**Charge for the Fourth Decadal Review of the NSF Long-Term Ecological Research Network**

This is the fourth decadal review of the NSF Long-Term Ecological Research Network. Long-term research is essential to understanding many of the ecological processes that shape our environment. The NSF began funding the Long-Term Ecological Research program (LTER) in 1980 to support site-based ecological research over broad temporal and spatial scales. Today the NSF LTER network is comprised of 28 distinct research sites, a network office, and a data management initiative. The disciplinary breadth of LTER research includes population and community ecology, ecosystem science, evolutionary biology, urban ecology, oceanography, and, in some cases, social and economic sciences. The LTER investment across NSF exceeds $30 million annually with most contributions coming from the Directorates of Biological Sciences and Geosciences. In addition to science funding, some sites in remote locations require and receive substantial support for ships and logistics.

LTER research is characterized by the study of ecological phenomena motivated by a strong conceptual framework and in that respect is similar to other ecological programs at NSF. However, three main components differentiate the science conducted through the LTER program. First, the questions addressed required long-term studies to answer. Second, LTER sites are chosen to represent major biomes or ecosystem types. Third, all sites are conceptually united by the requirement that data be collected in five core areas: 1) primary production, 2) population dynamics and food web interactions, 3) organic matter accumulation and decomposition, 4) inorganic inputs and movements of nutrients through soils, groundwater, and surface waters, and 5) disturbances. In addition to data all LTER sites collect in the five core areas, Urban LTER sites must collect data in at least one social, economic, or cultural process, and those data should be integrated with other core data to examine effects of human-environment interactions on urban ecosystem dynamics.

The LTER network incorporate a range of broader impacts both at individual sites and at the network level. The longevity of LTER sites makes them well-suited to develop and maintain relationships with stakeholders, educators, and the public. LTER sites receive support for a “Schoolyard” program and two Research Experience for Undergraduates students each year. The “Schoolyard” program is intended to enable sites to create and sustain activities that engage K-12 students and teachers.

Prior to 2015, the network office was responsible for (1) supporting network-level activities, which included governance and synthesis, and (2) data management, which included repository and methods development. Based on concerns raised in the thirty-year review and infrastructure needs at the network level, these two functions were divided. Network-level priorities that are currently managed by the LTER Network Communications Office (NCO) involve communication and coordination among all LTER sites and the establishment and support of synthesis activities. NSF has worked with the LTER sites and the NCO to streamline data management. This effort culminated in the development and support of the Environmental Data Initiative (EDI), which provides informatics expertise and serves as a repository for LTER data and data from ecological community at large. EDI works closely with the LTER Information Management committee to coordinate data management best practices and stewardship.

LTER Program Summary and Solicitation: <https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=7671>

LTER Network: <https://lternet.edu/>

**Charge:** The charge to the Fourth Decadal LTER Review Committee is to evaluate the significance of the long-term scientific findings and approach to research of the LTER Network over the last decade, and its readiness to support the research of future decades. The evaluation will culminate in a report to NSF assessing the 1) significance of the long-term ecological and environmental science produced by the LTER network over the last decade, and 2) strengths and weaknesses of the LTER network model of supporting long-term, site-based research through renewable funding. Any recommendations that emerge from the review should be developed in the context of an NSF program with stable support, but with the flexibility to make changes. The report will be delivered to the Directorates of Biological Sciences and Geosciences, including the Office of Polar Programs and Division of Ocean Sciences, for review and response.

**Report Guidance:**

The structure and length of the report will be determined by the Committee. The LTER Network will provide the Committee self-study reports for each site and a response to the thirty-review report. The Committee may also choose to visit individual sites, the NCO, EDI headquarters, meet with LTER PIs, and meet with NSF Staff and Program Officers overseeing the Program. In addition, NSF has developed the following overarching questions to guide, *not limit*, the decadal review.

**Research**

1. How well has the LTER network advanced important long-term research objectives and demonstrated a clear need for continuing the current model of long-term site-based research?
2. Could comparable results have been obtained through shorter-term awards to individual investigators through core Programs?
3. The current model for the LTER network requires data collections in at least five “core” areas, intended to characterize the defining structural and functional components of regions or biomes and to facilitate synthetic research. What are the strengths and weaknesses of this model?

**Synthesis**

1. How effective have synthesis activities (cross-site and beyond-site) been in expanding use of long-term data collected at the individual sites and expanding the research capacity of the network?

**Expanding Resources**

1. How effectively has the network addressed the resource challenges discussed in the thirty-year review recommendations?

**Education**

1. How effective has the LTER network been with fostering education and outreach activities that engage diverse communities in science?
2. Does training fostered by the LTER network broaden participation?
3. Are sites equipping the next generation of researchers to innovatively address complex ecological challenges?

**Outreach and Partnerships**

1. To what extent has the long-term data provided by LTER sites been instrumental in informing policy making and resource management?
2. How effectively have partnerships with federal agencies (other than NSF), non-profit organizations, state agencies, or other co-located research efforts provide mutually beneficial leveraging of resources at the LTER sites and expanded the overall research capacity of the LTER network?
3. How have the LTER sites interacted with NSF-funded observatories such as NEON, OOI, NCAR, and CZO in addressing their science objectives? What are the strengths and weaknesses of these interactions?

**Data Management and Ecoinformatics**

1. How do data generated by LTER research meet the recommendations of the FAIR principles (Findable, Accessible, Interoperable, and Reusable -<https://www.nature.com/articles/sdata201618>)?
2. How effective is the network in releasing data through independent repositories such as Environmental Data Initiative, Biological and Chemical Oceanography-Data Management Office and broader data portals such as DataONE?
3. How does the network keep up with or contribute to advances in data management, cyberinfrastructure, computational methods, and data standardization?

**Planning for the next decade**

1. How does ongoing work at LTER sites address past and emerging topics relevant to cross-NSF initiatives or areas of national interest, such as sea level rise, ocean acidification, and climate change?
2. How well prepared is the LTER network to advance ecological science and **meet future disciplinary and interdisciplinary research challenges in ecology, ecosystems science, and other fields of environmental biology?**
3. What are some of the network’s most compelling opportunities and pressing challenges?