THE LTER NETWORK INFORMATION SYSTEM: A FRAMEWORK FOR ECOLOGICAL INFORMATION MANAGEMENT

El Sistema de Informacion LTER Reda: Un Estructura para Manejo de Informacion Ecologica

James W. Brunt

Long Term Ecological Research Network Office, Department of Biology University of New Mexico, Albuquerque, New Mexico, USA
CORE RESEARCH AREAS

• Pattern and control of primary production
• Spatial and temporal distribution of populations selected to represent trophic structure
• Pattern and control of organic matter accumulation in surface layers and sediments
• Patterns of inorganic inputs and movements of nutrients
• Patterns and frequency of site disturbances
Science drives the need for information management

- At the Sites
  - e.g., long-term studies depend on databases to retain project history
- for the Network
  - e.g., communication and integration of data for cross-site projects
“The Americans have need of the telephone, but we do not. We have plenty of messenger boys.”

-- Sir William Preece, chief engineer of the British Post Office, 1876.

1988 Network Information Manager described
1989 Minimum Standard Installation (MSI) Defined
1990 Connectivity Committee formed
1991 Core Data set Catalog published
1992 Metadata content defined
1993 Site data sharing policy described
1994 LTER scientists demand on-line data
1995 Plan for a network information system drafted
1996 Working group for NIS created and charged
1997 First NIS prototype modules developed
LTER Information Managers Committee Goal:

• to promote ecological science by fostering the synergy of informatics and ecological research.
LTER Network Connectivity- 1988-1995

1988 BITNET email
1989 LTERnet Internet-based e-mail forwarding system
1990 Client/Server tools
1991 Gopher servers
1992 WAIS servers
1993 HTTP servers
1994 On-line Data
1995 Web to Database Connectivity
1996 Field site connectivity
1997 First sites connected vBNS (Internet II)
Why do we need a Network Information System?

• Modern Ecology requires increased access to data and metadata distributed across multiple sites for synthesis and integration across broad spatial and temporal scales.
Existing LTERnet System Functions

- Electronic mail forwarding system
- File transfer hub
- Hypertext (Web) server (WWW)
- Database server (ODBC compatible SQL Server)
- Data archive
A major challenge to the U.S. LTER network in the coming decade is the design and implementation of an information system that seamlessly facilitates intersite research.
The Ecological Informatics Challenge

• Can we make information available to ecologists:
  – in ways they can locate the information they need?
  – with information in forms they can readily use?
Philosophy

Develop from a Research Perspective

Corollary

• linked closely to efforts by LTER and collaborating cross-site and synthesis research groups.
Goals of the LTER NIS Effort

- Increase Utility of Existing System
- Increase Access and Query Capabilities on Intersite Data
- Capitalize on Strength in Site Diversity
New Software → Experimentation at a few sites → Spread to other sites → Continued use and evaluation → Abandonment

LTER “Software Cycle”
Desired Access and Query Capabilities

- Locate information anywhere in the network
- Combine and analyze data from different sites
- Answer standard information requests
- Economically build query systems for special projects
NIS Development Strategy

- Build prototypes using a variety of different technologies
- Evaluate prototypes for function and interoperability
- Design a modular framework from the results
What do we mean by “Framework”?

• A set of specifications to guide the NIS development that will assure modularity and interoperability through time.
The key to developing a truly interoperable information system is the development of a flexible metadata model.
Metadata content and structure vs. Level of Use

- Interoperability Level
- Exchange Level
- Personal Use Level

*following Michener et al. 1997*
Metadata interoperability does not start with standards

- scientifically meaningful content
- translated to accepted standards for interoperability
  - Z39.50
  - Dublin Core
  - SDTS
LTER METADATA MODEL V0.01
LTER Personnel Database
Preparation of DTOC Indices

Sites

- DTOC
- Dataset Metadata

Index Server

- Harvest Site DTOCs
- Split DTOCs into individual entries & add HTML titles

- Use WebGlimpse to index DTOC entries
- Use DTOC links to harvest & index all metadata at site
Data Table-of-Contents (DTOC)

• Each site created a simple Data Table of Contents containing their data sets
• Sample DTOC entry
  
  • Bird Species List for the H.J. Andrews Experimental Forest and Upper McKenzie River Basin -- AND
    -- McKee, W. Arthur
    -- biodiversity, bird, species list
    -- SA003

Colored letters have a WWW link back to site metadata
“The main objective of the present and future LTER NIS is to support basic ecological research and science, at both the site and network levels”

--1995 LTER Information Managers Report
Official ILTER Networks
- Brazil
- Canada
- China
- China–Taipei
- Colombia
- Costa Rica
- Czech Republic
- Hungary
- Israel
- Korea
- Mongolia
- Poland
- United Kingdom
- United States
- Uruguay
- Venezuela

LTER Networks in development, awaiting formal recognition from their governments
- Argentina
- Australia
- Egypt
- Ireland
- Japan
- Mexico
- Morocco
- Paraguay
- Portugal
- South Africa
- Spain

Countries expressing interest in developing a network of LTER sites
- Bolivia
- Chile
- Denmark
- Ecuador
- Finland
- France
- Indonesia
- Italy
- Kenya
- Namibia
- Norway
- Panama
- Peru
- Sweden
- Switzerland
- Tanzania
International LTER Network Information Management

Groundwork has been done, but there is a need for continued collaboration and cooperation among international information managers to establish international specifications for data exchange and information interoperability.