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Coordinating Committee Meeting, Trout Lake, Wisconsin, February, 1992

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MINUTES
ILTER Coordinating Committee Meeting
Trout Lake Station, Boulder Creek, Wisconsin
February 29 - March 1, 1992

BUSINESS SESSION

NSF Changes

James Edwards and Tom Callahan reported on structural changes within the division. Behavioral and Biological Sciences has been divided into two directorates, Biological Sciences and the Social, Behavioral and Economic Sciences. LTER is now under the Biological Sciences Directorate, Division of Environmental Biology (DEB; see attached sheet on program areas.)

NSF Funding

US-Asian Environmental Program. Cooperative US-Asian research program expanded to include the People's Republic of China and the Federation of Independent States, Russia. Provides support for fellowship and training (\$18 million/year in "new" money, \$5 million for development of a regional biodiversity conservation network). The cooperative relationship developing between LTER and the Chinese Ecological Research Network (CERN) is a model for potential relationships with other Asian countries. James Edwards invited ideas for proposals from LTER.

International Biodiversity Study Groups Fund provides an opportunity for U.S. and foreign scientists to analyze biodiversity, screen for products, and fund studies. The first program, which will offer three LTER-sized awards of \$3.5 million each, will commence in 1993 (descriptive flyer will be available in April).

Funding for undergraduate and graduate training and group coordination of research in plant sciences through NSF, DOE, and USDA in an effort to meet the need for ecologically-oriented activities. LTER urged to propose studies. Consortia proposals will be favored.

Research Agenda for Aquatic Sciences (sometimes erroneously referred to as the "Freshwater Initiative"). A proposal has been prepared for a workshop headed by Robert Naiman, Center for Streamside Studies, University of Washington, and John Magnuson to develop an agenda for aquatic ecological research.

LTER-specific funding for field station/marine lab improvements.
Deadline for proposals: December 15, 1992, with a June-October 1993 award receipt. Proposals should be decadal-scale, and will be evaluated externally.

10-Yr. LTER Review Tom Callahan requested by July 1 a document from the LTER/CC providing input to the design and execution of the long-term research plan. The document should include overall tasks, a timeline for completion and identification of individuals to complete tasks. Callahan noted that this is a significant opportunity for LTER to provide valuable and useful input; however, he stressed that there are no guarantees this input will explicitly guide the final design. An ad-hoc committee may be used. (See attached sheet for input from site representatives.)

Meeting Schedule **LTER/CC. Aug 1-6, in Fairbanks, Alaska**, as previously announced. Organizers need to know how many individuals per site will attend. Adrienne Whitener in the LTER Network Office will send out a preliminary registration request to solicit this information, as well as names of attendees.

LTER/CC. March or April, 1993. Bill Schlesinger offered to host the meeting at Jornada, suggesting attendees fly into El Paso, Texas and then on to Las Cruces, New Mexico.

LTER/EXEC. June 18-19, in Washington, D.C. James Gosz, in Washington as Director of the new Sustainable Biosphere Initiative office, offered meeting space. The meeting will be followed by a June 20 visit to the Smithsonian Environmental Research Center, the long-term research site in Edgewater, MD.

All Scientists '93. September or October 1993. The Executive Committee recommended the meeting should be near an airport in the center of the country, or at one of the southern latitude research parks which have long-term ecological research and monitoring programs. In initial talks at the 1991 Seattle LTER/CC, it was suggested that the YMCA facilities at Estes Park, CO be used again, but with attention paid to poster space and equipment in breakout meeting rooms. Site selection and program committees will meet at Trout Lake and will move ahead quickly with planning. **Site selection committee:** Carl Bowser (chair), John Vande Castle, Tom Callahan. **Program committee:** Caroline Bledsoe (chair), Dave Tilman, Tim Fahey, John Vande Castle, John O'Brien.

LTER/EXEC Election A replacement for Keith VanCleve (BNZ), whose term on the Executive Committee expires this year, will be selected by mail ballot. The newly elected member will attend the June meeting in D.C. Jerry Franklin noted that the Committee had begun to ask the alternate member to attend the meetings regularly as well.

Subsequent election results: Tim Seastedt (NWT), Fred Swanson (AND), alt.

Initiatives/Internat'l. Activities

CERN Interactions. James Gosz reported that the World Bank will support continuing scientific exchange with the Chinese research community (proposed \$20 million). A proposal is in to NSF which focuses on data management training for the Chinese. The proposed program would involve an LTER trip to China to identify sites and individuals for training in the United States, with a possible followup training in China.

**Initiatives/Internat'l.
Activities, cont'd.**

ILTER Research Coordination. Caroline Bledsoe's LTER research coordination activities will continue under subcontract to the coordination grant. She will work in three areas with LTER: (1) NSF program staff (Edwards, Roskoski, Penhale, Callahan, Reynolds, Wooley, Systematics, and Integrative Biology.); (2) the LTER Network Office (developing a bibliographic database, core dataset directory analysis, research capabilities, NSF communication and planning; and (3) scientists at sites (links to other networks, Network of Networks, trace gas pilot study, pilot synthesis project, global change book). The trace gas study involves a consortium of U.S. agencies (NSF, DOE, NPS, NOAA, ARS, IGAC/IGBP) who will arrange funding to start the project and hold a workshop. Dr. Bledsoe asked sites to participate in the planning phase.

Focus 2/GCTE Meeting, Trondheim, Norway. John Vande Castle reported on the June 1991 meeting on Global Change and Terrestrial Ecosystems (GCTE), which addressed global change research initiatives at the international scale. The focus of proposed research activities (with possible LTER collaboration) will be on modeling to integrate a wide range of temporal and spatial scales, from patch through landscape to region, using remote sensing and large databases. (A report on the meeting is available from the LTER Network Office.)

A Focus 3 workshop on global change and forest ecosystems will be held in Seattle next fall. The Network Office will assist with coordination.

NIN New Directions

Liz Blood reported on new research directions, restructuring and reorganization reflected in North Inlet's renewal proposal. The proposed research links regional to local and regional scale processes (including El Nino and La Nina effects), and looks at the major terrestrial impacts of Hurricane Hugo, including geological processes, soil and vegetation patterns and salinity, and interannual variation in sea-level rise. The significant difference in the proposed program is the soil-based terrestrial component, gradients across the landscape to tidal creek, looking at gas fluxes, vegetation patterns, soil dynamics, perturbation, exchanges across the landscape, and the role of disturbance. With funding from NOAA, urbanization impacts are also being studied.

Climate Committee

Bruce Hayden reported that storm data for all sites is now accessible over LTERnet, and that the climate bulletin board, Climate Ecosystem Dynamics Bulletin (*CED*), the first issue of which went out over LTERnet, has been developed. Issues will be posted periodically. Hayden solicited contributions and additional names of people, including non-LTER collaborators, who would be interested in receiving the information regularly. David Greenland, Tim Kittel and Bruce Hayden have submitted a proposal to update the climatic description and synthesis monograph for LTER. The comparative analysis chapter will be redone and the issue of climate change across LTER sites (including new LTERs) will be addressed. The Network Office will publish the document.

Publications

Jerry Franklin introduced the development of policy for the LTER publications program which, already in the works, was accelerated by recent requests of the Network Office to quickly produce and distribute reports. He also noted that the Executive Committee asked that a site distribution map, errata sheet, and an

Publications, cont'd. insert with an Executive Summary or statement of purpose, and a description of the Network Office, be added to the current site directory with mailings, and that these be included in future editions. Stephanie Martin reported that publications capabilities at the Network Office have been upgraded to allow for more compatible file exchange and more efficient production. She distributed a draft publications program description including goals and objectives, types of publications, author guidelines, status of projects, and a survey for feedback on the *Bulletin* and the *Network News*. Also distributed at the meeting were the technical report prepared by David Foster and Emery Boose (HFR), and a data management survey by Scott Chapal (NIN) and Rick Ingersoll (NWT). Stephanie invited regular feedback from the sites on the direction the publications program is taking.

Robert Waide (LUQ) announced that the current issue of *Biotropica*, which features LUQ and NIN, will be sent to each of sites.

Data Managers Report

James Brunt reported on the activities and achievements of the data managers detailed in the proceedings of the August 1991 meeting in San Antonio, Texas, which was recently distributed by the LTER Network Office. (Additional copies are available.) The document includes information on current working groups; outreach to groups such as OBFS-SAML, CERN, and LMER; a proposed international symposium; the *Databits* newsletter; the data management history file; SCS collaboration; the development of a data management slide presentation; participation in the LTER review and panel process; and quality assurance and quality control.

Future meetings: '93 (date undecided), to include representatives of OBFS, SAML, LMER. The group will meet for three days in Madison, WI in conjunction with AIBS; '94 in Albuquerque, NM (Paul Risser will be keynote speaker).

Updated MSI

Jerry Franklin reported that he had originally wanted an minimum standard installation (MSI) document included in the technical report prepared by David Foster and Emery Boose, but that it became clear the MSI would first need updating and expanding with input from the PIs and data managers. Rudolf Nottrott drafted and circulated an update for site input, including GIS, LAN/WAN, and high-capacity data storage systems. Prices were not included because they are too variable. Response so far from data managers is that full implementation of the suggested updated version of MSI would require full-time-plus data management personnel. Other feedback suggests that it is too early to implement the structured query language (SQL) database standard recommended in the document, so it will not be included. The LTER/EXEC recommended publication in a refereed journal, such as *BioScience*. Rudolf requested additional response from PIs.

SprintNet Access

Daniel Pommert, LTER Systems Analyst, described how LTER personnel may now access the long-distance SprintNet connection to LTERnet while on travel. This allows access to LTERnet functions, plus long-distance calling at no cost, since the LTER Network Office picks up the tab.

**Remote Sensing
Acquisition**

John Vande Castle reported that satellite scenes for several sites have been rejected, but are being re-acquired. EOSAT is backlogged, a situation which is delaying processing of the data. All but five of the SPOT satellite images have been acceptable. SPOT 2 images have better resolution than SPOT 1. NDVI (USGS) data are composited every two weeks and are available on CDROM.

**Possible NASA/
EOS Collaboration**

Steve Running proposed that LTER consider an organized and mutually beneficial monitoring effort, perhaps for ground truthing/monitoring in connection with the development of the new Earth Observing System (EOS). He requested both political and scientific input from LTER as this program develops, and noted that this would be an opportunity for LTER to help shape the final EOS. Major goals of EOS: understanding the Earth as a system, and supporting national policy determination. Running noted that in the current design, "user community" is not defined, except for universities. He hopes to have a preproposal ready to test out within six months. Within NASA, the best people to talk to initially in favor of the idea of a collaboration are Dickson Butler/EOS, Diane Wickland/Earth Science and Applications Division, and Tony Janetos. Possible areas of interchange: land-cover vegetation map; leaf area index map, possibly done seasonally; net primary production; standing biomass; litterfall, soil carbon/respiration; daily standard meteorological data; seasonal snowcover and snowmelt; soil structure and moisture depletion; hydrologic discharge from gauged watershed, soil nitrogen, foliar chemistry; lake ice cover, temperature, and chlorophyll.

What NASA wants: satellite-derived regional landcover maps defining biome coverages and facilitating quantitative change detection; regional maps of seasonally dynamic LAI, NP by biome type; regional maps of a variety of ecosystem processes in conjunction with integrated remote-sensing-ecosystem modeling projects; near real-time fire maps; regional databases of daily surface meteorology, cloudcover and aerosol corrections, temperature anomalies, surface wetness, surface resistance, etc.; higher spectral resolution VIS-NIR data researched for estimates of various nutrient cycling variables; radar and microwave products for spatial soil moisture, snowpack, microtopography, etc.

Bruce Hayden reported that VCR was encouraged by the results thus far of their collaboration with NASA in evaluating EOS. John Briggs (KNZ) and Tim Seastedt reported that they got and may continue to get a lot out of the NASA/FIFE experience. Phil Sollins (AND) suggested that a standing committee in remote sensing be set up to study the question, utilizing specialists in the Network. Jerry Franklin recommended that as a beginning a smaller group, perhaps at Trout Lake, meet to provide feedback to Running. He took a poll of the sites, which revealed **unanimous support for the proposed collaboration**. Bill Schlesinger suggested that the LTER/EXEC develop a preproposal, including the conceptual argument and political justification; then, personnel with the technical expertise could be brought in if the preproposal is well-received. Jerry Franklin proposed that the LTER/EXEC and interested individuals meet at Trout Lake to formulate the basis of a preproposal.

Working group: Jim Gosz, Bruce Hayden, Bob Waide (LUQ), Phil Sollins (AND), John Magnuson (NTL), John Aber (HFR), Tom Gower (NTL).

SYNTHESIS SESSION

- Introduction** *John Hobbie (ARC) and John Magnuson (NTL), co-chairs.* Goals of the session were to consider: What synthesis work have we done so far? How can we encourage Network science and synthesis? What are the promising topics and opportunities? What are the techniques/strategies for carrying it out? Brief reports on intersite synthesis followed, including process studies, climate forcing, spatial variability and temporal variability, and scaling up to regional and continental scales.
- PROCESS STUDIES:**
- Tilman & Zak/CDR** *Soil microorganisms along a gradient of climate on plant production.* Donald Zak and David Tilman studied C and N cycles in terrestrial ecosystems, scaling up from old fields to entire biomes. The work included 10 LTER sites with varying degrees of plant production, taking 10 samples along a transect. Analysis of organic C and N was completed within 24 hours of sampling. Tilman and Zak used multiple linear regression models to predict soil microbial biomass, soil respired C and mineralized N.
- Schlesinger/JRN** *Soil Warming Experiment.* On September 27-28, 1991, an NSF-supported workshop was held at Woods Hole to identify scientific questions and critical research needed to improve understanding of the effect of warming on soil processes. Ten recommendations for the initiation of a long-term, multi-site soil-warming experiment to understand the response of soils to global climate change were developed by participants. These are outlined in a report on the workshop available from Bill Schlesinger. A multi-site proposal to NSF is currently being developed toward meeting the June 15 deadline.
- Gower/NTL** *Network litter decomposition project.* Tom Gower reported for Mark Harmon (AND) on the 10-year test of climatic and substrate quality control of fine-litter decomposition involving 21 sites, 17 LTER sites. All sites participated in the successful initiation by collecting litter, placing materials in the field, and providing information about the sites. Modelers will predict C, N, and P dynamics and validate models from the field study, and an analysis group will perform chemical analysis, data management and preliminary data analysis.
- Sollins/AND** *Nutrient cycling comparisons using models.* Phil Sollins and his collaborators John Westall (OSU) and Paul Verburg (Wageningen Agricultural University) compared acidification, nitrification, and pH values of soils at participating sites: Cedar River, Solling (beech, spruce), Hubbard Brook, and H.J. Andrews.
- Boone/HFR** *Intersite Detrital Inputs, Removal, and Trenching (DIRT) study.* Richard Boone reported that this study was an outgrowth of the LTER Decomposition Workshop which draws on manipulation experiments conducted by Francis in '50s at the University of Wisconsin and Knute Nadelhoffer's 30-year C/N study. HFR study treatments: control; no litter; no roots; no litter/no roots, double litter; organic and A horizons replaced with B horizon soil. Boone suggested that the study is a good model for intersite work: DIRT plots may provide a relatively easy, low-tech way to determine the relative contributions of root respiration and soil organic matter decomposition to CO₂ flux from the soil. A proposal to NSF is currently being developed toward meeting the June 15 deadline.

Discussion/Summary John Magnuson asked the group to cite examples of synthesis work with data collected under the LTER Program. Jerry Franklin cited tree demography work, Magnuson's variability work, and the litter decomposition experiment. To the question of why more synthesis hasn't been done, Magnuson suggested that perhaps the measurements at the sites are often site specific and that more general approaches are needed for synthesis among such diverse site and straight data comparisons.

Further discussion addressed the usefulness of the Network database, the standardization of measurement techniques, and whether there are holes in the measurement and analysis program rather than in data management. He noted that it is in the nature of the sites that each has its biases. What process-level questions, given the structure of LTER, can be answered? The litter decay study suggests a possible synthesis approach, continuing to build in more standardization, comparability and sample exchanges. There are no measures to go along with the diversity data to expand from local to cross-site/regional or global scales. More examples: hydrological modeling, integrated forest sites, biogeochemical models.

CLIMATE FORCING

Hayden/VCR

Synthesis in climate study. Bruce Hayden The proposal to NSF (see "Climate Committee," page 1) includes an update of the LTER climate monograph, and a time-series analysis of temperature and precipitation and climate change at each of the LTER sites.

John Kutzbach

UW Madison

Climate global simulation models. John Kutzbach pointed out that climate model outputs will be at a scale useful to ecologists within two years. He presented examples of grid-scale/computing time simulations; nested (problems at boundaries), fine-mesh models and; statistical finest-scale structure models. The kinds of experiments to which these are suited include: present climate; past climate; $ZXCO_2$, $4XC0_2$ (equilibrium/transient); surface winds (temp and precip); predictions of how circulation winds would change; paleoclimatic data (over last 18,000 years): pollen, lake-level, midden, marine. With such models, climatic, topographic, precipitation grids from $5^\circ \times 5^\circ$ to $1/2^\circ \times 1/2^\circ$ can be generated. There have been modest improvements in resolution already; for example, the NCAR model (GCM2) which will be available to NSF users in October '92. Computing time to process the 100-fold increase in data is the only problem. One solution Kutzbach suggested LTER should consider having a dedicated: parallel computers could be built for about \$100,000 each to work at 1° -resolution.

Rastetter/ARC

Biogeochemical models and climate forcing. Atmospheric Carbon Budget, PCC Scientific Assessment. Bob McKane (CDR) reported for Ed Rastetter. Using MBL GEM model ($1/2^\circ \times 1/2^\circ$ scale), studied N input, temp, CO_2 vegetation, soils and litter, GPP, NPP, NEP, and soil respiration measurements at nine sites (temperate deciduous forest, coniferous forest, temperate prairies, high-latitude ecosystems). Observed changes in N storage, soil and vegetation with temperature increase. All participating sites (AND, ARC, KNZ, CPR, others) were LTER sites except Brookhaven.

Summary John Magnuson asked the group to consider whether there are obvious climate experiments/comparisons of interest to LTER sites; for example, temperature records, "retrospective" simulations, limnological ice-cover, surface water temperature, trend data (for next climate monograph), paleoecological data (pollen, cores)?

TEMPORAL and SPATIAL ANALYSES

Meyer/CWT *Intersite comparison among streams.* Judy Meyer reported that as an outgrowth of the 1990 LTER All Scientists Meeting, Network stream researchers formulated a questionnaire to compile basic information on the types of streams found at LTER sites, with the goal of identifying commonalities and stimulating and facilitating intersite stream research. Participating sites: CWT, AND, ARC, BNZ, HBR, KNZ, LUQ, NWT, NIN, NTL and SEV. Included are physical, chemical, and biological characteristics of streams. The information will be produced in May 1992 as an internal research report at the Network Office.

Kratz/NTL *Comparisons of variability among sites—on-site measurements.* Tim Kratz described the variability work done at NTL which, starting with 12 sites as data points, combined a total of 448 datasets in a melting pot approach to finding commonalities. The data sorted into four types of comparisons as influenced by variability: (1) aggregation, (2) biotic vs. abiotic, (3) spatial vs. temporal, and (4) landscape position.

SYNTHESIS and SCIENCE

Scaling Up: Continental & Global Scales

John Hobbie cited various examples of larger-scale models: land-use change, CO₂, and country-by-country scale models that would interact with GIS and can operate on several different scales, utilizing vegetation, soils, temperature, precipitation, and cloud data (1/2° x 1/2° cells). One can interact that model 1,000 times on a monthly time-step. Because these are process-based, one can change the factors: annual NPP, NDVI, etc.

Coffin/CPR *Cross-Biome Modeling Project.* Deborah Coffin described CPR's analysis of the response of the central Great Plains to climate variability over short and long temporal scales using ecosystem simulation models (CENTURY and STEPPE). A spatial database for the central Great Plains and adjacent areas of the Central Lowlands was developed and stored in a GIS. Long-term climate data for more than 400 weather stations in the region from the CLIMATEDATA database, and soils data from the USDA Soil Conservation Service STATSGO database, were overlaid in the GIS to produce a polygon map of input variables. Model output was then mapped for analysis of sensitivity to short-term climate variation. Found that the region is susceptible to significant reductions in primary production in response to short-term variation in climate.

Discussion/Summary After some concerns were expressed that synthesis is being presented as a requirement at LTER sites, and that its value is being oversold, John Magnuson stressed that, to the contrary, synthesis should be viewed as an opportunity, not a requirement. He noted that the National Science Foundation is interested in seeing synthesis activity stimulated because of the research opportunities that exist in commonalities among sites: common data, common process, common forcing, common question, common models, common tools (approaches, methods), and common funding. Some synthesis would require going beyond LTER, but would not necessarily require that all LTER sites be included. Introducing the next activity, Magnuson and Hobbie asked the group to consider: What synthesis will LTER propose to do? Who is going to lead it?

Working Groups Participants were divided into five subgroups to generate one to two questions each on the scope of intersite synthesis. John Hobbie challenged participants to explore the feasibility of each synthesis activity proposed, as well as the interest of potential collaborators. Spokespersons for each group reported the following:

Synthesis Questions

1. *Influence of animals on ecosystem processes, terrestrial/lake/ocean.* The work would involve measuring stable isotope (nitrogen) signature and detritus, looking at year-to-year temporal variability.
2. *Belowground processes, "Soil Ecological Health."* How can site degradation, soil ecological health, be measured? What are the legacies of past land use on belowground function/health? This activity would have three steps: (a) a survey of soil parameters; (b) a workshop in which participants bring data and work with a simple root model, predict production and compare to actual values; and (c) new data on soil ecological health.
3. *Climate hydrology.* This work would continue climate comparisons already completed, including El Niño phenomena (how they relate to process and controls at the sites), early-killing frost/periodic resetting events, snow and under snow conditions, cyclone frequency, and other climate data/storm impacts, as well as the occurrence of rare events. The comparison would include hydrology (rates, gradients, interannual variation, microbial diversity); waterflow and environment (rates and resident times of lake, stream, and groundwater); and the effect of snowpack and viability of organisms.
4. *Microbial diversity in soils.* This would be a comparison of different climatic regimes across aquatic, terrestrial, and marine sites, looking at microbial diversity from different scales. Samples would be collected using chemical signatures. Measuring methods would include carbon oxidation (bioplate), and FAME analysis (fatty acid content in soil, unique to certain microbial communities).
5. *Chihuahuan desert.* This three-site (SEV, JRN, CPR, possibly to include CDR as a fourth site) analysis of species distribution from desert to grassland would relate to diversity and ecosystem processes. The work would include a team search both in libraries and the field for common datasets, sampling along a gradient from Mexico to Colorado, and possibly Michigan, and would contribute to NSF's activities in biodiversity and systematics.
6. *Trend Analysis of Lake Ice, Surface Temps, Thermocline Depth.* This analysis, which will follow a workshop planned in conjunction with the ASLO '93 meeting, proposes to use existing long-term datasets from ARC/NL/Canada/Soviets/UK to look at trends in warming which are greater in terms of latitude, and coherence in pattern as a function of lake size and latitude. Organizers expect to produce a publication in a peer-reviewed journal.

10-Year LTER Program Review

On Saturday, James Edwards had requested input for the upcoming 10-year review of the LTER Program NSF is undertaking. He had asked that the sites consider the following questions for discussion: (1) Why is LTER more than the sum of its parts? (2) What about LTER Network results is greater than individual site results? He noted that synthesis would be of paramount importance as the evaluation is undertaken.

Jerry Franklin chaired the session, and asked the group to provide input for NSF. He noted that LTER participation in this process should also help to identify goals of the Network for the next 10 years, revealing issues of continuity and appropriate levels of standardizing measurements. He began by posing possible questions for consideration during such a process: How has LTER made use of long-term records? What use has been made of the five core areas, how well have they served us? What has LTER done differently, working collectively as a network as well as doing very good individual site science? What use have we made of the Network Office? How have we advanced information management? How have we advanced basic ecological knowledge? How productive have we been compared to our non-long-term peer groups?

Questions/Suggestions from participants:

- (1) Stress the long-term nature of funding support (detail the financial base), and the unique product(s).
- (2) What trends would we have seen without/with this long-term support, what societal gains?
- (3) What societal gains have been achieved?
- (4) Include federal agency participation in the review process, since they use LTER material and participate in LTER science.
- (5) How has LTER research influenced government decision-making?
- (6) How well have links between the science and feedback worked?
- (7) In what ways have LTER approaches assumed a leadership position/provided successful models?
- (8) How well have we developed standards/guidelines?
- (9) What has been LTER's role in educating future ecologists/our legacy in terms of students?
- (10) What has been the value of having sites in place to capture results of episodic phenomena?
- (11) Document programs that have tried to emulate LTER.
- (12) How has LTER used existing data?
- (13) Balance of short-term results versus longer-term change.
- (14) LTER technological innovations/new technologies.

10-Year Review, continued

- (15) Development of interdisciplinary interactions/social and economic sciences.
- (16) How well has the database served us?
- (17) How well have we approached the synthesis objective?
- (18) "Network of networks" idea.
- (19) Management of LTER, how well has it served the science?
- (20) Sites as local nuclei, attracting science and developing relationships with non-LTER scientists.
- (21) LTER workshop approaches.
- (22) Early efforts at cross-site analysis/comparisons.
- (23) Extent to which we've been able to set up experiments for long-term use, the legacy of our experiments.
- (24) Compare what we offer versus the alternative, in a positive sense.
- (25) Has age profile of researchers changed over the decade?
- (26) Relationship to Long-Term Studies Section of ESA.
- (27) What has been the role of mid-term reviews?
- (28) How well does LTER Network cover essential systems and processes?
- (29) What has been the effect of continuity on understanding systems?
- (30) Is the character of the latest cohorts different?
- (31) What is the measure of enthusiasm for scaling up?
- (32) To what extent is LTER representative of the broad field of ecology?
- (33) How has LTER closed links between the physiological and biological sciences/the terrestrial and aquatic?
- (34) What effect has LTER had (service, education) on other entities/agencies, both the explicit intent and the unanticipated results?
- (35) What have we contributed to larger earth-system science/global scientific issues?