

## **PALMER LTER INFORMATION MANAGEMENT**

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*Abstract.* Information management for the Palmer Long-Term Ecological Research (LTER) project is based upon a simple, but functional system which fulfills long-term study site requirements that data be accessible, recorded consistently, and archived digitally. Historical functions of the system include both an online bibliography as well as milestone timelines. With the advent of the common gateway interface internet tool, a dynamic data catalog now provides access to online data.

### **INTRODUCTION**

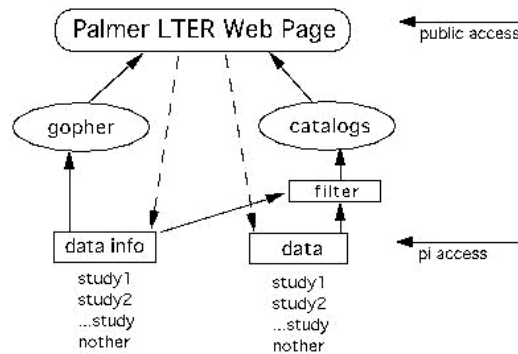
The initial vision of the Long-Term Ecological Research (LTER) network emphasized data management (Michener 1986, Michener et al. 1994). Individual sites have met data management challenges with a variety of approaches (Baker 1996, Benson 1996, Briggs and Su 1994, Ingersoll et al. 1997, Porter 1996, Spycher et al. 1996, Veen et al. 1994). The Palmer LTER, established in the fall of 1990, initiated site data management coordination with the appointment of a data manager in 1992. The Palmer LTER fulfills the data requirements of being a long-term study site by requiring that information be recorded consistently, quality assured, archived digitally, and accessible online (Baker 1996). The advent of the Internet and reliable software plays a critical role since the Palmer participants reside at different home institutions across the country and conduct research in the Antarctic either on station or aboard ship.

Funding limitations have dictated the need for a simple system that takes advantage of technology but minimizes high technology costs. To avoid the need for a central librarian, the responsibility for documentation and data maintenance has been assigned to the data originator. Further, files are kept in unformatted text, avoiding the need for individual users or a data librarian to learn special (mark up) languages. World Wide Web (WWW) use at the network level (Internet.edu) is extended by the Palmer LTER at the local level to coordinate and highlight topics and to preserve a hierarchical data and documentation (metadata) structure initially implemented for a gopher presentation (Figure 1).

Data sets are organized by studies where each study consists of a research cruise or a field season and each data set may consist of one or more data files. Each investigator has an account on the central computer and may access either of the parallel, hierarchical metadata and data directories. It is the responsibility of the individual investigator to document methods and transfer online data sets. Both study and metadata template forms

are maintained online. Once files are uploaded and privileges turned over to the data manager, the files are added to the list of those served through a web browser. Files are maintained and updated by the individual principal investigators.

Figure 1. The hierarchical structure for the database showing both the data sets organized into studies as well as the public and the principal investigator (PI) entry points.



## HISTORICAL DEVELOPMENTS

The data manager provides some group historian functions through creation and maintenance of the bibliography, a vision timeline, and a milestone timeline. The bibliography is maintained with UNIX software (Bibix) which works in conjunction with the nroff/troff text editing system. Key categories include manuscripts in refereed journals, unrefereed papers, reports, abstracts, and talks by LTER investigators or other individuals associated with LTER efforts. Starting in 1995, bibliographic entries included an abstract and were associated with a larger LTER effort (Chinn 1997). Further, a list of works related to the LTER Palmer field site is maintained. A timeline with lists of changes by date was initiated to document shifts in philosophy or methods that affect core research at the site. Originally, the primary objective of the milestone chart was to document the annual data management developments at the site level in context with the network level (Table 1), but major research developments were also included.

As shown in the milestone table (Table 1), an online information system for browsing metadata was implemented in 1992. This structure was suitable for network distribution in 1993 when gopher software became available. Although data were stored in a hierarchical structure parallel to that of the metadata, they remained accessible to all PIs who had individual user computer accounts rather than through the public browse system. An online World Wide Web implementation of this browse system was completed in 1994, first with Mosaic and, subsequently, with Netscape.

Table 1. A data management subset of the milestone history for the Palmer Long-Term Ecological Research site.

***Management Milestones***

1990 lter: new LTER site added (PAL)

1991 lterdm: DM meeting San Antonio, Texas with ESA

lterdm: GIS Working Group report

lterdm: GPS Workshop

paldm: bibliography started

paldm: historical files, weather

paldm: cruise eventlog initiated

1992 lter: new LTER site added (MCM)

lterdm: DM meeting Honolulu, Hawaii with ESA

lterdm: outreach/China

paldm: datamanager designated (K.Baker)

paldm: 600mbyte disk online

paldm: develop dataforms

paldm: online browse of metadata

paldm: first mac ip tunnel

1993 lterdm: DM meeting Madison, Wisconsin with ESA

lterdm: Environmental Information Management & Analysis Symposium

paldm: datamanager becomes PI

paldm: gopher network browse of metadata

paldm: lter data policy drafted

paldm: field documentation facilitated

paldm: field file transfer via satellite explored

1994 lterdm: DM meeting Seattle, Washington OUTREACH

lterdm: coordinated online data table

paldm: McMurdo User Working Group Member 1994-1997

paldm: www implementation (1990 www began; 1992 mosaic; 1994 netscape)

paldm: 2GB disk online

paldm: historical documentation

paldm: station eventlog initiated

1995 lter: televideo cc meeting

lterdm: DM meeting Snowbird, Utah STRATEGIC VISION, NIS

paldm: PAL/MCM: GIS in Limnology and Oceanography, ASLO, Reno, NV

paldm: skeleton notebook/files online, in field

1996 lterdm: ECOINFORMA participation

lterdm: DM meeting Archbold Biological Station, Florida

paldm: PAL/BAS data manager meeting

paldm: data policy rewritten to OPP/NSF criteria

paldm: data catalog created using dynamic web page

paldm: 9GB disk online

paldm: ZIP disk drives used in the field

paldm: field data transfer via LES9 satellite weekly

paldm: member ASA Palmer Working Group on weather

1997 lterdm: DM meeting Univ. of New Mexico

lterdm: ESA/LTER/OBFS Information Workshop

paldm: Member of Data Manager Climate Committee

paldm: Web based forms developed

### *Dynamic data catalog*

A data catalog presentation of the online data sets was implemented in 1996. A dynamic web page (one that runs a program to produce desired content) produces the Palmer catalog upon request from the existing directories of study data sets. Development of dynamic web pages holds many advantages (Wasser 1996), including low cost as well as maintaining the hierarchical study or data set structure for the Palmer LTER. A non-interactive retrieval of documents is performed by a common gateway interface (cgi) script via WWW, gopher, and file transfer protocol (ftp) servers. The study catalog highlights study documentation, metadata, and data (Table 2). Most files are column-delimited ASCII text in order to facilitate transfer, and most graphics are in graphics interchange format (gif). The catalog script gathers tagged lines of the documentation forms for summary as a data catalog organized either by data set or by study.

Several documents for each study are standard: (1) an overview, (2) site maps, (3) a participant list, and (4) an event log chronologically listing the type and location of measurements made during the study. The event log provides an initial cross-index of all component participation for the duration of each study.

Table 2. Subset overview of the dynamic web catalog page.

#### Palmer LTER Catalog by Study

##### Palmer LTER Cruise List -----

91nov PD91-09: Annual cruise [participants] [table] [eventlog] [map]

\* bioacoustics info ( acoCalib.dat acoEvent.dat acoMatchMulti.dat

swarmHdr.dat )

\* bops info ( bopscast.list opticsnoon ts )

\* chl info ( pd9109.chl )

\* chn info ( pd9109.chn )

\* krillgrowth info ( IGR.details IGR.sum adultIGR larvalIGR )

\* nutrientsdi info ( pd9109.nuthplclog pd9109.nuts )

\* pigmhplc info ( pd9109.hplc pd9109.nuthplclog )

\* prprodpi info ( pd9109.pidata pd9109.pifit )

\* trawlgen info ( krill.tl.wwt trawl.catch trawl.list )

\* trawl2m info ( altscatter krill.lfhist krill.raw )

92nov PD92-09: Marine Carbon Cycling [participants] [table] [eventlog] [map]

93aug PD93-07: Spring cruise [participants] [table] [eventlog] [map]

93jan PD93-01: Annual cruise [participants] [table] [eventlog] [map]

93mar NBP93-02: Fall cruise [participants] [table] [eventlog] [map]

94dec PD94-12: SantaClaus cruise [participants] [table] [eventlog] [map]

94jan PD94-01: Annual cruise [participants] [table] [eventlog] [map]

95jan PD95-01: Annual cruise [participants] [table] [eventlog] [map]

96jan PD96-01: Annual cruise [participants] [table] [eventlog] [map]

97jan PD97-01: Annual cruise [participants] [table] [eventlog] [map]

Palmer LTER Season List [map1] [map2] -----

9192pal Palmer Station Season [participants] [eventlog]

\* adbreed info ( broods91 ckcnts91 flwts91 humpop91 repro91 )

\* addemog info ( bands91 census91 seen91 )

\* adforage info ( diet91 fish91 header91 krill91 prey91 )

\* adtelem info ( telem91 telhdr91 )

\* bioacoustics info ( acoBiomass.dat acoEvent.dat )

\* chl info ( 9192pal.chl )

\* chn info ( CHN\_Diel.txt CHN\_STA\_B.txt CHN\_STA\_E.txt CHN\_Sample\_Log.txt)

\* krillgrowth info ( adultIGR adultIGR.details adultIGR.sum larvalIGR

larvallIGR.details larvallIGR.sum )

\* nutrientsdi info ( 9192pal.nuts )

\* pigmhplc info ( 9192pal.hplc )

\* prprodpi info ( 9192pal.pidata 9192pal.pievents 9192pal.pifit )

\* zodtrawl info ( trawl.lis zodtrawl.rec zodtrawlI.dat )

9293pal Palmer Station Season [participants] [eventlog]

9394pal Palmer Station Season [participants] [eventlog]

9495pal Palmer Station Season [participants] [eventlog]

9596pal Palmer Station Season [participants] [eventlog]

9697pal Palmer Station Season [participants] [eventlog]

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## DISCUSSION

The existing Palmer LTER data structure creates a simple and functional system. A forms-driven summary of multiple file transfers would be a useful extension of the currently established catalog system, although browser developments may progress to address such issues. A network catalog across all LTER sites is under development. Under consideration is the interface of existing metadata to national standards as well as the question of archiving a long-term online repository of data. Efforts will continue to facilitate connectivity whether at the local, network or national level.

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