

Report of the
LTER National Advisory Board
December 10 and 11, 1998
Sevilleta LTER Site, New Mexico

I. Introduction

This is the report of the LTER National Advisory Board which met at the Sevilleta LTER site, New Mexico, on December 10 and 11, 1998. Membership of the Board is as follows: Ann Bartuska, U.S. Forest Service; Jim Beach, University of Kansas; Mary Firestone, University of California, Berkeley; Bill Heal, United Kingdom; Jim MacMahon, Utah State University; Bill Murdoch, University of California, Santa Barbara; Paul G. Risser (chair), Oregon State University; and Rebecca Sharitz, Savannah River Ecology Laboratory.

The charge to the Board was to:

- * provide regular review and advice to aid in the periodic review needed by the LTER program and by NSF;
- * provide guidance on new directions or interactions that might be pursued by the program; and
- * help to publicize the activities and opportunities in the LTER program.

The Board also has the responsibility to provide independent oversight for the LTER Office.

In considering its charge, the Board recognized its responsibilities not as a typical research evaluation, but rather as advisors bringing different experiences and perspectives to the LTER program. The focus of the advice in this report is directed primarily toward the LTER network, but also includes the LTER Office.

The Board read a significant amount of background material in preparation for its visit. Of particular importance was the Ten-Year Review of the National Science Foundation Long-Term Ecological Research (LTER) Program. During the meeting, the Board heard the presentations and participated in the discussions as listed in the attached agenda (Attachment A).

II. Progress Since the Ten-Year Review of the LTER Program

The 10-year review made two overarching recommendations concerning the scientific focus of the LTER network. The first, concerning locally-focused science has two components: (a) long-term measurements of patterns and processes, taken consistently over the duration of the project; and (b) intensive question-driven studies appropriate to each site. These studies are the core and the great strength of the LTER program. The LTER sites continue to conduct excellent research in these areas, as reflected in a very extensive publication list, marked by a substantial number of publications that have gained national and international attention.

The second recommendation of the ten-year review was to expand the site-focused research to achieve integration and synthesis, and to generalize results over broader spatial scales. Such analysis and synthesis could include cross-LTER-site comparisons, scaling up from one or two sites to a regional scale, and/or comparisons across many sites including those not in the network. Some analysis and synthesis has been achieved along these lines. For example, generalization to the regional scale has been achieved at the H.J Andrews forest site, incorporating satellite vegetation data over a substantial region of the US. Also, a detailed

analysis of the similarity of environmental conditions has defined the region of reasonable extrapolation from the data collected on the shortgrass LTER site. In a study across most of the LTER sites, the relationship between biodiversity and NPP has been analyzed at a very broad spatial scale.

Despite these example successes, larger-scale integration and synthesis is currently more an area of promise than accomplishment. The modest success is understandable because synthesis naturally follows site-specific research. Furthermore, cross-site comparisons and synthesis have quite rigorous requirements for comparability of data, an issue we comment on below. Some LTER scientists, however, are clearly interested in achieving broader synthesis, and there is a belief among these scientists (and the National Advisory Board) that the network is poised to make substantial progress in this area.

The remainder of the 10-year review's recommendations concerned governance and the role of the Network Office. A clear governance structure has been developed, with the Coordinating Committee being the primary body, and its relationship to the Network Office has been clarified. The network responded to the recommendation that it seek outside advice and commentary by creating this National Advisory Board. Standing committees have been developed within the LTER to focus on a variety of substantive scientific and technological issues that are relevant across the sites. As the 10-year review recommended, and we discuss below, the Network Office should continue to facilitate synthesis. Finally, the Network Office is to be congratulated on achieving an apparently seamless move to its new location while sustaining the network activities.

III. Operational Issues of the LTER Program

There are a number of "operational" issues that require consideration by the LTER program and by the Network Office. In the sections below, we offer observations and advice on the most important of these issues.

A. Network Structure

Among the persistent issues is the question of whether the LTER Network should add more sites or augment funding to existing sites. The Board believes this issue should be addressed in the 20-year review process. Until that time, however, expansion of the number of sites is not advisable because of the potential to further dilute the funding base of existing sites. The Board believes that current funding for the individual LTER sites is minimal, and if there is to be further investment in the LTER program, additional funds should be allocated to the existing sites rather than expanding the number of sites.

B. Increasing Responsibilities at the LTER Sites

Over the years there is a pattern of increasing breadth and number of responsibilities accepted or assigned to the existing personnel and site infrastructure. These additional expectations arise because the LTER sites and network offer powerful research possibilities and opportunities to

respond to scientific initiatives. However, many of these additional expectations arrive without comparable increases in the funding level. At some point, this expansion of responsibilities will begin to undermine the success of the core LTER Mission. The Board has some concern that this point has been reached. The LTER Network Office and the individual sites must focus on and retain the important components of the program, reducing efforts in more ancillary efforts. Alternatively, funding increases will be required to enable effective and high-quality responses to expanding responsibilities.

C. Network of Networks

The individual LTER Sites and the Network as a whole are becoming victims of their own successes. The unique strength in long-term research on the dynamics of a suite of ecosystems is recognized regionally, nationally and internationally. The accumulated experience in long-term research, the wealth of accumulated data and information, the high quality of the research, and the range of environmental and ecological issues and systems that are being addressed, all represent a national capital. This capital is of increasing importance as environmental issues rise on the political agendas (e.g. Biodiversity, Global Change, Sustainable Development) and as the value of long-term and spatially extensive information is recognized. Many organizations are now attempting to establish systems for environmental monitoring and are looking towards LTER as a source of information and/or as participants.

The international effort has developed very well during recent years. LTER is now a realistic organization with an important contribution being developed with GTOS and other international efforts. The primary aim of the LTER program has been one of capacity building in other countries. The plan now is to increase the autonomy or self determination of international regional networks. This is a sound principle which will allow the LTER Program to judiciously assist other networks without undue commitment of time and attention to them.

As a nationally funded program, the LTER has significant responsibilities for sharing information and expertise, and for providing assistance to others. The Advisory Board recognizes these responsibilities, and applauds the LTER for its responsiveness to others and for the myriad ways in which the program has shared its information and advice. However, the LTER program now has such a strong reputation and record of success that it is attracting more demands than can be satisfied by the program and LTER Network Office.

Since the LTER network is a high profile and successful example of a "network," multiple opportunities are and will continue to arise for connecting to existing networks. While there may be benefits to the connection of extant groups or networks, there will be costs in terms of dedication of investigator time and effort for establishing these connections. To continue to focus the LTER program, decisions to connect with other networks must be done in the context of careful prioritization of effort.

Although the Board recognizes that invitations to join other networks are a validation of the LTER concept and its scientific credibility, the Board also recommends that these invitations be accepted only in those cases where there is a clear benefit to the LTER Program.

D. Partnerships

Partnerships with other ecologically-based research sites is poised to happen in a major way. The 158 OBFS sites, the 40+ Forest Service experimental forests, the numerous Research Natural Areas supported by Federal agencies, and others provide a means to determine the ecoregional representativeness of a LTER sites and enhance opportunities for regionalizations (see next section). New partnerships could be developed with groups who can speak on behalf of the LTER program, thus relieving some of the burden from the scientists. Partners are a way to leverage additional funds for the science and management at both the sites and the Network office, and thus to capitalize on a broader community interest in collaborating with LTER. If done carefully, this can be done without sacrificing the core functions of the sites.

E. Regionalization

As recommended by the 10-year review document and noted above, many LTER sites have initiated efforts at regionalization. The general goal of all of these efforts is to achieve some degree of generalization of site-based information to a broader geographical area. However, under the umbrella term of "regionalization" currently there are a number of types of distinctly different projects. Approaches range from taking additional measurements at sites within a geographical locale with similar vegetation types or management regimes to comparing data bases obtained from two or more regions from different parts of the globe to relating site measurements to land use histories. Because the term "regionalization" is used in so many applications, it is not communicating much information. There are an array of types of studies that can be used to generalize results obtained on LTER sites; the value and structure of these studies will be communicated more effectively if more explicit and descriptive terminology is utilized. The Board does not wish to restrain the scientific imagination of the Program, but it does recommend that the term "regionalization" be restricted to efforts to define the appropriate region of extrapolation of site-based research. This regionalization process is important for understanding the site-based research, and for understanding the realm of applicability of the LTER research program.

F. Cross-site activity and synthesis.

In planning the next steps in the LTER Program, an important question is the balance of effort between research at individual sites and that concerning across sites. The design of the LTER Network and the importance given to Informatics aims to capitalize on accumulated information and the principle that 'the whole is greater than the sum of the parts'. The potential of the information across sites is increasing and has yet to be fully realized. Synthesis by network scientists can take two forms: experiments integrated over more than on site and analysis and synthesis of data from more than one site (perhaps including non-LTER sites).

Synthesis is primarily a bottoms-up activity originating from individual or groups of scientists thinking broadly about their own and related disciplines. Although it is difficult to centralize synthesis, the Coordinating Committee and the Network Office can encourage and facilitate synthesis. There are several models, for example, by bringing together scientists from different sites to explore application of cross-site information and data in relation to particular science questions. It may be advantageous to appoint senior scientist to short-term periods in which they devote all their energies to synthesis, involving other scientists as appropriate. Some LTER synthesis is and should continue to be conducted with the National Center for Ecological

Analysis and Synthesis. In addition, the LTER Network Office could provide initial data analysis and then involve scientists in the synthetic interpretation of the results.

The Network Office can also support future synthesis by ensuring, to the extent that it is efficacious, that new projects and measurements that are undertaken at different sites generate data which are directly comparable, perhaps in many cases by standardization of methods.

The impressive accumulated documentation of "Recent Achievements" from individual sites is worth exploring to summarize evidence of long-term changes in the ecosystems of North America. A cursory examination indicates, for example, the importance of events, as distinct from longer-term trends, in determining species habitat diversity. Are there patterns of change across sites or are sites responding individually? Is there evidence from across the sites of systematic (or regional) changes in biodiversity? The accumulation of information warrants increased effort in synthesis.

G. Responding to New Initiatives

As noted above, each LTER site must continue to function and initiate research projects as independent entities. However, it is also critical that the sites not miss the opportunity to coordinate their responses to new initiatives, especially those that take advantage of the network. This does not mean that the research projects proposed by sites must be totally integrated or coordinated. It falls to the Network Office to ensure that there is some level of coordination in response to new initiatives. The Network Office can foster this coordination - and potentially help identify individual investigators with expertise appropriate to take a leadership role in coordination.

The Microbial Observatory Network opportunity now before LTER is an excellent example of a research area where a coherent, explicit technology plan and vision for the strategic support of microbial research would position LTER to be a center of excellence in conceptualizing and analyzing sequence and related data in a way which would permit the development of a knowledge network of microbial information within LTER and to external molecular communities. That is not to say that the Network Office should re-invent archival sequence databases or existing technology tools in a separate parallel informatics development. In this area and all the other related database areas, the LTER Network Office should first look very hard at existing standards, protocols, models and other information technologies from other research, archival and bibliographic communities, before considering the development of a new architecture. Nevertheless, it is clear that there are many exciting, integrating, informatics opportunities in ecology that the LTER Network Office could show substantial and valuable leadership in.

The informatics partnerships with the San Diego Supercomputer Center as part of the SCSC NPACI partnership award is an excellent example of an appropriate and exciting external collaboration with the high performance computing and museum/biodiversity communities. This will ensure engagement of the LTER network with the informatics architectures being developed by related communities.

The Network Office should be encouraged to submit informatics and technology proposals to other NSF programs, such as Computational Biology and Database Activities at NSF/BIO and from NSF/CISE to leverage their core funds and to ensure that the research informatics activities

are validated by external reviewers of those programs. The LTER data management group and data management committee has done some of that but should be strongly encouraged to seek more extramural funds where appropriate for network informatics activities. The opportunities for developing a robust and valuable informatics architecture are quite obvious with the planned NEON program. The Network Office and data management committee and group are ideally situated to lead the nation in this area.

H. Communications, Marketing and Education

Outreach takes many forms -- informing local communities about the LTER site in their midst, briefing Congress on the value of LTER science, and conducting educational programs at all levels from beginning students to continuing education for adults. Full realization of the LTER Network concept, with exploitation of the many opportunities for expanded partnerships and increasing the resources needed to implement this concept, brings with it the importance of outreach. Aspects of communications, marketing and education are a continuum of a set of activities and practices to broadly inform multiple audiences about both the importance of the LTER as a program and about the science represented by LTER.

The Board recognizes and commends the LTER Network for initiating communications and education activities; they are excellent first steps. Given the array of opportunities and the importance of these activities as LTER matures, the Board believes a more strategic approach is needed. Specifically, the Network Office should develop a Communications and Education Plan with the involvement of the sites and others identified by the LTER Program. There is a clear opportunity to build upon the work of the Education Committee and its recommendations. Elements of such a plan might include, but not be limited to:

- * identification of the target audiences;
- * development of key messages and the story LTER wants to tell;
- * identification of partners with the scientific and financial capacity to augment both research and outreach done within the LTER Program;
- * tools and methods of outreach and education for each target audience,
- * targeted outreach to under-presented groups, taking advantage of the geographic location of these sites (e.g Hispanic communities at Sevilleta);
- * establishment of a training program for LTER scientists to become effective science communicators to the many audiences (possible linkage to the Aldo Leopold Leadership Program);
- * investing in a cadre of extension-type specialists who would work in partnerships with LTER scientists to broadly communicate the science; and
- * a timetable for implementation and a budget estimate.

I. Setting Priorities

The LTER Program is in a new phase, incorporating the value of being a network without affecting the integrity of the individual sites. Because of the successes of the LTER program, many opportunities now arise for program expansion, for developing new partnerships, and for responding to requests for assistance from other organizations and individual scientists. These requests and opportunities are compliments to and marks of accomplishment by the LTER program.

The LTER must consciously set priorities for its commitment of time and resources. In fact, setting priorities is now one of the chief responsibilities of the LTER program leadership. These priorities must be set in the context of the strategic directions taken by the LTER program, and as the program positions itself to make significant contributions into the indefinite future. If priorities are not set, the program runs significant risks that its core competencies and studies will be undermined.

Priorities are necessary to weigh the values of new opportunities as well as the costs of lost opportunities. Setting priorities will be the ultimate responsibility of the program leadership. However, this process should be designed so the participants in the program have a significant role in setting priorities and participate in the decisions about the future directions of LTER activities. Given the multitude of opportunities, the Executive Committees and the LTER Office should establish mechanisms for announcing and sharing potential priorities, for seeking advice, and for providing explanations for decisions about priorities. The proposed 'strategy' for determining priorities for controlling development needs to be carefully managed by the Executive Committee.

The Advisory Board can not set priorities for the LTER program-the program, through the Executive Committee, Coordinating Committee and the Network Office must set these priorities. Among the topics for consideration include: decisions about the relative attention to activities at the individual sites and the network; how much effort should be devoted to regional, national, and international networks; and how much effort should be directed toward education, communication, and outreach. These choices all must be made in the context of retaining a strong, long-term ecological research program while seizing new opportunities as they arise.

In considering these priorities, the Board recommends that the program recognize that LTER is a multifaceted organization, and as such it will need to balance a number of competing demands and opportunities. While maintaining strong, long-term integrated studies in the core areas is undoubtedly the highest priority, the program does not have the luxury of ignoring data sharing responsibilities or the power of the network which is one of the strong contributions of the LTER program. Similarly, the LTER must be constantly in search of new ideas, technologies, partnerships, and collaborations.

The Advisory Board's opinion reflects the apparent views of the program, noting that the top three priorities in order are the following: (a) long-term, integrated, site-specific studies on important ecological processes; (b) conceptualization, representation and sharing of data using a comprehensive, flexible and accessible information system within the LTER community and beyond; and (c) cross-site comparative, integrative and synthetic studies at the site and network levels. These must remain as the driving force and fundamental elements (the core) of LTER which must be protected. However, the questions which are addressed will change as the science develops - this includes exploring different spatial and temporal dimensions, responses to different drivers, and utilizing opportunities provided by technology developments.

Beyond these first three priorities, there are many other opportunities, for example, regional representation of the sites, collaborating with other national and international networks, education and communication, and responding to new initiatives. The program needs to develop a specific priority-setting framework for making these decisions. Illustrative criteria which should/could be applied when considering developments include:

- * Relevance to understanding long-term trends and dynamics;
- * Application to and integration across clusters of sites or to the network as a whole;

- * Addressing emerging ecological questions;
- * Exploring the application of new technologies; and
- * Integrating information across sites and disciplines (expanding spatial, temporal and intellectual scales)

Setting priorities is perhaps the most significant new responsibility of the LTER today. It is a sufficiently important task that the Advisory Board would appreciate the opportunity to review this framework within the next six months.

J. Other Issues

Several other issues arose in discussions with the National Advisory Board. These are not necessarily of lesser importance, but rather are discrete topics that merit attention. The Board is willing to offer comments on these topics in the hope they will be of assistance to the LTER Program.

Collaboration with Other Agencies and Organizations

The increased interest from NGO's, other sites and agencies provide important opportunities to apply the results and the experience of LTER more widely. Given the need to conduct successful core studies and the limited resources, the Board suggests that these activities should be tackled with limited input from LTER scientists. The approach should be one of encouraging input from the interested organization e.g. by placing personnel at the sites or by encouraging access to sites, experiments and data. Although this needs to be carefully managed, the input of effort from outside can reduce the demand on LTER personnel and still result in significant progress in the conduct and application of long term ecological research.

The Role of Technology in Setting the Research Agenda

The issue of LTER Network activities being "research-driven" versus "technology-driven" is an unnecessary dichotomy which represents an incomplete understanding of the integral relationship between the two. The decision to acquire and use any particular technology should be justified by one of two reasons

(a) It has immediate, obvious value for research underway or being planned in that research project management benefits can be identified; e.g., that new, research relevant classes of data can be collected, or that data can be conceptualized, integrated, linked, or accessed more effectively for longer-term network objectives. Some disciplines are data-driven such as microbial ecology where the generation of sequence data and its management obviously requires investment in sequencers and data management technologies in order for the science to progress efficiently.

(b) There are additional uses of technology such as information conceptualization, representation, and analysis technologies (e.g., metadata standards, information models, and standardized network interfaces) that are integral to the horizontal and vertical integration of LTER data for current research objectives and for effective utilization of long term data into the future. Use of information technology in this way does not equate to LTER activities being technology driven, but represents prudent, responsible intellectual investment in maximizing the utility and durability of LTER data sets for use in the future and for use by other research communities.

The greatest strength of the long-term research at LTER sites is its question-driven, intensive site-based nature. It is important to combine long-term experimentation and hypothesis-driven research with monitoring and environmental measurement. The LTER program is embracing the application of new technologies to the study of long-term ecological processes. Examples include the use of hyper-spectral high-resolution satellite imagery to estimate primary productivity, application of eddy covariance techniques to estimate trace gas emissions, use of genetic probes to determine levels of biological diversity, and the application of super-computers to large ecological computational problems. As noted above new techniques give scientists the opportunity to see different things; new observations lead to new questions and new science. The core value of the LTER science is based on testing hypotheses regarding ecological processes and patterns, using the most appropriate methodologies tools available.

Data Management

The relatively recent Network Office investments in human resources, networking connectivity, hardware and software database technologies are on target and commendable. The Network Office should continue to emphasize rigorous scientific management as a network activity and continue to develop the computing architecture for the support, access and exploration of site and cross-site data sets. The Network Office's support of the Data Management Committee and the Data Manager's group should be sustained, and where external funds can be acquired, enhanced to anticipate the role of increasing technology support for the enlarging programmatic vision in such areas as the vertical integration of LTER data (within, across and to external sites) and for areas such as LTER education objectives and in the area of microbial ecology.

Coordination of Measurements

A valuable service which the network office can provide the LTER community is to facilitate or catalyze communication among researchers making comparable or similar measurements. This could take the form of electronic bulletin boards or actual meetings to exchange and compare information on methods used and data gained. While this activity may or may not result in standardization of methods, it should minimally result in enough method comparisons that data taken using different techniques can be normalized.

Standardization

Many large, multi-site, multi-investigator programs have promised to make ecological measurements across a variety of habitats, using standardized methods. This simple plan, a network of standard measurements was not well implemented throughout the IBP or EMAP.

The LTER program, in its infancy, offered the hope of yet another attempt at a network of sites, each implementing a set of standard measurements. Again, this goal seems difficult to obtain. In fact, there are good reasons to believe that for many types of measurements absolute standardization is neither possible nor desirable.

The Board suggests that the LTER program address this problem in an open manner, confronting this continuing problem rather than tacitly ignoring it. Where possible, all sites should use a prescribed set of measurements to insure direct comparability of data. Where this is not possible, e.g, because of problems of scale, attempts should be made to develop ways to normalize or "harmonize" data collected by a variety of means so that the measurements can be directly compared.

Many members of the ecological community still presume that the implementation of standardized measurements, across a variety of habitats, is a trivial exercise. It is important to dispel this myth. It maybe worthwhile to prepare a manuscript describing, from the current LTER experience, the problems attendant to standardization and to document commonly used measurements that can be standardized and those that cannot. Additionally, if harmonization techniques are available, it would be useful to summarize these.

Application of Research from the LTER Program

The strength of the LTER research approach is that well-conceived ecological variables, measured over long time will reveal ecological phenomena that are not obvious in short-term studies. These data may very well provide information of great interest to managers, even though they were not specifically designed for this purpose. Additionally, many sites have been exposed to anthropogenic influences that provide a management context for the long-term observations or the researchers are implementing manipulations that are directly related to management concerns. This set of circumstances preadapts the LTER program to provide data of value to managers, without the program itself being distracted with a specific management goal.

A number of LTER sites have very specific studies that are closely tied to management issues. This research, which has the overall goal of long-term analysis of ecological processes and documentation of the states of communities and ecosystems, has proven very valuable in assisting in the formulation of public policy and in making management decisions. The application of research from the LTER program represents another measure of success, and it is recognized in a community broader than the ecological science community.

New Metrics of Performance

As the LTER program matures, and as the federal government seeks a more quantitative assessments of the returns on expenditures of funds, it will be necessary to develop new metrics for analyzing the performance of the LTER program. It is clear that simply listing publications will not suffice, nor will enumeration of various ways in which the LTER has been asked for advice or participation in other endeavors. The program, under the leadership of the Network Office, must develop measures that assess the impact of the projects. These impacts can be descriptive assessments, although greater quantification will be preferable. Impacts of LTER can be cast in a number of ways, including economic, environmental quality, social or scientific values. Exploring approaches already taken by other agencies (e.g., U.S. Department of Agriculture and the Cooperative Extension Service) may be beneficial.

The Need to Continually Look Outward

There is great power derived from the LTER network, including an array of well-instrumented sites with long-term comparable data sets. In addition, the scientists within the LTER develop an understanding of each other and of each other's science. As a consequence of these characteristics, there is a tendency to focus inwardly on the network and not to look outward into the larger intellectual community. Since the science will benefit from broad participation by researchers in the LTER program and from outside the network, the program needs to guard against the natural tendency of a more-or-less "closed shop."

IV. Future Direction

The goals of the LTER program are to conduct long-term continuous measurements and analyses of ecological patterns and processes. The emphasis here is, and should remain, on "long-term" high quality science. As the LTER program approaches the end of its second decade, results are being brought forward that could come only from continuous study and from integration and synthesis within and among sites. In many instances, ecological processes and the effects of humans on them can be understood only through long-term measurements that address the relationships between the controlling factors and the ecological processes. Such studies require long-term funding and a stable infrastructure.

As noted in the 1993 review, renewal proposals characteristically strive to include new research areas and objectives in addition to continuing long-term study objectives proposed at the outset. There frequently have been insufficient funds to address new research and still maintain the original long-term objectives. The value of long-term high quality science must not be compromised by emphasis on shorter-term studies. Indeed, more effort should be directed toward comparisons and syntheses among LTER sites.

The five core research areas identified to direct research at LTER sites are defined broadly. Nevertheless, there has been a tendency to focus research on ecosystem-level processes and the factors that control them. As programs at LTER sites are evolving and maturing, research is being directed toward a wider range of ecological organization levels and a more complete suite of scientific disciplines. This is strongly encouraged. Experience has demonstrated that ecological processes must be understood at many levels, from molecular, individual, population and community to landscape and global levels. Ecosystem-level responses to management techniques may depend on ecological processes operating at the genetic or population level of organization, for example. Furthermore, inclusion of social sciences (and economics), as is being done at some sites, is essential to provide the understanding necessary to address national resource questions and to develop policy recommendations that will lead to sustainable ecological systems.

Agenda for the Meeting of the
LTER National Advisory Board
December 10-11, 1998
University of New Mexico

Purpose of the Meeting

As stated in the proposal, the National Advisory Board (NAB) will provide regular review and advice to "aid the periodic review needed by NSF, provide guidance on new directions or

interactions and help to publicize the activities and opportunities in the LTER program. The NAB will also provide an independent form of oversight for the Office. The Office will provide logistical arrangements for the NAB meetings which would occur biannually with the first meeting scheduled at the end of the first year of the award. The NAB will provide its independent report to NSF and the LTER/CC."

December 10

8:00-8:30 Welcome/Introductions/Review of agenda/10 Year Review Report
Recommendations from 1993
8:30-9:00 The National Science Foundation's vision for the LTER Network - Mary Clutter
9:00-10:00 Achievements and Status of the LTER Program- Jim Gosz
10:00-10:15 Welcome and Message from UNM administrators
10:15-10:30 Break
10:30-11:00 Science at the Network Level - John Magnuson
11:00-11:20 LTER video
11:20-12:00 Discussion of progress with NAB - Paul Risser
12:00-1:00 Lunch
1:00-1:30 Role of the Network Office - Bob Waide
1:30-2:00 Network Information Management System - Susan Stafford
2:00-2:30 Discussion
2:30-3:00 Break
3:00-3:20 Partnership with SDSC - Peter Arzberger
3:20-3:40 Partnership with OBFS - Jack Stanford
3:40-4:00 Partnership with USDA Forest Service - Doug Ryan
4:00-4:20 LTER International - Gerardo Ceballos
4:20-5:00 Cross-site and regionalization efforts - David Foster
5:00 Discussion until dinner
7:30-8:30 Closed session with Exec Committee and NAB

December 11

8:00-8:40 Visions for the future - Indy Burke
8:40-9:00 Microbial Observatories - John Hobbie
9:00-9:20 Biodiversity Initiatives - Mike Allen
9:20-9:40 Intensive Research Sites - Indy Burke
9:40-10:10 Discussion
10:10-10:25 Break
10:25-11:10 Socioeconomic Outreach/Urban initiative - Charles Redman
11:10-11:40 Educational Outreach - Alan Berkowitz
11:40-12:30 Final discussion
12:30-1:30 Lunch
1:30- Report writing
Dinner and departures

Other Participants

LTERR Executive Committee (Jim Gosz, Indy Burke, Ray Smith, David Foster, Tim Kratz, John Porter (won't attend))

NSF (Mary Clutter, Jim Edwards, Scott Collins)

LTERR Network Office (Bob Waide, John Vande Castle, James Brunt, Patricia Sprott, Chris French, Louise Williams, Carolyn Souther, Richard Dahringer, Colin Johnson)

Susan Stafford (LTERR Data Management Committee)

Alan Berkowitz (LTERR Education Committee)

John Magnuson - North Temperate Lakes LTERR program

Bob Parmenter - Sevilleta LTERR program

John Hobbie - Arctic LTERR program

Mike Allen - Sevilleta LTERR program

Charles Redman - Central Arizona/Phoenix LTERR program

Peter Arzberger (San Diego Supercomputer Center)

Jack Stanford (Organization for Biological Field Stations)

Gerardo Ceballos (LTERR Coordinating Committee)

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