



ECOLOGICAL INFORMATICS

IN LONG TERM

ECOLOGICAL
RESEARCH

Ecology is an information-rich discipline covering vast temporal and spatial scales. Information Managers in the Long Term Ecological Research Network are promoting ecological science at the site, network, and global levels through

bottom-up and research-driven approaches to informatics.

Promoting Ecological Science

Complex issues confronting scientists and policy makers require interdisciplinary collaboration and synthesis at much larger spatial and temporal scales than are typical in traditional ecological studies. LTER information managers see the importance of bringing leading edge capabilities in computing, communications, and information science to benefit and drive advances in ecological science. By recognizing that_

wEcological Information Systems are dynamic, in a continual state of evolution and refinement, and

wEco-Informatics is an area of active research, as well as a discipline that supports ecological research,

LTER Information Managers are preparing to meet the information challenges of the next century.

wNetwork Information System**w**

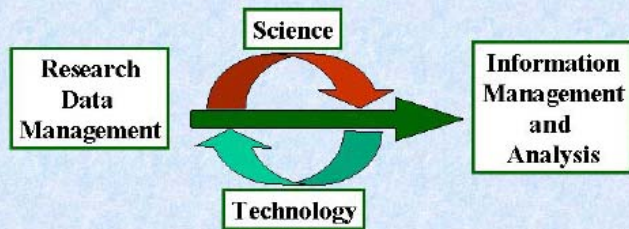
The LTER vision is one of **one-stop shopping** access to ecological data and metadata. Prototypes of a Network Information System (NIS) have been developed that take advantage of contributed mechanics and the latest in web to database connectivity. These include a streamlined data catalog, site description and personnel database, and a network climate database. The next step is to incorporate more ecologically explicit data and metadata into the framework.

Information Systems Designed

Specifically for Ecological Science

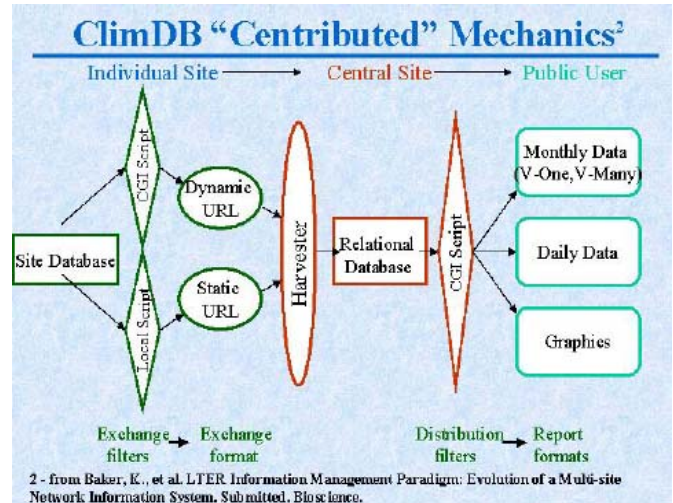
LTER has pioneered the use of "contributed" mechanics which leave the data at the site where it can best be managed while making it accessible through a common interface. These

The Evolution of Eco-Informatics¹



1 - from Stafford, S.G., J.W. Brunt, & W.K. Michener. 1994. Environmental Information Management and Analysis: Ecosystem to Global Scales. Taylor and Francis, Ltd. London.

prototype systems take advantage of the latest in web to database connectivity.



2 - from Baker, K., et al. LTER Information Management Paradigm: Evolution of a Multi-site Network Information System. Submitted. Bioscience.

LTER has recognized that new science and new technology interact to evolve the role of informatics in ecology. Taking advantage of improved tools and computational hardware particularly network technologies where LTER has a history of leadership in the ecological community will help to promote ecological science by fostering the synergy of information systems and scientific research. The challenge is providing integrated access to heterogeneous and distributed information resources needed by ecologists.

Discipline specific working groups form the integrative/interoperability layer in the network information system development. Scientists know data and its uses - Information managers know information science and technology. By forming these integrative working groups bringing together disciplinary specialists with information specialists, strong productive partnerships have been formed to solve real-world issues in ecology.

Distributed Informatics Laboratory

The LTER Network is as a testbed for ecological information management tools and techniques.

• individual sites test different hardware and software approaches

• successful approaches ported to the entire ecological community

This approach is being successfully demonstrated today as LTER approaches are being used at field stations and research sites

Training the Next Generation

In this complex research environment, all scientists need some background in informatics and computational ecology. Synthetic, data intensive projects will be even more common in the future and will require trained information managers who have skills beyond the custodial and archiving functions that data managers have had in the past. Subsequently, the LTER information managers have emerged as a training resource for ecological information management.

wEcological Informatics Institutew

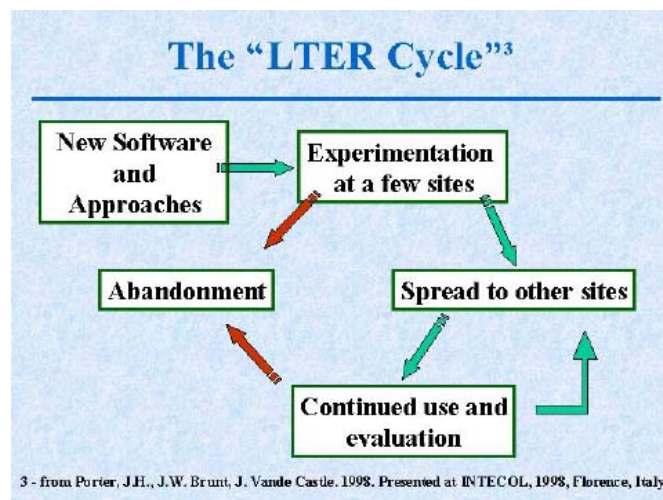
LTER has been training data and information managers for almost two decades. The experiences gained are enabling formalization of a curriculum for next-generation scientists that melds ecology and informatics. Demonstration of the utility of this program is being sought through:

w outreach to biological field stations and marine labs

w forging linkages with international LTER programs

The ultimate objective being to establish an Ecological Informatics Institute in a distributed environment.

around the world.



Community Impact

Data and information management plays an important role at LTER sites. As the demands for network information resources increase, the activities of LTER information managers has focused on network-level issues. The site and network approaches of the LTER information managers are having wide-ranging impacts through:

1. published guidelines for managing research data,
2. published content standards for ecological metadata,

Striking a Balance

Meeting standardized goals employing a variety of site-specific solutions has built strength into the LTER Network because,

the diversity of science and organizational models at LTER sites demands flexible solutions to site information management challenges, and

meeting network-level goals requires a minimum level of homogeneity across sites.

The challenge is to find solutions that are viable and beneficial at both site and network levels. LTER has become a laboratory for the testing of informatics solutions in this setting. For example, software is most often designed to provide business solutions, whether a given package will function as a tool for ecologists is never clear in the beginning. The breadth of expertise and infrastructure in the LTER network has allowed the distributed testing and evaluation of tools for ecologists without the costs of network level implementation.

3. national and international training in data management,

4. participation in standards activities and symposia, and

5. development of the centralized model of data dissemination.

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