U.S. - CHINA EXCHANGE
Laying the foundations for collaboration

A n LTER delegation, under the chairmanship of James Gosz, visited China for three weeks in September, completing an exchange between the LTER Network and the Chinese Ecological Research Network (CERN) that began with a CERN delegation visit to five LTER sites and the LTER Network Office last May. Others in the LTER delegation were Carl Bowser, James Brunt, Debra Coffin, Kay Gross, Art McKee, Bill Michener, and John Pastor.

The main objective of the exchange was to increase opportunities for collaboration between the two networks at scientist-to-scientist, site-to-site, and network-to-network levels. Both sides agreed the China visit would focus on developing cooperative research, data management, modeling and geographic information system (GIS) capabilities.

CERN U.S. Visit
Following visits to the LTER Network Office, and the Andrews, Kellogg, Konza, Central Plains and Sevilleta LTER sites, the Chinese concluded that the United States leads all other countries in the development of successful long-term ecological research through a combination of solid theoretical and practical science and good management. They found that the log decomposition study has implications for Chinese forest management; the burning trials in the tallgrass show fire’s role in sustaining prairies for rangeland production; shortgrass steppe carrying capacity studies also show the relevance of basic science studies to rangeland productivity and sustainability for animal production; and that many studies, such as the carbon cycling component of the log decomposition study, are relevant to Chinese IGBP projects. Furthermore, their visit reinforced the importance of variable—especially large-scale—long-term ecological research, and the value of both cross-site and intersite studies.

The Chinese identified five LTER characteristics of key value to CERN. They observed that LTER: (1) conducts basic science that has important practical applications; (2) research is conducted in an integrated manner with universities, government agencies and local communities; (3) studies emphasize dynamics and elements; (4) research is multidisciplinary; and (5) relies on sound data management and is built on successful collaborative research.

Because the Chinese Academy of Sciences (CAS) is still in the process of establishing CERN, LTER organization and management were of particular importance to the Chinese delegation. The LTER Network Office made a very strong impression about how to manage the administrative and communications links among sites. The Chinese felt the publications program, workshops, and the All Scientists Meeting provided instructive means for transferring knowledge. They saw the LTER Coordinating Committee as an important management tool, and were very interested in the idea of having co-principal investigators (PIs) to offset administrative demands that can detract from a PI’s ability to both conduct research and attend well to site and network demands.

LTER China Visit
In Beijing, the LTER delegation met with CERN representatives and visited the main CAS institutes involved in the development of CERN, the Ministries of Agriculture and .

See page 10
A tribute to the late Virginia Coast Reserve LTER principal investigator

William Eugene Odum
1942-1991

Bill Odum had his softball shirt retired to the wall of the College Inn in Charlottesville, Virginia, his favorite eatery. Visitors to the Inn bask in the ambiance of the "Beagles," Darwin's Beagles, emblazoned on his shirt. Bill never made Charlottesville's all-star softball team, but there are lots of reasons to have your shirt retired.

While many of us split off and study, Bill lumped together and synthesized. Wetlands were his special thing. His spectrum ran from tidal hypersaline to non-tidal freshwater marshes. He viewed microtopography and water-table levels, fluctuations and disturbances as critical to understanding wetlands ecology. He was convinced that a wetlands ecologist just had to know near-surface, groundwater hydrology. He learned how and rose to the top in our weather forecasting contests. He was hard to draw in a wetlands hydrologist team. Bill was also convinced that fresh rainfallwater input to the marsh surface resulted in lowered salinity and a primary productivity boost. He thought it would help to know about and be able to predict the weather. He learned how and rose to the top in our weather forecasting contests. He was always the student.

Bill gave his research interests as follows: "Understanding the interplay between physical and biological factors in shaping community structure and ecosystem processes is the central theme of my research efforts. Most of my research is conducted in coastal environments which receive periodic physical stress (e.g., barrier island beaches, tidal marshes and mangrove swamps). Processes of interest include vascular plant production and decomposition, secondary production, and transport of dissolved and particulate organic matter between wetlands and nearby bodies of water. Aspects of community structure which are included in these studies include plant and animal distributions, habitat partitioning, and interactions. The most recent project involves a comparison of these factors in a salt marsh and a tidal freshwater marsh."

In the months before his death Bill and his LTER colleagues were working on the nature of state changes in ecosystems. At the VCR, major wetland state changes have taken place during the last few decades. An extensive tract of farmland has become salt marsh; high marshes have become Salicornia hypersaline flats; extensive sea grass beds are now mudflats, and a 1930s Hog Island maritime pine forest is now grassland. Bill was convinced that the interplay of microtopography and air-water and fresh-salt water interfaces, under the influence of a background sea-level rise, results in binary ecosystem state change. At some critical point the maintaining of one type of ecosystem fails and an alternate form takes its place. He was also convinced that the actual point of state transition is usually determined by normal environmental disturbances. He viewed disturbance as the trigger in state change, not as its fundamental cause.

Most of the state changes at the VCR result from changes in topography, changes in sea level or changes in the level of the water table. Relative sea-level rise, currently on the order of 2 mm/yr, and microtopography changes in the range of centimeters give rise to ecosystem state changes. The idea that great ecosystem changes may come from small, persistent actions is like a paraphrase of Bill's 1982 BioScience article "Environmental degradation and the tyranny of small decisions." Near the end of his life, he came to understand that microphysical processes may be giants in ecosystem structuring.

Bill knew how to get things done in a mob of not-so-small-egoed colleagues. When he believed in something, he pushed you in an endless series of low-key, brief contacts, making a little progress here and a little there until he won. In a way, he was applying the "tyranny of small decisions." We accused him of having a small attention span. In Madison Avenue parlance, he "mother-henned" everything. That included his graduate students and the LTER project. His students were well-served. The VCR LTER was well-served. Leaders serve.

Bruce P. Hayden
Virginia Coast Reserve
The first in a series of articles on the Smithsonian Institution's long-term ecological research sites

In a sense, the history of long-term ecological research in Panama began over three million years ago, with the final closing of the Isthmus of Panama. This event created a barrier between previously contiguous marine biotas of the Atlantic and Pacific Oceans, and created a land bridge for the interchange of previously isolated terrestrial biotas of South and North America. This geological and biological revolution provides the historical context and, in many cases, the primary motivation for research at the Smithsonian Tropical Research Institute (STRI).

Biological exploration of Panama began in the 1500s and has continued into the late 20th century; large areas of Panama remain biologically unknown. However, it was the construction of the Panama Canal in the early part of this century that catalyzed quantitative, long-term studies of tropical forest plants, animals and environment. The damming of the Chagres River produced Gatun Lake, which in turn created the 1,564-hectare Barro Colorado Island (BCI), the largest island in the Lake.

The largely intact plant and animal communities on BCI attracted the attention of naturalists and researchers, who established it as a biological reserve in 1923. A laboratory/dormitory was built in 1924, and immediately began attracting professional researchers who initiated systematic surveys of the fauna and flora and behavioral studies, and established a climatic monitoring program. The reserve was administered by the National Academy of Sciences along with the Smithsonian and other institutions until 1946, when it was transferred to the Smithsonian Institution, under the management of STRI.

In 1977 the adjacent mainland peninsulas were added to BCI to form the Barro Colorado Nature Monument (BCNM), with a total of 5,400 hectares of Tropical Moist Forest. The peninsulas are used for experimental studies and collecting, while BCI is maintained as a strict reserve. The adjacent Soberania National Park provides an additional 22,000 hectares to the east of the BCNM. This park is connected to pacific dry forest in the Metropolitan Nature Park near Panama City by a protected forest corridor.

Barro Colorado Island has over 1,300 plant species, with published floras on vascular plants, bryophytes and pollen. A seed and seedling flora for the Island is in preparation.

There are 366 bird species, 56 bat species, and a primate species, with 465 species of vertebrates in all. Over 1,000 species of true bugs, 1,000 species of leaf hoppers and plant hoppers, and 100 species of cockroaches have been collected on the Island. Two hundred species of ants are known.

Barro Colorado Island now has modern living space and air-conditioned laboratories for up to 35 researchers, with many additional scientists and assistants commuting to the island daily. Smithsonian Tropical Research Institute headquarters in Panama City maintains one of the most complete tropical biology libraries in the world, with over 1,000 journal subscriptions. Modern facilities for studies of physiology, biochemistry, molecular evolution and behavioral ecology are available, along with logistical support for visitors and resident scientists. There is a permanent scientific staff of 29 researchers. Several hundred students and senior scientists visit STRI for varying periods every year, many on Smithsonian fellowships.

Barro Colorado Island is protected under international law, and managed by STRI under agreements with the Republic of Panama. The Institute was granted International Mission status by the government of Panama in 1985. This continuous, very long-term protection, combined with the scientific and logistical support of STRI, makes BCI one of the preeminent sites for tropical forest research.

Research Program

Many studies on BCI have continued for 10 to 20 years; climatic data and inventories of birds, mammals and plants extend back to the 1920s. Monitoring of climatic and edaphic factors, and of selected species or guilds of lizards, birds, mammals, insects and plants are supported by the Smithsonian's International Environmental Sciences Program, which guarantees project funding for five years with the expectation of repeated renewals.

Center for Tropical Forest Science

The Smithsonian Tropical Research Institute recently established the Center for Tropical Forest Science, with Harvard and Princeton Universities, to support long-term and large-scale studies of tropical forest dynamics and management.
During the 150-year period starting in 1750, the landscape of central New England underwent a complete transformation. Settlers cleared forests at a prolific rate, established pasture and cropland across 50 to 75 percent of the upland area to support a mixed agricultural economy of grain, beef and dairy production and, subsequently, abandoned this open land to pursue urban jobs and agricultural opportunities in the Midwest.

Today, forest vegetation covers 65 to 95 percent of the region and broad-scale human activities continue to exert a pronounced impact. Logging operations maintain a largely even-aged structure to the forests on public and private lands, and introduced pathogens have severely impacted populations of chestnut, elm, beech and, most recently, hemlock. Air masses crossing major urban and industrial centers in the Midwest and Atlantic states impose chronic inputs of nitrogen, sulfur and other byproducts of fossil fuel production and subject the area to episodes of high ozone concentrations.

Clearly any comprehensive understanding of forest ecosystems in this region must include an assessment of the impacts and legacies of these human activities.

Meanwhile, natural processes have been far from static. Historical reconstructions and paleocological studies indicate that wind damage, ranging from small gaps to infrequent broad-scale blowdown resulting from hurricanes, is probably the most important natural disturbance. Recent studies suggest that fire may have occurred at intervals of a few hundred to a thousand years.

Past Research Efforts
In recognition of the dynamic nature of these forests the HFR LTER program has focused its efforts on an understanding of the forest ecosystems in central New England within a context of historical and modern factors initiating change. To do this, we have assembled a group representing Harvard University, the University of New Hampshire, the Ecosystem Center at Woods Hole, plus five additional institutions.

Major efforts continuing from the onset of the program include: analysis of biosphere/atmosphere interactions (fluxes of carbon and nitrogen gases, ozone, heat and water vapor) on a 30-m environmental monitoring station, assessment of the nitrogen saturation hypothesis in conifer and hardwood forests, historical and paleocological analysis of forest and environmental change, and integrated studies of ecosystem recovery after simulated hurricane and pathogenic attack to forests. In the hurricane simulation study we have pulled over two areas (0.5 and 0.8 ha) of hardwood forest, whereas to study the impact of pathogens we are selectively killing one overstory species in 0.2-ha plots.

In 1991 the following new projects were initiated by HFR LTER scientists with support from additional funding sources.

GIS Analysis of Land-Use & Forest Change Across Central New England
This historical project is assessing spatial variation in the type and intensity of land-use activity across the cultural and environmental gradients that exist in New England from the Connecticut River Valley to the surrounding Highlands. This history is being related to past and modern variation in the extent and type of forest vegetation. The project is partially funded by NSF programs in Ecology and Human Dimensions of Global Change and the Mellon Foundation.
Modeling the Meteorology of Historical Hurricanes in New England

To better understand spatial variation in hurricane impacts to the New England landscape, a meteorological model developed as part of the Luquillo LTER site analysis of Hurricane Hugo in Puerto Rico is being utilized. The project seeks to reconstruct the meteorological scenarios for important past storms (1600 A.D. to the present), to develop a more comprehensive understanding of the disturbance regime in New England, and to interact this model with landscape features and vegetation on GIS.

Soil Warming Experiment

The response of the below-ground system to global warming is being assessed in a soil-warming experiment in a mixed hardwood forest conducted in collaboration with the Ecosystem Center at Woods Hole. Treatments consist of six 5 x 5-m replicates of (1) experimental plot with the soil temperature 5°C above ambient, (2) control plot, and (3) "disturbed" control with heating wires installed but not turned on. Soil and ecosystem processes examined include mineralization, decomposition, soil trace gas fluxes and leaching losses. The project is partially funded by the U.S. Environmental Protection Agency and Department of Energy (DOE).

Ecophysiology of Canopy Trees/Scaling from Leaf to Ecosystem Level

In a project seeking to link the ecosystem measurements made in the Environmental Monitoring Station (EMS) with physiological studies of individual leaves, HFR researchers have erected two canopy-access towers from which detailed micrometeorological and physiological measurements can be made. From each tower there is access to at least one individual of four species of tree (red maple, white pine, red oak, and paper birch). Physiological response is being correlated with micrometeorological measurements (PAR, humidity, wind speed, temperature) and concentrations of trace gases and pollutants measured at the EMS. Funding is provided by DOE and the NSF Ecosystem program.

Expansion of the Atmosphere/Biosphere Monitoring Program

The presence of the Environmental Monitoring Station and electrical and telephone service in the center of the Prospect Hill tract at the Harvard Forest have served to attract much of the field research associated with the DOE-funded Northeast Institute for Global Environmental Change to the site. New experiments include assessments of turbulence and turbulent exchange, and of atmospheric methane, nitric acid, and atmospheric SO2.

These new research efforts continue to attract additional researchers to the Harvard Forest. This past summer, more than 40 scientists from outside groups worked with the HFR LTER science team, and 20 undergraduate students were supported in our Summer Research Program.

For further information contact David Foster, Harvard University, Harvard Forest, Petersham, MA 01366, 508-724-3302.
Hubbard Brook Experimental Forest

By Timothy Fahey

The watershed ecosystems of the south-facing slope of the Hubbard Brook Experimental Forest (Watersheds 1 through 6) have been the subject of intensive study for such a long time that it is natural for the uninitiated to wonder what more could be learned there. Through the funding and organizational basis provided by the LTER program at HBR, our hope is to continue a carefully crafted combination of ecological monitoring and experimental studies into the distant future, thereby slowly peeling away the mysteries that limit our understanding of ecosystems and their dynamic responses to natural and anthropogenic disturbance.

Hydrochemical Monitoring Studies

The hydrochemical monitoring studies at HBR continue to provide both insight into ecosystem dynamics and new, perplexing questions to challenge our current conceptualizations. Take, for example, the long-term behavior of the N input-output budget in the control Watershed 6 (W6). When monitoring began in 1963, the forest on W6 was a rapidly aggrading 50-year-old stand, still recovering from heavy logging early in the century. At that time, stream output of N was low (100 mol/ha/yr) and well below bulk deposition of 200 to 400 mol/ha/yr (Figure 1).

Atmospheric deposition of N continued to increase at HBR over the next decade, and stream output showed a coincident rise, actually exceeding bulk precipitation input in 1969. Deposition leveled off at 700 mol/ha/yr after 1973, while stream output dropped precipitously despite the fact that forest biomass increment on the watershed had slowed as the stands matured. From 1982 to 1987 biomass increment was near zero, yet retention of precipitation N continued. Only in the past three years have we begun to see an increase in streamflow losses of N.

The long-term record of atmospheric input and stream output for base cations and sulfate has also revealed an intriguing pattern: declines in regional emissions of SO₂ and loading of SO₄ and base cations have been reflected in parallel declines of streamwater outputs and, consequently, pH in the stream has remained roughly constant (Figures 2 and 3).

These intriguing results have stimulated our planning for a long-term, chemical manipulation of an undisturbed watershed at HBR. We hope to improve our understanding of the processing of acids and bases and of N by chronically increasing the loading of bases, SO₄⁻ and NO₃⁻ over a number of years and measuring responses of budgets and key processes at the small plot and landscape level. This manipulation will also provide important data to validate the plant-soil simulation model we have been developing with John Aber (Harvard Forest), VEGIE-MANE.

Other Long-Term Monitoring Efforts

- Studies of the interaction between populations of neotropical migrant songbirds and their principal food source, phytophagous insects
- Gaseous and dry deposition of elements, particularly N and S, as revealed by three complementary methods: air quality monitoring (inferential technique), net throughfall flux, and watershed input-output budgets
- Vegetation dynamics and productivity on control (undisturbed) and treated watersheds
- Heterotrophic processing of detritus and consequent temporal patterns in pool sizes of dead organic matter (forest floor, dead wood and soil organic matter)

Process-Level Studies & Modeling

Process-level studies and modeling in the HBR-LTER are designed to complement the long-term monitoring program. For example, our ability to quantify the internal fluxes of materials in watersheds has been
limited by the complexity of water flow pathways in soils. Studies of hillslope hydrology have revealed the magnitude and mechanisms of macropore or pipe flow in HBR soils, as well as the existence of ephemeral saturated zones that develop, even in these extremely porous soils after large storm events. Together with information on near-stream water table dynamics, these data are being incorporated into an expanded simulation model of forest hydrology.

An inconsistency in the carbon and nutrient budgets of disturbed watersheds at HBR has been linked to overestimates of the magnitude of forest floor dissipation in the first decade of ecosystem recovery, as originally revealed by chronosequence studies. Direct studies of organic matter burial and in situ decay of forest floor have revealed a rate of mineralization that agrees well both with watershed budgets and with predictions from VEGIE-MANE.

The initiation of the LTER project at HBR has stimulated activity in both data management and GIS. A public access electronic bulletin board, "Source of the Brook," has been implemented allowing easy retrieval of many data sets from the HBR ecosystem study. The HBR-GIS supports site management needs and is being increasingly integrated into research activities, including spatial modeling of soil temperature and moisture and trace gas emissions. A major undertaking in the coming months will be to spatially distribute the forest growth simulator, ZEUG, across a gridded landscape. Ultimately, we hope to contribute to an improved understanding of the relationships between spatial scales and vegetation pattern and process in forest simulation models.

For further information contact Timothy Fahey, Cornell University, Department of Natural Resources, Ithaca, NY 14853, 607-255-5470.
Data Management Meeting

Twenty-five scientists (one or more from each LTER site) attended the annual meeting of the LTER Data Managers held August 1-3, 1991 in conjunction with the Ecological Society of America meeting in San Antonio, Texas. Lawson Spivey, Global Change Director for the USDA Soil Conservation Service (SCS), gave the keynote address, which was followed by extensive discussion on potential collaboration between the SCS and the LTER Network. The rest of the meeting was devoted to assessing LTER Data Management (DM) activities since the 1990 meeting and forming working groups to address specific topics:

Activities/Accomplishments Since 1990 Meeting:
(1) LTER Core Data Set Catalog published, with electronic versions (ASCII & WordPerfect) available via FTP; (2) DM symposium proposal, "Environmental Information Management and Analysis: Ecosystem to Biosphere Scales," under NSF review; (3) supplemental proposal to develop an intersite LTER climate database funded by NSF; (4) April 1990 DM workshop report for Field Stations and Marine Labs in press; (5) collaboration with the Chinese Ecological Research Network (CERN) has been initiated (see pg. 1); (6) data access policy guidelines completed and sent to all sites; (7) GPS proposal funded (see next page); (8) Databits, the DM newsletter continues to serve a critical need; (9) SPRINTNET connection added to LTERnet; (10) DM history and reference file compiled at the Network Office; (11) C-News bulletin board and news software running on LTERnet.

1991 Meeting Accomplishments:
• Design characteristics for Interactive Data Access (IDA) systems were outlined, and six steps to support further development were proposed. Other data access mechanisms (including on-line catalogs, data publication, interactive workshops, and education) were discussed.
• A Minimum Site Capability (MSC) working document and site review criteria were developed for review by the LTER sites, to aid new sites in establishing DM systems, assist site reviewers in assessing DM, and potentially influence the availability of DM funding. These documents will be submitted at the North Temperate Lakes LTER Coordinating Committee meeting next February.
• The NSF Science and Technology supplements have enhanced creation of the current LTER technological infrastructure and collaborative research, and have allowed sites to expand the spatial and temporal scale of their research, but that the MSI is dynamic and requires regular updating and continuing support.
• Proposed mechanisms for supplemental funding: (1) undertake personnel- and/or computationally-intensive DM projects; (2) include refurbishment projects or new facilities as university cost sharing; (3) encourage sites to achieve MSC; (4) support acquisition of new technologies which will facilitate intersite research, DM and analysis.
• Proposed future activities (* initiated): (1) a pilot research/DM project of benefit to the entire LTER Network; (2) *DM slide presentation; (3) workshops on new analytical/statistical techniques; (4) expand Bulletin Board/Email activities; (5) publish LTER data; (6) *include non-LTER scientists in 1992 meeting (OBFS, SAML, LMER); (7) *collaborate with SCS and CERN.

LIDET: The Long-Term Intersite Decomposition Team

Although the formation of soil organic matter has long been a central theme of decomposition research, the short-term nature of most studies has limited knowledge of this process. A recent LTER workshop, organized by Jerry Melillo (Harvard Forest) and Knute Nadelhoffer (Arctic Tundra), examined possible long-term, intersite experiments that might advance our understanding.

One of these experiments, a 10-year test of climatic and substrate quality control of fine-litter decomposition, was begun last year at 21 sites, 17 of which are LTER sites. Although these sites represent most of the major biomes in North America, seven additional sites are being added to represent missing conditions. A wide range of litter types was used, with 10 standard types (i.e., 6 leaf, 3 fine root, and wooden dowels) sent to each site, and 21 "wildcard" species of leaf litter that appear randomly throughout the experiment.

Given the large number of individuals involved, it was crucial to explicitly define their roles and expectations. A group was identified to complete and publish the results from these experiments. The Long-Term Intersite Decomposition Experiment Team, or LIDET, is divided into: (1) Field Collaborators who oversee the study at their respective site; (2) Modelers who will predict C, N, and P dynamics and validate models from the field study; and (3) a Central Analysis Group which performs chemical analysis, data management, and preliminary data analysis.

Although field results are just beginning to become available, this effort has shown that a large number of sites can function together in a coordinated fashion. All participating sites have contributed to the successful initiation of this project by collecting litter, placing materials in the field, and providing information about the site.

A table of the individual LIDET investigators, their site affiliations and research tasks, is available from the LTER Network Office. For further information on the experiment, contact Mark Harmon, Oregon State University, Forest Science, Peavy 154, 3200 Jefferson Way, Corvallis, OR 97331-5705, 503-750-7333.
Global Positioning System Workshop and Field Campaign

As LTER Network scientists focus on broader-scale spatial phenomena, accurate knowledge of their position on the earth's surface becomes critical. Historically, expansion of the spatial scale of ecological research projects has been hindered by the necessary reliance on expensive and time-consuming traditional surveying techniques. Recently, however, Global Positioning System (GPS) technology has become an integral component of many LTER-related research projects.

Coupled with Geographic Information Systems (GIS), GPS technology can greatly facilitate mapping and research efforts. This technology, developed by the U.S. Department of Defense, utilizes a ground control segment and a constellation of 21 NAVSTAR satellites (plus three spares) orbiting at an altitude of 20,200 km to triangulate positions on earth. Collection of ground truth data in conjunction with GPS data is essential both in poorly mapped regions and where features suitable for ground-based navigation by triangulation are absent. Among other advantages, GPS does not require visibility between sites, fewer personnel are required, and surveys can be performed in inclement weather.

National Science Foundation support has enabled the LTER Network to acquire three Trimble 4000SST GPS receivers (for use where position fixes accurate to a few centimeters are required) and 10 Trimble Pathfinder GPS receivers, and to provide a training workshop on collection and processing of both 4000SST and Pathfinder data.

Local arrangements for the workshop, held September 30-October 5 in Boulder, Colorado, were supported by Leanne Lestack (Niwot Ridge), University NAVSTAR Consortium (UNAVCO) personnel, including Randolph Ware (Director), James Stowell and Brennan O'Neil provided training in use of the 4000SST receivers. Barbara Perin (UNAVCO) provided training in processing high-precision GPS data. Chuck Gilbert (Trimble Navigation) and William Michener conducted a short workshop on Pathfinder data collection and processing. Phyllis Adams (Bonanza Creek) and William Jefferson (North Inlet) also provided training in the use of a Geodetic Total Station to obtain elevation and distance measurements.

Eighteen LTER scientists participated in the training sessions. Most remained through Saturday for a GPS field campaign conducted at the Central Plains Experimental Range (CPR) LTER site. At six different locations across the site, the field team established concrete benchmarks, obtained precise position fixes for those benchmarks using five 4000SST receivers, and utilized the Pathfinder GPS units to obtain position fixes for fenced enclosures and other CPR field locations. Despite harsh weather conditions on Friday, an excellent database was generated. On Saturday the group returned to UNAVCO where the data were initially processed and Barbara Perin provided additional training.

Participants can now design a field GPS campaign and collect and initially process high-precision GPS data. As the data needs at each site are identified, a schedule for use of the equipment will be developed with UNAVCO. The North Inlet site will serve as the initial point of contact for LTER sites interested in using the 4000SST receivers. Attendees suggested that access to the units would be essential during winter months for temperate forest sites (leaf-off conditions) and during summer months for other sites dependent upon an adequate supply of personnel or restricted by other seasonal weather conditions. Initially, highest priority will necessarily be given to those sites with no nearby horizontal or vertical control points. The North Inlet, North Temperate Lakes and Virginia Coast Reserve sites also presented ideas on how high-precision GPS surveys could eventually become an integral component of ongoing LTER projects.

William K. Michener/North Inlet LTER

ESA Long-Term Studies Section (LTSS) Collaboration

The Ecological Society of America (ESA) LTSS and the LTER Network have initiated a collaborative effort to establish an EMail communication system that will link the computers of the approximately 500 LTSS members. This system, to be developed and operated by Rudolf Nottrott at the Network Office, will enhance intra-section communication of LTSS members, and will vastly increase the communication capabilities between LTER researchers and those scientists working on long-term studies not directly affiliated with LTER. Additional network linkages with the ESA Vegetation Section are also being discussed. If successful, the system may serve as a model for networking the entire ESA membership.

The system will permit rapid dissemination of information relevant to ecologists involved with long-term studies, and allow feedback to the Section's Executive Committee from the membership on Section issues and activities. As with the present LTER EMail system, scientists will be able to query other researchers for information or data on topics of mutual interest. It could also be used to instantly poll scientists worldwide on important environmental issues.

An LTSS EMail directory will be compiled this winter following dissemination of a written survey to LTSS members. A previous survey of the membership indicated that 96% owned (or had access to) some form of computer, but that only 50% had an EMail address. The upcoming survey will contain instructions on how to connect to EMail and access the network. The system should be operational by spring, 1992. Once the system is completely operational, further details will appear in the Network News.

Bob Parmeter/Sevilleta LTER/LTSS Chairman

(L to R) Jim Laundre (ARC), Haiping Su (KNZ), and Lolita Kriews (KBS) program GPS receiver at Central Plains Experimental Range.
STRI, from 3
throughout the tropics. The primary
focus of the Center is the
establishment of 50-hectare mapped
plots in many different forests. In
each plot, every tree over 1 cm in
diameter is marked, measured
and identified. The plots are
resurveyed every five years, with
two years of post-treatment
monitoring. Phenology, demography
and physiology were followed for
representative species, along with
microclimatic and edaphic factors.
As part of the study of forest
dynamics, STRI has pioneered the
study of canopy biology—
physiology, phenology, plant-animal
interactions, climatology and related
studies—using a construction tower
crane. A prototype crane has been in
successful operation for over a year
in the Pacific dry forest near
Panama City. It provides extensive
data on the responses of canopy
trees and vines to seasonal and
shorter-term variations in light,
temperature and humidity, and on
the seasonal and spatial patterns of stingless bees. The crane
provides safe, rapid and non-destructive access to over
122,000 cubic meters of forest.

Marine Program
The Smithsonian Tropical Research Institute has maintained a
large and diverse marine program since the early 1960s, with
long-term research on the ecology and evolution of the biotas
of reefs, mudflats and mangroves on both the Atlantic and
Pacific coasts. It maintains marine stations on both coasts and

center for

Paleoecology

The Institute established the Center for
Paleoecology to encourage the analysis of
the geological, environmental and
human history of Panama and other
tropical regions. Six staff scientists and several visiting
scholars are exploring the histories of marine and terrestrial
sites, using paleopalynology, phytolith analysis, isotope
analyses and traditional archeological and geological
approaches. These studies provide an historical and
evolutionary perspective for current, "long-term" ecological
research, and for recent patterns of environmental and
biotic change.

Alan P. Smith, Deputy Director
STRI-Panama, APO Miami, 34002-001

China, from 1
Forestry, and the Chinese National Environmental Protection
Agency (NEPA). They were then organized into three
ecosystem subgroups—agriculture and hydrobiology, forestry,
and transition—which were dispersed to different regions of
China to explore research opportunities at actual sites.

The agriculture group traveled to CERN stations on the
North China Plain, and to the hydrobiology station at Donghu
Lake in Wuhan. The forestry group started at the largest intact
temperate forest near the North Korean border, then visited a
tropical area near the Laozhen border and a subtropical area in
Guangzhou. The transition group followed a rainfall gradient in
the grassland areas of Northeast China, through Inner
Mongolia, to a grassland-to-desert transition zone in western
Xinjiang Province.

During its visits across China, the LTER delegation
observed that: (1) sustainability of production is the primary
objective of Chinese science policy; (2) heterogeneity exists in
the CERN sites, scientific concepts, staffing and infrastructure;
(3) integration of science is affected by socioeconomic issues
and economic and institutional constraints and, when such
integration is found, it is at the local level; and (4) data
management is variable and rudimentary at most stations.

The LTER delegation refined the list of cooperative
research topics proposed in May to: (1) nutrient and carbon
cycling in ecosystems, (2) local to regional water balance, (3)
spatial and temporal heterogeneity and landscape analysis, and
(4) continuation of current initiatives in data management.
They recommended that the research be carried out using
decomposition experiments, micrometeorological and gas
exchange studies, spatial sampling and statistics and, at the
CAS institute level, GIS appropriate to research design,
modeling and training. It was agreed that collaboration will
necessarily proceed at different rates and will be implemented
over the next five to 20 years, coupling a long-term perspec-
tive with short-term scientific results and productivity. The
approach will emphasize appropriate technology and build on
the success and experience at local and regional levels.

James Gosz/Sevilleta & Beryl Leach/NAS
**H.J. Andrews Field Studies**

H.J. Andrews Experimental Forest (AND) researchers invite collaborators to capitalize on several in-progress and pending large-scale field studies at AND. A stream fertilization experiment, patterned in part after a Arctic site experiment, was conducted over a two-month period on lower Lookout Creek in summer 1991. Additional nutrient manipulations are planned for summer 1992 (S. Gregory).

Canopy gaps of various sizes were created in mature and old-growth conifer forests by tree removal in fall 1990 (T. Spies). Pretreatment sampling is underway for two additional studies: (1) long-term site productivity effects of various levels of woody debris and silvicultural treatments in 90-year-old, post-wildfire stands and (2) wildlife response and silvicultural effects of various forest structures and compositions created by experimental commercial thinning treatments in 40- to 50-year-old conifer plantations (J. Tappeiner). Manipulations are planned for 1993.

For further information on these and other projects, contact project leaders (names in parentheses), A. McKee (Site Coordinator), or F. Swanson (Principal Investigator), Oregon State University, Forestry Sciences Laboratory, 3200 Jefferson Way, Corvallis, OR 97331.

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**LMER Program Meeting**

With support from the National Science Foundation (NSF), the four Land-Margin Ecosystem Research Program sites (Chesapeake Bay, Columbia River Estuary, Tomales Bay, and Waquoit Bay) met November 14-17, 1991 at the Marriott Conference Center near the Tomales Bay LMER site. Among the 50-plus participants were representatives from the North Temperate Lakes, Arctic Tundra, North Inlet and Virginia Coast Reserve LTER sites, as well as the LTER Network Office and NSF's Biotic Systems and Resources and Biological Oceanography Divisions. Other participants included representatives from the National Oceanic & Atmospheric Administration (NOAA), Woods Hole Oceanographic Institute and The Ecosystem Center, Marine Biological Laboratory, and the Academy of Natural Sciences.

Following a plenary lecture by John Hobbie (Woods Hole Marine Biological Laboratory, Arctic Tundra LTER), were presentations on estuarine scaling, classification, denitrification, particle trapping, community metabolism, and coupling biological and physical models. Participants then met in working groups, and gave reports on group topics the following morning before exploring the Tomales Bay area.

The LMER group will meet in at the Marine Biological Laboratory in Woods Hole in fall 1992, and may send representatives to one of the two 1992 LTER Coordinating Committee meetings. A final working group report from the November meeting will be prepared and may be obtained from meeting coordinator Stephen Smith, principal investigator of the Tomales Bay LMER.

For more information, contact Stephen V. Smith, Department of Oceanography, School of Ocean and Earth Science and Technology, University of Hawaii, Honolulu, Hawaii 96822, 808-956-8693.

**New LMER Site Competition**

The National Science Foundation has announced an open competition for $400,000 in program funds for a new Land-Margin Ecosystem Research (LMER) project. Four projects are funded currently. Proposals for the 1992 competition are due January 15, 1992, and awards will be announced in summer 1992. New projects will commence not earlier than September, 1992. For more information, contact James Callahan, Ecosystem Studies Program, Division of Biotic Systems & Resources, Rm. 215, NSF, 1800 G Street, Washington, D.C. 20550, 202-357-9596.
SCS-LTER Collaboration

Estimates of LTER Soil Moisture & Temperature Regimes

The U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) has prepared individual computer simulations of soil moisture and temperature for stations close to the LTER sites. The computation of soil climatic parameters and classification of soil moisture and temperature regimes is based on climatic data provided by the National Oceanic and Atmospheric Administration (NOAA). These climatological normals (NOAA 1982) are based on records for the 30-year period 1951-1980.

A normal of a climatological element is the arithmetic mean computed over a time period spanning three consecutive decades. Homogeneity of instrument exposure and station location is assumed. If no exposure changes have occurred at a station, the normal is estimated by averaging the 30 values from the 1951-1980 record.

The model also estimates the duration, commencement and end of the growing season, which is considered as the period when there is no temperature or moisture stress. A Moisture Stress Severity Index (CSSI), a Temperature Stress Severity Index (TSSI), and a Climate Stress Severity Index (CSSI) are also estimated. Additionally, for a few of these stations, the SCS has long-term climatic data based on which the probability of events have been calculated. These are not included in the simulation, but are available on request.

Actual climatic data for LTER site collaborators can also be computed. The information needed is: (1) name of station, (2) latitude, (3) longitude, (4) elevation (m), (5) monthly precipitation (mm)*, and (6) monthly temperature (°C)*. (*Yearly, as many years as possible.)

For further information, or a copy of the simulation, contact Lawson Spivey, US Department of Agriculture Soil Conservation Service, 14th & Independence Aves. SW, Washington, D.C. 20013, 202-720-6371.

SINO-ECO Club

The SINO-ECO Club is an organization established for Chinese ecologists overseas, primarily those pursuing doctoral degrees at universities in North America. The club was established in 1989 following the 1988 Ecological Society of America (ESA) meeting in Davis, California, and has focused on promoting academic activities of these ecologists overseas via an electronic mail newsletter.

Club members are very active presenting research papers at annual ESA meetings and regional symposiums and international conferences and publishing in ecology journals. SINO-ECO also maintains relationships with individual scientists and organizations such as the Chinese Ecological Society and ESA. Ecological studies in China in the near future will undoubtedly be strongly influenced by this group as they complete their studies and return to China.

The newsletter contains information on current research, upcoming meetings and conferences, domestic news, exchange programs, etc. To receive a copy, contact Jiquan Chen, University of Washington, Olympic Natural Resources Center, College of Forest Resources, AR-10, Seattle, WA, 206-685-4802, or on Bitnet at "JIQ@max.u.washington.edu".

Third Annual Konza Prairie Workshop

On October 19, 1991 over 75 individuals, representing five universities and three federal agencies, attended the Third Annual Konza Prairie LTER Workshop in Manhattan, Kansas. Twenty presentations were given and a dozen posters were on display describing ecological research on the Konza Prairie Research Natural Area.

Program copies, complete with abstracts and figures, can be obtained from John M. Briggs, 913-532-6629, or via electronic mail (jbriggs@lternet.washington.edu, jbriggs@lternet, or jmb@andro.konza.ksu.edu). An ascii version, without figures, is also available through anonymous FTP (filename program.19oct91 in the subdirectory pub) on andro.konza.ksu.edu.

U.S. Mitigation & Adaptation Research Strategies Program (MARS)

The MARS Working Group of the Committee on Earth and Environmental Sciences has been charged with development of a coordinated federal research strategy for mitigation of, and adaptation to, global change, with assessment of economic, social and environmental effects of the proposed responses. The strategy emphasizes two key themes: risk assessment and a "comprehensive approach." The goal of the program is to establish the scientific, technological and economic basis for developing policies and strategies that will result in responses to global change that are efficient and that maximize environmental and economic well-being.

Funding for the core program proposal for the Human Dominated Systems Directorate was recently approved by the U.S. National Committee for the Man and the Biosphere Program (MAB). The Directorate focuses on ecological systems that are significantly affected by human activities, with a central theme of ecological sustainability. The project will explore issues in the context of some very real environmental problems within three U.S. Biosphere Reserves: the Everglades and surrounding areas of south Florida; the New Jersey Pinelands; and the Virginia Coastal Reserve.

The program goal will be to (a) define ecological sustainability for the ecosystems of the case study reserves and surrounding areas in terms of particular levels of selected ecological endpoints; (b) evaluate patterns of human uses of environmental resources and other anthropogenic stresses imposed upon these systems; (c) examine societal and institutional factors influencing ecological sustainability; and (d) assess their compatibility with essential characteristics of ecological sustainability.

Methodologies for defining ecological sustainability and understanding its causal relationships with an feedbacks from society will be developed for each case study. A control systems model of coupled human/ecological systems will provide the overall framework, the focal point for specific hypothesis testing and data integration and analyses, and the point-of-departure for a continual development and refinement of a conceptual model as the project proceeds.

For further information, contact, the U.S. MAB Secretariat, Human Dominated Systems, OES/EGC/MAB, Department of State, Washington, DC 20522-3706, 703-235-2946/2947.

USGS Global Land Information System

The U.S. Geological Survey (USGS) Global Land Information System (GLIS) can now be accessed on the Internet. This useful system assists in data inventory and acquisition. Among other information, AVHRR, Landsat-TM and MSS data catalogs are on-line.

Further detail on the system is on the Internet at GLIS.CR.USGS.GOV (192.41.204.54). There are also DECNET and dial-up connections. For GLIS user assistance, call 1-800-252-GLIS or FTS 753-7099.

1991 LTER Site Directory Now Available

The sixth edition of the LTER site directory is now available from the LTER Network Office. The revised directory, Long-Term Ecological Research in the United States: A Network of Research Sites 1991, was edited by Keith Van Cleve (Bonanza Creek LTER) and Stephanie Martin (Network Office), and was developed from the individual site papers written for the fall 1989 LTER All Scientists Meeting.

The 8 1/2- by 11-inch, 178-page book contains descriptions of the 18 LTER sites, their current research programs, future directions of research, and climate data collected and interpreted by David Greenland (LTER Climate Committee Chair; Niwot Ridge LTER).

Included are black-and-white overview and research activity photographs for each site, as well as numerous informative figures and tables.

Copies may be obtained from the Network Office: LTER Network Office Publications, University of Washington, College of Forest Resources, AR-10, Seattle, WA 98195, 206-543-4853.

Publications of Interest:

  Report developed by an external group for the purpose of providing recommendations to BBS that will improve its organizational structure and enhance the effectiveness of that structure in responding to future scientific opportunities and challenges. NSF Forms and Publications Unit, Room 232, 1800 G Street NW, Washington, D.C., 20550. Internet ("pubs@nsf.gov") or BITNET ("pubs@NSF")

  New quarterly journal which aims to enhance the scientific understanding of the conservation of marine and freshwater ecosystems. John Wiley and Sons Inc., 605 Third Avenue, New York, NY 10158, USA.


CALENDAR

Winter - Fall 1992

JAN

NSF Target date: Biotic Systems & Resources. Animal Behavior (Fred Steinitz, 202-357-7949); Decision, Risk & Management (Robert Bordley, 357-7269); Geography & Regional Science (Brian Holly, 357-7320); Instrumentation Facilities for BBS (Robley Light, 357-7652).


FEB

21 LTER Network News copy deadline, Spring '92 issue. Stephanie Martin, editor, 206-543-6764, "smlarling@direct" (Bitnet), "smart@terart.washington.edu" (Internet).

MAR

APR


MAY
4-6 7th Circumpolar Symposium: Remote Sensing of Arctic Environments. Tromso, Norway. Reid Amundsen, Centre for Arctic Research, University of Tromso, Ph: 47-83-45-240/Fax: 47-83-80-705.


JUN
1 4 NSF Program Deadline: Geosciences. U.S. Antarctic Research; Division of Earth Sciences; Continental Dynamics (Leonard Johnson, 202-357-7721); Geology and Paleontology (John Macinnis, 357-7896); Geophysics (Michael Markow (357-7355)); Instrumentation and Facilities (Daniel Weill (357-7807); Tectonics Program (Thomas Wright 357-7355); Research on Terrestrial and Limnetic Ecosystems in Antarctica (Paul Perkaus, Polar Programs, 357-7894).

15 NSF Target Date: Biological, Behavioral & Social Sciences. Ecology (Laurel Fox/Joann Roskoski, 202-357-9734); Ecosystem Studies (James Reynolds/James Callahan, 357-9596); Population Biology and Physiological Ecology (Carol Lynch/Grace Wright/James Callahan, 357-9720); Systematic Biology (Terry Tales/Gaines Eates/James Rodman, 357-9598).

JUL
31- AUG
6 LTER Meeting: Executive and Coordinating Committees, Talkeetna, Alaska. Co-sponsors: Bonanza Creek and Arctic Tundra LTER sites.


SEPT
1 NSF Program Deadline: Polar Programs. Arctic Research, 202-357-7917.

NOV
1 NSF Program Deadline: Scientific, Technological & International Affairs. U.S.-Argentina/Brazil/Mexico/Venezuela Cooperative Science (Harold Stolberg or Emily Rudin, International Programs, 202-357-9564).