ground,

undisturbed profile drainage lysimeters are being installed to test hypotheses about nutrient turnover, plant uptake, and microbial dynamics within soil wetting fronts. In ancillary wheat subplots, different 2-4,D concentrations are used to study mechanisms of gene transfer in soil.

## Research Awards

In recent months KBS LTER researchers have received a number of research awards for work centered at the site. Among these are grants overseen by Stuart Gage ("Influence of local landscape structure on the distribution, abundance and movement of insects"), Kay Gross and Kurt Pregitzer ("Mechanisms of belowground competition in plants: linking form and function"), Eldor Paul and Kurt Pregitzer ("Fine root and soil organic matter turnover in C, N, and P cycling of *Populus* plantations"), Phil Robertson and Al Smucker ("Process-level interactions in agricultural ecosystems"), Mark Scriber and Matthew Ayres ("*Papilio glaucus* in temperate and subarctic forests: host plant quality and temperature adaptations"), and Jim Tiedje and Bill Holben ("Molecular approach to understanding genetic response of soil population selection"). The Kellogg LTER site is also the primary field site of the Science and Technology Center for Microbial Ecology, with which seven LTER scientists are associated as principal or co-investigators.

For further information contact Phil Robertson, W.K. Kellogg Biological Station, Michigan State University, Hickory Corners, MI 49060-9516. ■



Plowing the high-chemical-input plots at Kellogg Biological Station, Hickory Corners, Michigan

## April '89 LTER Field Trips

**Sevilleta.** Following the April Coordinating Committee meeting in Albuquerque site representatives set out for the Sevilleta Wildlife Refuge, 75 km south. Added to the Network in September 1988, at 100,000 hectares the Sevilleta is the second-largest of the LTER sites.

The first stop, across the muddy Puerco Rio (Pig River), was dry steppe marked by creosote shrub and dead juniper (from a '50s drought) that 18,000 years ago had been a conifer forest. PI James Gosz provided an overview of the site, and Manual Molles, an introduction to a watershed study of both large-scale climatic variation (including El Niño effects) and local precipitation on the hydrology and ecology of ephemeral streams. Molles, a climate/hydrology/fluvial ecology specialist, explained his two-fisted approach: high-tech timelapse video recorders, with low-tech painting of stream channels, pebbles and boulders as a back-up. Thus far he has found that the most flow follows dry winters, and that the zone is moving into a period of frequent returns (four to seven years) of El Niño effects.

Other stops included desert grassland communities of blue and black grama grass and kangaroo rat mounds, riparian cottonwoods along the Rio Grande, and limestone caves where a USGS paleoecologist from Tucson, AZ, has found human remains and pleistocene material 20,000 to 50,000 years old. A lunch of Jim Gosz's homebred pork with beans and an array of fruit was served at the foot of the Los Piños Mountains, where mountain lions reportedly feed along the canyon wash at night.

Several species of "critters" and birds were sighted throughout the day, including a herd of muledeer, a bullsnake, a Gambel's quail, a pair of burrowing owls and an imported lab-bred kangaroo rat. Flora included *Ephedra* (mormon tea), four species of cactus, and pinyon pine.

**Jornada.** The group had dwindled from 30 to 11 for the four-hour drive to the Jornada Experimental Range and New Mexico State University Ranch the following day. The tour was condensed into just a few hours to accommodate departures from El Paso and Albuquerque.

Forty kilometers north of Las Cruces, south of the White Sands Missile Range (site of the first atomic bomb test), co-PI Gary Cunningham directed the group onto the vast 104,166 hectare Range. Research

PHOTO BY JACK WEBSTER



Above: James Gosz with an aerial site overview; Nel Caine left, John Magnuson right. Below left: Bruce Milne with bullsnake. Right: flowering cactus. PHOTOS BY JERRY FRANK

activities at Jornada focus on desertification and the consequent alteration of the water and nitrogen distribution.

Tour stops on the Jornada del Muerto ("journey of death"—so-called by the unfortunates who attempted to cross it on foot) plain included playa and basin grassland communities and mesquite dunes. One phenomenon observed, common in such arid ecosystems, was a syn-cyclonic storm or dust convective ("dust devil") that carries seed long distances. The folk explanation offered by guide Bob Parmenter (SEV) was that there were two

See "Field Trips," p.

PHOTOS BY TED THOMAS



Above: Dean Berg describes survey methods to Sarah Greene and Chen Hwa. Below left: Roger Gibson taking remeasurements in a 45-year-old spruce fir stand. Right: Subalpine communities with Dyers Peak (12,804 feet) in the background.

## Fraser, CO, 'Pulse'

During the week of June 11, 1989, scientific personnel from the H.J. Andrews LTER, Central Plains LTER, the Network Office, and the U.S. Forest Service's Rocky Mountain and Pacific Northwest Forest and Range Experiment stations conducted a collaborative field exercise at the Fraser Experimental Forest in the Front Range of Colorado. The Fraser site is dominated by old-growth forests of lodgepole pine and Engelmann spruce-subalpine fir and by alpine tundra. It has a long history of research on hydrology and forest management.

A major objective of the research "pulse" was to measure tree growth

and mortality in five large (over hectares each) permanent sample plots established about 50 years in undisturbed old-growth forest. The mortality data will be an important data set for the LTER synthesis workshop on tree death planned for March 1990. The research teams also collected data on aquatic (stream) and riparian communities, amounts and decay rates of coarse woody debris (standing dead trees and down) and spatial distribution of tree species. These data are comparable to data already available at several LTER sites but provide information on ecosystem types not currently represented within the LTER Network.

—Jerry Fra



## Six Research Models

By Caroline Bledsoe

As LTER Research Coordinator for the past 18 months, I have observed a wide variety of methods for conducting intersite research. Here are six models; others may be currently in use or under development.

**The Airplane Model.** The intersite person flies to a number of LTER sites, where he or she talks directly with LTER researchers, enlisting their interest in a particular project. John Magnuson used this approach for the Variability Workshop at North Temperate Lakes LTER (NTL). He visited 12 LTER sites, collecting data on variability across time (five-plus years) and space (five-plus locations/LTER sites). John also identified an interested participant who joined the workshop at NTL and analyzed the variability database from all 12 sites. In this case, authorship of publications will be multiple.

**The Camper Model.** Here, a researcher develops a multiple-site experiment in collaboration with researchers at several sites. Then he or she loads a camper, van, or trailer with experimental supplies and camping gear and begins a trek to the LTER sites, where the experiments are set in place. Later, the experimenter returns to collect data. This approach was used by Cathy Tate, Konza Prairie LTER (KNZ), to study dynamics of stream organisms, using a series of clay saucers with or without nutrient amendments which were placed in streams at Konza, Coweeta Hydrological Lab LTER (CWT), North Temperate Lakes, and at a non-LTER site in the Colorado alpine.

**The Divide-Up-The-Work Model.** Here, several scientists interested in a synthetic activity agree to divide up the LTER sites and individually contact them for the desired publications or information. Bill Lauenroth, Central Plains LTER (CPR), Jim Morris, North Inlet LTER (NIN) and I are using this approach to compare root biomass across LTER sites.

**The Questionnaire Model.** In order to collect information for an intersite project, the researcher designs a questionnaire which he or she mails to each LTER site, requesting certain data. After the questionnaires are returned, the researcher evaluates and synthesizes the data, testing the hypotheses which initiated the project. Dave Tilman of Cedar Creek LTER (CDR) is currently using this approach in his study of productivity across lifeform gradients.

**The Sabbatical Model.** A scientist simply arranges to spend some sabbatical time at another LTER site, conducting research. Nel Caine of Niwot Ridge LTER (NWT) spent several months at the Andrews LTER (AND), working with Fred Swanson. The two had mutual interests in geomorphology and wrote several papers describing sediment budgets for catchment areas at NWT and AND.

**The Workshop Model.** LTER sites are invited to send a representative to a workshop which focuses on a particular topic. The participants evaluate the topic, discuss ways to conduct intersite research and, if possible, develop a specific research plan. The recent Decomposition Workshop, organized by Jerry Melillo of the Harvard Forest LTER (HFR), is an example of this approach. Participants designed two intersite experiments—litter bag and soil plot studies—to examine the inputs to soil organic matter (SOM) both above- and below-ground and the slowly decaying fraction of SOM.

**Others.** If you know of other models for conducting intersite research, contact me and I will add them to the list. In this way, prospective intersite workers will have more ideas to choose among. There are, of course, advantages and disadvantages to all the above approaches—most involve trade-offs of time and money. But there is one thing the majority of those who have conducted intersite research can agree on: that personal contact and exchange can ensure a project's success.

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### The Ten Commandments of Comparative Analysis\*

Compiled by a discussion group on improving the use of existing data sets, led by Cathy Tate (KNZ) and John Magnuson (NTL), Third Cary Conference, May 1-3, 1989. Printed by permission of Springer-Verlag, New York, Inc.

1. Thou shalt honor the advancement of ecology.
2. Thou shalt seek great patterns among divergent ecosystems.
3. Thou shalt not kill creativity.
4. Thou shalt not commit adulteration of data.
5. Thou shalt not steal.
6. Thou shalt make thy data available even unto thine enemies.
7. Thou shalt not assume all ecosystems are different until you do the residual analysis.
8. Thou shalt honor probability theory whenever possible.
9. Thou shalt release thy data from bondage.
10. Thou shalt not covet thy neighbors' data until they've had a crack at them.

\*Tate, C.M., and C. Jones. Improving use of existing data. In comparative analyses of ecosystems: patterns, mechanism, and theories. J.J. Cole, S.E.G. Findlay and G.M. Lovett, editors. Springer-Verlag, NY, 1990.

## Meetings/Workshops

### Data Managers Meeting

The LTER data managers meeting took place in Toronto, Ontario, August 4-6 prior to the Ecological Society of America meetings. In two days of productive discussion the group addressed data and information management problems that have come up during the last year or that have plagued the Network for some time.

Among the topics discussed were: long-term goals for research data management and information resource development, the state of network connectivity (see article, page 4), sharing of information and databases, special interest subjects (including database software, optical disk storage, and developments in computer workstations), and GIS/data management integration.

### Decomposition Workshop

An LTER workshop on decomposition processes was held at the Marine Biological Laboratory in Woods Hole, Maine, in May, 1989. Representatives of each of the 17 sites shared information, new experiments and technologies were outlined, and two proposed experiments—litter bag and plot studies—were designed as a resource

### Recommendations:

The following recommendations were developed in discussion subgroups and synthesized by the data managers as a whole. They will be outlined in more detail at the fall 1989 Coordinating Committee meeting at Harvard Forest.

- Establish a bimonthly newsletter to be distributed to site data managers electronically and by regular mail.
- Establish a one-year task force to (1) formulate, with data managers' input, the agenda for a 1990 meeting; (2) provide a liaison to the LTER/CC; (3) begin development of future data management priorities and goals;

and (4) facilitate exchange among data managers.

- Develop an all-site catalog of key, long-term core data sets.
- Develop an all-site bibliographic database.
- Establish research data management as a sixth LTER core area.
- Compile a set of LTER data management-related documents to provide background information for new data managers and increase continuity among the group.
- Develop, with the LTER GIS Working Group, documentation standards for GIS products.
- Develop a UNIX system administration workshop to facilitate rapid development of UNIX expertise at each site. □

for the next several decades for both LTER and non-LTER scientists.

Benefits of the workshop included: 1) resulting data will increase understanding of how litter quality and environmental conditions interact in effects on decomposition rates; 2) the litter bag experiment will provide estimates of the "meta-stable" fraction of soil organic matter; 3) decomposition model data will allow predictions of carbon dioxide fluxes from a wide range of

vegetation types across the United States, and can be used in global climate circulation models; 4) the experimental design provides opportunities for non-LTER scientists to collaborate; 5) the plot experiment provides process-level information on above- vs. below-ground inputs to soil organic matter; and 6) analysis can be done centrally, ensuring uniformity and timeliness, and creating a central database. □



*WAN Conference participants. Back row: John Dowd (CWT), Bill McIner (NIN), John Porter (VCR), Rudolf Nottrott (NET), Tom Kirchner (CPR), Alan Craig (NCSA), Bob Robbins (NSF). Third row: Barbara Dumas (BBN), James Brunt (SEV), Craig Partridge (BBN), Gary Cunningham (JRN), A.El Haddi (CDR). Second row: Mark MacKenzie (NTL), Tom Callahan (NSF), Bill Lawrence (LUQ), Cindy Veen (HBR), Jim Halfpenny (NWT), Phyllis Adams (BNZ), Barbara Benson (NTL), Jim Laundre (ARC). Front row: Dan Van Belleghem (NSF), Karen Roubicek (BBN), John Briggs (KNZ), Caroline Bledsoe (NET/NSF), John Gorentz (KBS). Photo Courtesy of NCSA access, May-June 1989.*

### WAN Conference

A wide-area networking (WAN) conference was held in April, 1989 at the University of Illinois at Champaign-Urbana. The event was a combination of hands-on experience with computer networking and learning new techniques from a variety of presenters. Three LTER representatives gave demonstrations of their use of networks and various speakers introduced Internet resources and support services, the evolution of NSFNET and the current Internet, network security and secure passwords, David Kingsbury's "collaboratory" concept, the future of computer networks for biologists, and the possible uses of supercomputers for graphics.

Participants agreed to trade information via electronic mail (e-mail) about computer purchases and GIS hardware, and the need to develop common standards, protocols and software to the integrated activities (data sharing, synthesis, comparative research) was recognized. Also discussed were links between LTER sites, supercomputers and remote sensing, centralized image-processing and georeferencing, as well as the development of an LTER database consisting of cross-referenced lists of publications from all LTER sites, which would be available both to LTER and non-LTER scientists.

**HYDROLOGIC/HYDRAULIC  
TECHNIQUES MANUAL**

The Centre for Environmental Applied Hydrology, University of Melbourne, Australia, is involved in the transfer of technology from hydrologists to stream ecologists and would like to develop U.S. contacts. As part of their work, they will be publishing a "user-friendly" manual on hydrologic/hydraulic techniques. Contact T.A. McMahon, Director, Divil and Agricultural Engineering, University of Melbourne, Parkville, Victoria, 3052 Australia.

From "Field Trips," page 6

"jackalopes" fighting and kicking up dust.

Brad Music of the University of New Mexico's Technology Application Center, described the Desert Winds Project "geomet" station set up two and a half years ago to define the geologic and meteorologic controls on processes—primarily wind erosion and deposition—that shape desert surfaces. The sophisticated instrumentation—a NOAA-developed sand flux sensor, soil heat flux sensors, and a Fryrear sandcatcher—measures windblown

From "Hubbard Brook," page 6

large-scale disturbance, and documentation of changes in vegetation composition, biomass and chemistry in permanent watershed plots with contrasting disturbance histories.

HBR is also developing research linkages with other LTER sites including: studies of bole wood decay (H.J. Andrews and Coweeta); vegetation and soil response to large-scale disturbance (Luquillo and other forested sites); hydrogeochemical processes in first-order stream catchments (Niwot Ridge); and near-stream biogeochemical processes (Arctic Tundra).

For additional information contact Charles Driscoll, Department of Civil Engineering, Syracuse University, Syracuse, NY 13244-1190, or Timothy Fahey, Department of Natural Resources, Cornell University, Ithaca, NY 14853.

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**Comprehensive Bibliographies:**

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Central Plains Experimental Range, 1939-1988  
Hubbard Brook Ecosystem Study, 1955-1988  
Konza Prairie Research Natural Area, 1973-1989  
Belle W. Baruch Institute for Marine Biology  
and Coastal Research (North Inlet LTER), 1969-1989  
North Temperate Lakes, 1890-1989

From "Brooks," page 1

at NSF chronicles the presentation of these ideas for community evaluation at a succession of three workshops, and the announcement of the first LTER competition in 1979.

THE FUTURE IS BEGINNING with an LTER Network that provides evidence of gathering strength. To date, preliminary reports from the site review teams of Cohort I have indicated strong site projects. That is no surprise. But what is most heartening to me is the evidence of the functional integration of the Network. Recent strides in implementing Geographical Information Systems (GIS) at all sites

and the potential for the fuller exploitation of remotely sensed data, together with the growing ability to utilize established computer networks and the access to super-computers, promise breathtaking advances. The plans for the all-site experimental study of decomposition that emerged from the recent workshop are but one major step toward establishing the required experimental basis for comparative ecosystem science. The "Network" is becoming a network.

My hope for the future is that all environmental biologists will come to appreciate that "ecosystem

See "Brooks," back page

# CALENDAR

— 1989 - 90 —

SEPT 18-19	<b>ILTER Workshop: GIS Training</b> Fort Collins CO Indy Burke, CPR, 303-491-1620	MAR tba	<b>ILTER Workshop: Tree Death</b> organizer tba
28-30	<b>ILTER Workshop: Stable Isotope</b> Woods Hole MA Brian Fry, ARC, 508-548-3705	APR tba	<b>ILTER Executive &amp; Coordinating Committee meetings, site tba</b>
OCT 2 - 4	<b>2nd International LTER Conference</b> Oct 4 "teleconference" to Network Albuquerque, NM James Gosz, SEV, 505-277-2265	24-26	<b>ILTER Workshop: Root Techniques</b> Hickory Corners MI Alvin Smucker, KBS, 517-355-8370
10	<b>ILTER Executive Committee meets</b> Harvard Forest LTER, Petersham MA	JULY 29	<b>Ecological Society of America</b> Snowbird, UT
11-13	<b>ILTER Coordinating Committee meets</b> Harvard Forest	AUG 2	Louis Pitelka, 415-855-2000
14-15	<b>ILTER Field Trip: Hubbard Brook LTER</b> Durham NH	12-16	<b>AIBS meeting, Richmond, VA</b> Louise Salmon, 1-800-882-AIBS(2427)
NOV 2 - 3	<b>ILTER Workshop: Remote Sensing</b> University of NH, Durham John Aber, HFR, 603-862-1792	23-30	<b>INTECOL 1990, Yokohama, Japan</b> Secretariat of INTECOL '90, InterGroup Corp, Akasaka, Yamakatsu Building 8-5-32, Akasaka, Minato-ku, Tokyo 107, JAPAN
DEC 12-13	<b>ILTER Executive Committee meets</b> Washington, D.C.	SEPT 9 -14	<b>International Mycorrhizal Congress</b> Jackson Hole WY Martha Christiansen, 307-766-2140
JAN '90 tba	<b>ILTER Workshop: Trace Gases</b> Woods Hole MA organizer tba	OCT tba	<b>ILTER Executive &amp; Coordinating Committee meetings, site tba</b>
FEB 10	<b>Network Deadline: Spring '90</b> LTER <i>Network News</i> copy	FALL/ WINTER '91	<b>ILTER All Scientists Meeting, tba</b>

From "Brooks," page 11  
science" is not just those aspects of life on a delimitable portion of the earth's surface that are currently the purview of the Ecosystem Studies Program at NSF. To understand the

interactions of the present inhabitants of any landscape unit, and their responses to any future global change, we must have concerned research on all aspects as studied by community and population ecologists, physiological ecologists,

population geneticists, and systematists. Only then will ecosystem science be what it has to become if biologists are to shoulder their part of the burden of preserving this fragile and precious earth. □

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