Through the Looking Glass: What do we see, What have we learned, What can we share? Information Management at the Shortgrass Steppe Long Term Ecological Research Site

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Abstract

This poster displays the development of a successful information management system at a Long Term Ecological Research (LTER) site that has a rich history of data collection and management. Over sixty years of data from three separate projects are incorporated into the Shortgrass Steppe (SGS) LTER information management system and databases. People with different strengths and expertise ranging from clerical administrator, programmer, to ecologist, have filled the role of Information Manager (IM) at the SGS-LTER. Today the information management needs of the SGS are provided by a team of IMs with various levels of expertise in a wide variety of domains from information technology administration to education and outreach. It is critical for IMs at any long-term research site to understand how information and data were managed in the past and what recent changes have been added to the system, in order to effectively implement a management plan for the future. We are able to evaluate the effectiveness of different approaches to information management and have a commitment to share our successes with the information management community.

Introduction

Data collection methods at the SGS-LTER have evolved from paper field forms and notebooks to automated data loggers and downloadable satellite images. As a result of technological advances in scientific equipment, the stream of incoming information to manage and data to archive has grown in volume and complexity. The community of IMs across the LTER Network and other organizations is able to share what they have learned, as well as continue to develop tools to better manage and synthesize more data and information. As a site, we are able to look back to see how research projects, data collection and management have changed over sixty years.

Figure 3. Systematic approach to involvement of staff, information managers and researchers in all steps from project design to data and information publication

History of Research Programs and IM Tools Used to Manage Project Data and Information (Figure 1)

Central Plains Experimental Range established 1939

➢Data collected in field notebooks on CPER
➢Results and information published in technical reports

International Biome Project established 1968

➢Data from 7 grassland sites synthesized by clerical staff at the Natural Resource Ecology Lab
➢ Data shared between scientists taking an interdisciplinary approach to ecosystem research
➢ Results and information published in technical reports
➢Data archived on hard-copies of standardized field data collection forms and digitally on > 2 dozen 7-track tapes

Shortgrass Steppe LTER Site established 1982

➢SGS researchers and information managers inherited legacy data generated from the IBP from 1969-1978
➢ Researchers and information managers used legacy data to plan new research strategies (Figure 2) and built a flat file database
➢Late 1980s, SGS-LTER integrated a Local Area Network computer environment
➢ In the 1990s, SGS-LTER researchers and programmers developed complex models
➢ SGS-LTER information management system was enhanced by hardware and software capable of mass storage, increased processing power and speed and management of spatial data
➢By the Late 1990s, SGS-LTER utilized new data technology RAID Redundant Array of Inexpensive Disks) and implemented a hierarchical data storage & management design for researchers
➢Data and metadata were archived in an Access RDBMS (relational database management system) and may be downloaded from the SGS-LTER website (sgs.cnr.colostate.edu)
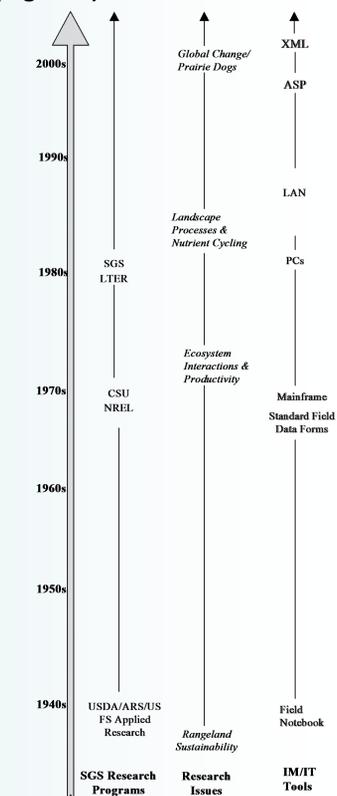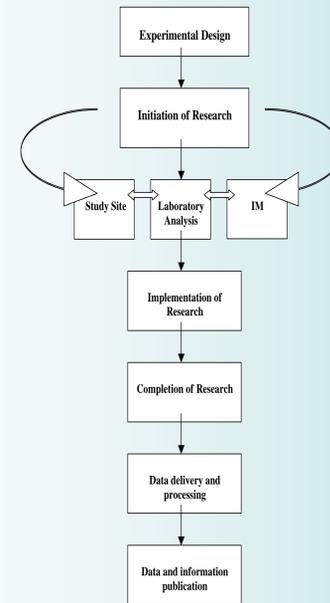

Figure 1. Development of research programs, research issues, and information management and technology tools from 1939 to present.

History of the IM Staff and Their Responsibilities from CPER to LTER

CPER (1939 – present)
➢In 1939 researchers did not think about archiving, sharing or synthesizing their data sets or metadata
➢Staff at CPER are currently transferring historic CPER data from paper to digital format

IBP (1968-1974)
➢Centralized clerical support staff and available facilities at the Natural Resource Ecology Lab
➢Support staff integrated data from 7 satellite research sites in different grassland regions of North America
➢Staff produced a series of technical reports along with a keyword index and 1 volume of abstracts to collate and categorize information from the technical reports in one place

LTER I (1982-1986)
➢Programmers reduced software development costs by creating utilities that can serve several types of data
➢Researchers centralized processing and screening of data in a timely manner
➢Data manager (programmer) and researchers prioritized the safeguarding of data documentation to avoid loss or corruption

LTER II (1986-1990)
➢Support staff became more involved with researchers during data and sample collection, verification, lab processing or data entry, QA/QC, archival, and publication
➢Researchers and IMs formed teams to assure data quality, documentation, and timeliness
➢Programmers and researchers developed models with data collected in the field

LTER III (1990-1996)
➢IM personnel consisted of two programmers with backgrounds in biological sciences
➢Programmers generated and manipulated more complex data in models that predicted environmental factors for cross site studies
➢IM staff became involved in the field and laboratories, and at all steps from project initiation to publication and archival information (Figure 3)

LTER IV (1996-2002)
➢Half time project manager and data manager
➢Data manager designed and implemented a Relational Database Management System to track project metadata and data for the SGS-LTER and ARS
➢ SGS-LTER website was created and data management staff, including students from the CSU School of Business, published project and research information

LTER V (2002-2008)
> Major technological advances such as faster and larger capacity PCs and the internet over the past decade place new demands on IM staff
➢IM staff needs to be proficient in biological sciences, information technology, computer network and database administration, programming and web site development
➢An IM team includes expertise in several areas and works with researchers to meet new challenges presented when applying new IT tools to ecological research (Figure 4)
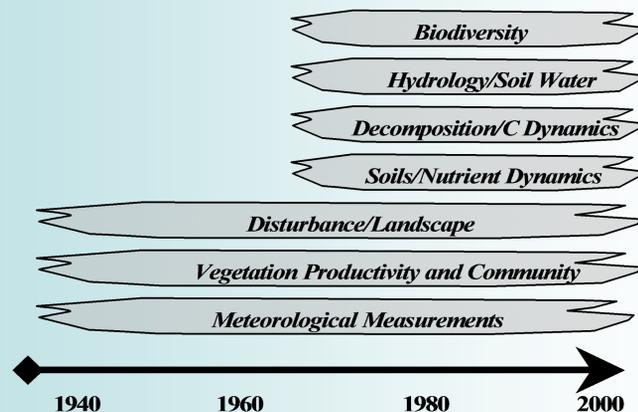

Figure 2. Data sets have been collected from research conducted on the CPER, and during the IBP and LTER programs. Diverse categories of data sets continue to be collected.
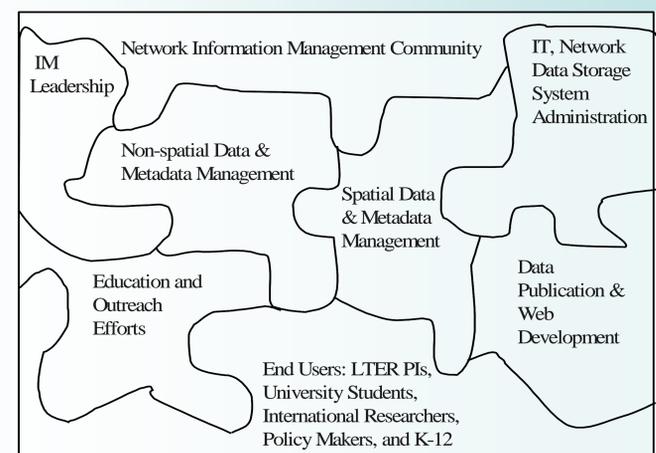

Figure 4. Information Management Team: current and proposed personnel components at SGS-LTER