

An LTER Network Vision for the Next Generation LTER Network Office

January 21, 2013

In anticipation of an RFP by NSF for a next-generation LTER Network Office (ngLNO), a committee comprised of 13 members from various LTER sites¹ was convened by the LTER Network's Executive Board to envision the suite of functions that the Network would like to see in an ngLNO. The committee met 3 times in Fall 2012 to refine its task, survey the leadership of LTER sites, and deliberate. This report summarizes those deliberations, informed by survey responses from each of the 26 sites. The survey was forward looking rather than evaluative, and allowed sites both to rate the importance of potential activities identified by the committee (based largely but not entirely on existing LNO activities) as well as to provide fresh ideas and input on other potential activities, for which we received substantial input.

Below we discuss the potential functions of an ngLNO. Activities are separated into four main functions that we believe are essential: 1) to facilitate Network-level science synthesis, 2) to provide support for the information management necessary for Network-level science synthesis, 3) to provide communication, outreach, and education coordination, and 4) to provide logistical support for Network-level activities. We address each of these in turn.

In a final section we also discuss alternative organizational models. Although we are intentionally agnostic with respect to the potential organization of an ngLNO and believe that respondents should be left to their own creativity, we believe potential pitfalls are worth noting. We further note the challenge of multiple reporting lines.

1. Synthesis

Cross-site synthesis is a core science activity of the LTER Network for which the ngLNO must be an effective facilitator. High priority ngLNO activities to support and promote synthesis include the organization and funding of cross-site Research Working Groups and coordination of the triennial All Scientists Meeting. The All Scientists Meeting is broadly viewed as important to Network synthesis at many levels, including the initiation and expansion of cross-site activities.

The success of NCEAS and SESYNC suggests these centers as potential models for ngLNO synthesis activities, but with a focus (for LTER) on the synthesis of long-term data and knowledge. Such syntheses should be LTER-centric but should welcome other similar networks (e.g. LTAR, ULTRA, NEON, EFR) and relevant long-term data collection activities (e.g. NERR, field station-based projects). Notably, a model for LTER Network synthesis does not necessarily imply a NCEAS or SESYNC structure. Rather, we encourage creative thought about how to incorporate critical functional elements of these successful centers into a model for the LTER Network. Hosting site scientist rotators in the ngLNO might be one

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element of such a model. A logical extension of this creativity should incorporate knowledge transfer, the informing of societal decision-making, and “knowledge to action” goals.

Network synthesis is tightly coupled to other nGLNO functions. First and most important is a tight coupling of network-level database and information management to future synthesis activities (Section 2, below). This will be a logical next step following the development of the LTER Network Information System (NIS), and should also involve some innovative thinking about how to couple data to broader-scale synthesis. Synthesis should be a dominant driver of information management thinking and activities, and interactions between those involved in synthesis and those involved in information management should be as bi-directional and seamless as possible. A second nGLNO function to which synthesis is coupled is the coordination of logistical support for synthesis activities: meeting planning, workshop support, and other technical logistics (Section 4, below).

It is worth emphasizing that we see the nGLNO as a synthesis facilitator that enables success rather than a synthesis leader. There is broad and explicit support among sites for bottom-up synthesis leadership via the Science Council (and its Executive Board) as guided by the Network’s Strategic Implementation Plan. We would expect respondents to the nGLNO RFP to provide creative ideas for how to best facilitate and strengthen such synthesis. A Science Advisory team comprised of LTER scientists might be one way to provide nGLNO staff with the scientific context and understanding for effectively facilitating synthesis.

2. Information Management

Information management is integral to synthesis and underpins the long-term value of LTER site science at both local and larger scales. Coordinated information management is also crucial for LTER to function as a network, and the nGLNO will play a critical role in helping the Network to achieve its potential in this regard. IM activities that require local knowledge of site data, scientific practice, theory, logistics, culture, and host institution regulations should continue to be conducted at individual LTER sites. This includes most data processing and quality control, as well as synthesis support activities such as scaling and aggregating primary data. Other activities, however, could benefit from a more centralized approach to achieve economies of scale, provided that strong governance structures and accountability mechanisms are in place to ensure that sites have sufficient access and control to meet local as well as Network needs. Four specific types of nGLNO activities are envisioned:

1. *Data Cataloging and Synthesis Support.* We strongly support the continued operation of a Network Information System (NIS) to provide a centralized outlet for site-collected data to facilitate synthesis. Centralized staff should have primary responsibility for implementing and operating the NIS, with ongoing development performed in consultation with LTER scientists and guided by network science goals and research working group needs. Providing assistance to synthesis working groups for organizing and analyzing data and assimilating products into site and network information systems is a high priority for researchers and data managers across all sites. It is therefore critical to have knowledgeable Network Office personnel available to assist with data curation and synthesis and with the development of curation standards, best practice documents, software tools, workflow scripts and other resources to

assist sites and promote cross-site knowledge sharing. Interoperability with DataONE and other repositories and support for retrieving data into analytical frameworks will also be priorities for the ngLNO.

2. Web Presence and Network Databases. We view the maintenance of Network websites and administrative databases such as Network personnel, bibliography, site characteristics, and working group and governance documents as important activities of the ngLNO. Because sites require regular access to these databases to update content and retrieve information for local needs, these databases must also support synchronization via web services. Additionally, hosting websites for working groups and projects will reduce the need for dedicated web development at individual LTER sites.

3. Support to Sites for Network-level Information Management. Neither individual sites nor an ngLNO will have all the expertise necessary to meet every information management need. Everyone benefits from collaborative development and shareable software tools. Many sites have developed specialized tools for site-level data management or data analysis that may prove useful across the Network. The ngLNO should therefore provide a way to evaluate site-based products and then distribute or integrate them into the network system (e.g. via a software registry and review system). This capability will require support for Network information scientists to participate in the broader informatics community through, for example, participating in informatics conferences. It will also require a capacity for sites to be compensated for providing site personnel for Network-level information management activities. Such activities include hardening or adapting local software for broader use, orientating Network personnel to the use of emerging tools, testing software developed by ngLNO personnel, and consulting on the use of community standards. Another example of Network-level support that should be provided by the ngLNO is shared IT infrastructure (possibly arranged through third party vendors) such as servers and offsite data storage for sites and working groups.

4. Technical Consulting and Workforce Training. It is difficult for site IM personnel to keep up with the rapid pace of change in information management and cyberinfrastructure, and it would be helpful for an ngLNO to provide workforce training as well as to facilitate workshops in software and database development for working groups. ngLNO personnel might also investigate new and emerging technologies potentially of use to scientists and the Network, and facilitate partnerships with other informatics centers and vendors to take advantage of synergies and avoid duplication of effort on software development. ngLNO personnel could also train scientists and site information managers in the use and application of new software and hardware. This training should not duplicate training resources available at home institutions, though, and some training could best be facilitated via site-to-site communication.

3. Communication, Outreach, and Education

The LTER Network faces growing challenges in internal communication. It also has an increasingly complex need to communicate research findings to external stakeholders, including federal, state, and local agencies that manage environmental resources and decision makers at all levels including the

public. Education is also integral to the Network's mission, and the ngLNO could help to coordinate and facilitate education activities that include graduate, undergraduate, and K-12 levels. Centralized activities that require coordination by the ngLNO include:

1. Communication. Communication includes exchanging information with Network sites; promoting LTER sites and findings to NSF; and interfacing with other organizations or funding agencies (e.g., USDA, ESA, AIBS, AERC, DataOne) and networks (e.g. NEON, CUAHSI). Activities currently range from internal newsletters to the annual NSF Mini-symposium to targeted discussions with other organizations.

2. Outreach. Outreach includes extending LTER research to external stakeholders. Outreach targeted to two audiences bears particular attention: 1) the scientific community and policy makers to illustrate coherent, exciting network-level science relevant to these groups, and 2) the media, especially at the national level, to promote the value of long-term research conducted by one or many sites.

Particularly needed is a science writer who is continually working to bring new stories to our target audiences using a wide variety of communication tools, and is involved in reaching out to a wide range of stakeholders via the network website, press releases, and social media. This person would take content from scientists and sites and present it in a manner appropriate for different audiences. This is essential for maintaining the quality of information disseminated from the ngLNO on a continuing basis. This person will need to interact closely with scientists at the sites to ensure the most relevant and up-to-date material is presented in a way that a broad audience can understand.

Additionally, a regular presence for the Network is needed in Washington, DC. Not only is the science-policy nexus increasingly important, especially for environmental issues, but LTER science needs to be visible to be useful for policymaking and federal program design. There are a variety of models that could effectively meet this need, some via partnerships, and the ngLNO should carefully consider creative options.

3. Education. Education-related activities could benefit substantially from strong coordination by an ngLNO via a network-level Education Coordinator. This might include 1) the distribution of curriculum materials developed at individual sites to provide K-16 educators and students with classroom, laboratory, and field exercises that use or build on LTER research approaches and findings; 2) access to grade-appropriate datasets for hands-on learning; 3) links to training resources and other appropriate education programs; 4) centralized access to information on REU and graduate programs at individual LTER sites; 5) identification of funding opportunities for education; and 6) coordination of the Schoolyard children's book series, including assisting sites in finding funding to produce and print a book.

The ngLNO could also develop and coordinate a comprehensive program of Massive Open Online Courses (MOOC) on topics relevant to LTER science and especially on cross-site themes. These courses would serve as effective educational tools and would highlight LTER research. A companion series of on-line "TED"-like talks could also be developed to highlight exciting LTER research areas.

4. Logistical Support

The nGLNO will need to perform or coordinate basic logistical activities in support of Network science, governance and other functions outlined above: synthesis, information management, and communication, outreach and education. These activities include organizing and providing logistics for the triennial All Scientists Meeting, for annual Science Council meetings, and for both physical and virtual meetings of the Executive Board and other Network committees such as those for Information Management, Education, and Communication; and providing travel arrangements for various ad hoc meetings that range from workshops and training activities for information management to research working group and synthesis workshops. These activities could be performed by nGLNO staff or contracted out.

5. Organizational and Reporting Structures

We considered briefly the potential organization of an nGLNO. There are advantages and disadvantages to a centralized (single entity) vs. a distributed (multiple entity) office. Advantages of a centralized model might include greater efficiency, lower cost, and more flexibility as functions evolve in the future. Advantages of a distributed model might be the ability to take advantage of special skills and strategic locations and to leverage institutional contributions. Functions that might logically be separated from others in a distributed model include information management, communication and outreach, and logistical support. Provisions would be needed in a distributed model to meet the challenges of communication and coordination.

A second issue facing the nGLNO is reporting structure. The current LNO reports to NSF, to the LTER Network Science Council (through its Executive Board), and to the host institution (through cost-share arrangements and organizational reporting structures). This raises the potential for conflicts. We believe the nGLNO should report directly to the Executive Board of the Science Council, which takes direction from the Science Council according to the LTER Network Bylaws and Strategic Implementation Plan. The most effective path for Network integration, then, might be a model in which NSF communicates its priorities to the chartered leadership of the LTER Network, and the nGLNO is held accountable to Network needs so-established. One possible approach would be to fund the nGLNO with a standard or continuing grant and not with a cooperative agreement, thereby creating the environment for greater flexibility in responding to Network needs.

6. Summary

To meet next-generation LTER science needs the Network envisions a versatile, robust, and responsive nGLNO that:

- 1) facilitates new science synthesis through the organization and funding of cross-site Research Working Groups and the triennial All Scientists Meeting, and as well through a tight coupling between network-level information management and future synthesis activities;

- 2) provides and coordinates network-level information management that includes data cataloging and synthesis support via the Network Information System; a web presence and administrative databases to support critical functions (research working groups; communication, outreach and education; governance and logistics; and local site needs); and technical support to sites for information management and workforce training.
- 3) provides centralized coordination and support for communication, both internal to the Network and outward to NSF and other entities; for outreach to external stakeholders including the scientific community, the public, and the media; and for educational activities related to the Network's strong engagement in graduate, undergraduate, and K-12 education;
- 4) provides or coordinates basic logistical support for Network science, governance, and other functions; and
- 5) is organized in a way that provides for an efficient, flexible, responsive, and forward-thinking entity accountable to the needs of both the Science Council and NSF.