

LTER Information Managers 1997 Annual Meeting Report



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1.0 Executive Summary (S. Stafford (AND) and D. Henshaw (AND))

Information Managers (IM's) from the LTER Network met for a one-day annual business meeting at the University of New Mexico, Albuquerque, New Mexico, on August 7, 1997. An evening mixer, August 6, provided an informal opportunity to meet representatives from the two, new Urban sites of Baltimore and Phoenix (CAP) and to hear reports on the individual site activities (See site flashes in Appendix B). This meeting preceded the 2-day "Data and Information Management in the Ecological Sciences" Workshop (Section 7.0) in which several LTER IM's actively participated by giving presentations and demonstrations.

Eighteen Action Items were listed in the 1996 IM Meeting Executive Summary (<http://www.vcrlter.virginia.edu/nis/im96/im96rept.htm>). It is worth reporting that at least 12 of these 18 action items were accomplished in part or in entirety by LTER IM's. This highly productive year includes continued LTER Network Information System development and a draft of an LTER Data Access Policy. Other accomplishments include surveys of web site development, online data access policies, and site software.

Progress reports were given on the status of current Network Information System (NIS) development including the

site-level Data Table of Contents (DTOC) (Section 3.1) and the Climate Database Project (ClimDB) (Section 3.2). There was significant discussion of an LTER Data Access Policy (Section 4.0) which was debated with Scott Collins (NSF). The meeting concluded with election of new members to DataTask (Section 8.0) and plans for next year's meeting in Baltimore, Maryland (Section 9.0).

2.0 Role of the Network Office in Information Management Efforts (J. Porter (VCR))

During April, 1997, Susan Stafford and John Porter met with NSF Program Officers Scott Collins (Long-Term Studies, Division of Environmental Biology) and Jim Beach (Database Activities Program, Division of Biological Infrastructure) to discuss the proper routing of proposals to support NIS development. Collins and Beach said that proposals for LTER Network NIS development should come from the Network Office, but that the Network Office should not be taking a leadership role in establishing directions for the system - that should come from sites.

At the 1997 Data/Information Managers meeting we discussed the need for developing a model of interaction that benefits both sites and network. This could be done by using a "centributed" approach, where a specialized database at the Network Office would be administered on a site-by-site basis over the network. This approach would be especially important where specialized (and expensive) software are involved. Questions that remained to be resolved were 1) what formal mechanisms we want to use to interact with the Network Office and 2) to what degree we want to tie that interaction to the internal structure of the Data/Information Managers' group.

3.0 Network Information System (NIS) Development

3.1 Data Table of Contents (DTOC) Project

3.1.1 Prototyping Options for All-Site LTER Data Catalog (J. Porter (VCR))

At the 1996 LTER Data Management Workshop we discussed four options for the implementation of all-site data searching capabilities. The options were:

1. Generate table for different types of data with links to sites that have that type of data
2. Use WWW indexing tools
3. Use existing catalog archive (GCMD)
4. Create own catalog archive

We decided we would investigate prototypes of each of these methods. A WWW page was created that facilitated comparison (<http://www.vcrlter.virginia.edu/nis/ccall397.html>) among systems. Specific prototypes were:

1. A table of data types by LTER site (generated by Mike Hartman, NWT)
2. Use WebGlimpse network searching software linked to the data pages for each site (John Porter, VCR)
3. A customized search form for the Global Change Master Directory (GCMD) that would call up LTER Core Datasets already posted in the system (John Porter, VCR)
4. A prototype data catalog input system using the WWW (James Brunt, SEV and John Porter, VCR)

The prototypes were evaluated by data managers at seven sites who then discussed the options via a conference call in

March 1996. The conclusion was that initial efforts should be concentrated on the second option (using WWW searching tools). Several reasons were cited. Option 1 was manually intensive, with few good options for automation. Options 3 and 4 would require duplication of many metadata elements, with one copy at the site and another copy at the catalog archive. It was felt that this would present problems for keeping the two versions updated. Additionally, it was felt that the advantages that options 3 and 4 would present (primarily in the area of structuring searches) might not be needed given the expected volume of LTER Datasets and that the search interfaces for the prototypes were not particularly easy to use.

The selected second option (e.g., using existing WWW search engines) still had some deficiencies. The first was that the WWW data pages for each site often contained links to information that was not data. For example most data pages had links to the personnel directories, to publications and to the main page for the site. These are important links for human users, but it meant that using the data page as a starting point for a WWW search would yield undesirable results. For example, a query on "nitrogen" would return paragraphs from proposals that mentioned "nitrogen," not just metadata that listed "nitrogen." Additionally, the search engine being used for the prototype (WebGlimpse) treated documents as a single index entry. Thus a search on "nitrogen" would return the entire main site data page for most sites, since most sites have at least one dataset title that includes the word "nitrogen."

To remedy these problems, we proposed creating for each site a Data Table of Contents (DTC). The DTC for a site would contain lists of datasets at the site with only WWW links that pointed to the metadata. A draft format for DTC entries was proposed:

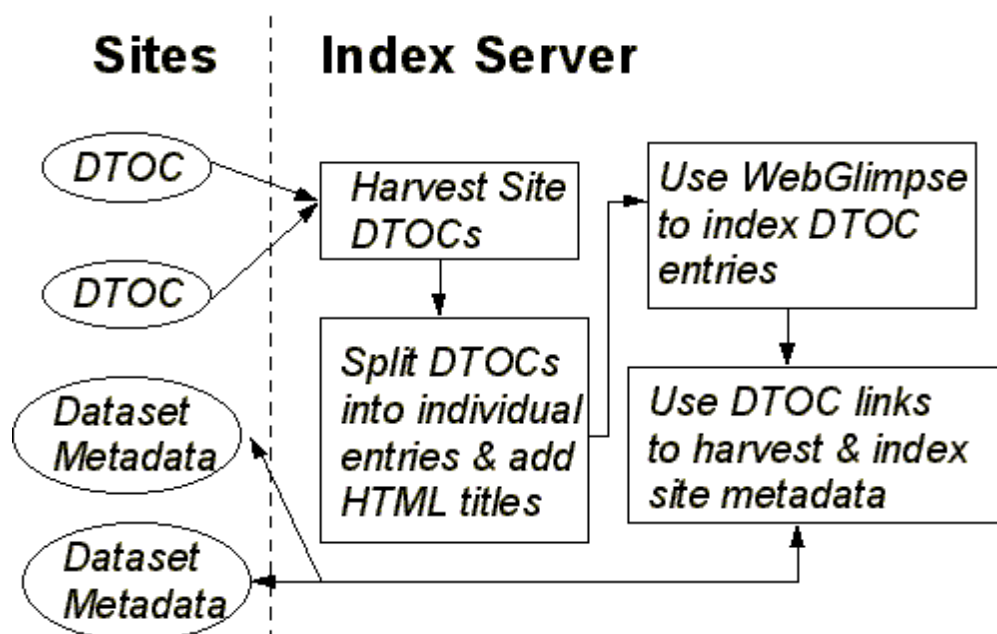
```
<LI><A HREF="http://www.fsl.orst.edu/lter/data/studies/sa003/sa003fmt.htm">
Bird Species List for the H.J.Andrews Experimental Forest and Upper
McKenzie River Basin</A> -- AND
<BR>--<!-- originators -->McKee, W. Arthur
<BR>--<!-- keywords --> biodiversity, bird, species list
<BR>--<!-- datasetid -->SA003
<BR>--<!-- other --> test DTC entry
</LI>
```

The entry would appear on the screen as:

- Bird Species List for the H.J.Andrews Experimental Forest and Upper McKenzie River Basin --AND
- McKee, W. Arthur
- biodiversity, bird, species list
- SA003
- test DTC entry

The proposed format includes HTML comments that make it possible to parse an entry into its components, should that be desired at a later time. The only required elements are the identity of the dataset (title) and the site code.

Existing WWW "fetching" software was used to harvest DTCs directly from the sites. This allowed sites easy maintenance of DTCs, since they reside as local documents on the each site's WWW server. Several sites implemented automated DTC generation so that the DTC for the site is updated whenever metadata at the site is changed. Custom-written software takes the DTC for each site and breaks it up into individual DTC entries for indexing by WebGlimpse. The WebGlimpse indexing software traverses the link provided in the DTC entries back to site metadata so that the search is not constrained just to information in the DTC entries.



Five sites (AND, ARC, NTL, NWT, VCR) created DTOCs prior to the 1997 meeting for use in demonstrating the capabilities of the system. The system currently resides at the Virginia Coast LTER, but it will be moved to the LTER Network Office subsequent to its move to New Mexico in October 1997. It can be accessed at: <http://www.vcrlter.virginia.edu/nis/toclist.html>.

3.1.2 NIS DTOC Development Working Group Report (M.Hartman (NWT))

The next step in the development of the NIS-DTOC prototype will be the inclusion of DTOCs from the remaining sites (as of 8/7/97, only AND, ARC, NTL, NWT, and VCR have created DTOCs). A target date of September 30, 1997, was given for all the sites to provide a DTOC. These can be either static or dynamic HTML pages, but the entries should have the following format:

```

<LI><A HREF="http://www.vcrlter.virginia.edu/where_data_is"> The title of the dataset goes here
</A> -- VCR

<BR>--<!-- originators -->Comma separated list of investigators

<BR>--<!-- keywords -->Comma separated list of keywords

<BR>--<!-- datasetID -->Site-specific dataset ID

<BR>--<!-- other -->Other optional information sites want to add

</LI>

```

Examples can be seen within the current prototype at: <http://www.vcrlter.Virginia.EDU/nis/toclist.html>

In the meantime, different search engines (e.g., Isearch, webcrawler, etc.) should be investigated to determine if they can provide any desired features beyond that of Webglimpse. Different search options should also be looked at, such as a shallow (e.g., DTOC entry) vs. deep (e.g., DTOC entry and Metadata) search, or the ability to search just one or two sites instead of the entire LTER network. The latter option could be particularly useful to those sites that do not currently have search capabilities on their home pages. A conference call is planned to facilitate discussion of these options. Once all of the DTOCs have been provided, user feedback needs to be solicited from the larger community.

Each site should put a link to the search on their WWW homepages, as well as ask any interested parties for their impressions. The goal is to have a working system that can be presented at the CC meeting in October.

If it is well received, future expansion and enhancements can be looked into. An important key to the current prototype is its simplicity and low cost. If it proves useful, but more flexibility and greater features are desired, additional resources might need to be allocated. Regardless, the system will need to be transferred from its current location at the VCR LTER to the Network Office. Our intent is that once it is moved, personnel at the Network Office will be able to dedicate the time necessary to make improvements, and help minimize any increased burden on the individual site Data Managers. An enhancement that has already been discussed is to use keywords instead of free-text searches. One approach to doing this that would avoid the dreaded "standardized" list of words is the development of a keyword thesaurus. The feasibility of this and other approaches could be better determined by compiling and comparing the keywords used by each site in the individual DTOCs.

3.2 Climate Database Project (ClimDB)

3.2.1 ClimDB Report (D. Henshaw (AND))

The primary participants in this project are Don Henshaw (AND), Robin Stubbs and Barbara Benson (NTL), Karen Baker (PAL), Darrell Blodgett (BNZ), and John Porter (VCR). The idea for the project was developed at the 1996 LTER Information Management Meeting at Archbold Field Station. The LTER Network Information System (NIS) has a primary goal of facilitating intersite research, and the ClimDB project is a prototype of one strategy to accommodate the needs of various LTER intersite and synthesis efforts.

The ClimDB prototype was implemented by the North Temperate Lakes (NTL) LTER site. The ClimDB webpage currently resides at NTL (<http://www.limnology.wisc.edu/climdb.html>). Eventually the ClimDB development efforts will be moved to the Network Office.

Objectives:

- Develop a dynamic system for providing current climate data from multiple LTER sites.
- Provide comparable data using distribution report formats.
- Facilitate intersite and synthesis efforts by employing a strategy to link individual site information systems to improve data access.
- Demonstrate a "centributed" approach. This approach allows individual sites to maintain climate data in local information systems while a centralized site continually updates and provides access to all sites' data through a common database.

Background:

- 1986 – LTER Climate Committee develops standards for meteorological measurement. (<http://lternet.edu/im/climate/standard86.htm>)
- 1996 – CLIMDES project creates climate descriptions and monthly summaries for all LTER sites. Monthly summaries are static (1960-1990) with no mechanism for updating. (<http://lternet.edu/im/climate/climdes/>)
- 1996 – XROOTS Climate Workshop recommends two monthly distribution tables, V-One and V-Many (e.g., one variable, many variables) for providing climate data. The notion is that data can be distributed in report formats amenable to user needs independent of the data storage format. The separate table formats were developed to accommodate both spreadsheet (V-One) and database (V-Many) users. (<http://lternet.edu/im/xroots/aclim.htm>)

Specifics:

- Participating sites prepare daily climate data in a standard comma-delimited format.
- Individual sites provide URL address.
- Central site harvests data with command line browser.
- Harvested data is captured into an Oracle database.
- Application programs summarize all data in V-one and V-many monthly report formats.
- A webpage is established for queries by LTER site, weather station, measurement parameter, date, and output format. Daily and monthly data is available.
- A simple quality data flag system is employed: M=missing, E=estimated, Q=questionable, and G or blank=good.
- A metadata database for all weather stations will be developed.

Notes:

A Climate Meeting was held Oct. 2-5, 1997, including 4 members of the Climate Committee, 4 data managers, and 4 representative database users and/or modelers. The ClimDB prototype was demonstrated at this workshop and provided a baseline for discussion, refinement, and further development. Meteorological standards enhancements, the metadata database, a climate glossary, and data quality codes were considered. The Climate meeting has a webpage <http://www.geog.unc.edu/~greenland/CLIMSTAN.html/Default.htm>

The ClimDB paper from the Albuquerque, NM Data and Information Management in the Ecological Sciences workshop is online (<http://www.fsl.orst.edu/lter/pubs/spclrpts/climdbnm.htm>).

3.2.2 ClimDB Working Group Report and Discussion (D. Henshaw (AND), J. Porter (VCR))

ClimDB Future:

- Expand prototype to include all LTER sites by Sept. 30, 1997. Continue to evaluate format and codes during this expansion.
- Develop a metadata database for individual stations. Metadata requirements will be addressed at the October Climate Meeting. See Appendix C for the proposed metadata database schema.
- Move ClimDB prototype to the Network Office
- Establish a standard harvest schedule, probably monthly
- Enhance prototype:
 1. Include complete sets of records (current effort 1991-1995)
 2. Include secondary as well as primary stations
 3. Include graphics
- Expand effort to include non-LTER sites (e.g., OBFS)
- Interface with other search engines (e.g., DAAC, NASA, Park Service)

Discussion:

The real benefit from the ClimDB project could be the extension of this harvesting strategy to other datasets. While the climate data may not be perceived as exciting in itself and would likely not be an attractive NSF proposal, the generic aspects of the project need to be identified. A proactive approach to identify potential datasets that will benefit cross-site efforts may be necessary, although the effort needs to be question-driven to be attractive to the LTER CC. Potential efforts might include the more frequently requested, universal datasets (e.g., species lists, all-site bibliography). Other datasets may not be so universal as climate data and may only include a subset of the sites (e.g., soil data, and streamflow).

The comparability of collected data is also critical. Differences in collection methods, instrumentation, data units, and data aggregation may prevent meaningful comparisons. Standards need to be developed at both the PI and IM levels as

standard requirements vary across these levels. ClimDB has had the advantage of a standards document produced by the LTER Climate Committee in 1986 (<http://lternet.edu/im/climate/standard86.htm>).

There is a need for "tithing", or having people at individual sites put 10% of their time (as a baseline) toward network activities, to accomplish projects such as ClimDB. These projects should also provide some payback to the site. For example, the ClimDB project may save sites having to produce monthly summaries of their meteorological data.

Another lesson learned is to keep structures simple and be willing to compromise. Haggling over structure details was time consuming for ClimDB. Once a structure was picked, the project moved forward quickly. We add to our credibility when we discuss what did not work as well as what did!

4.0 Data Access Policy

4.1 **DRAFT** Data Access Policy for the LTER Network (J. Briggs (KNZ))

- Data managers developed an example of a data user policy in 1990. This set an umbrella policy for the LTER Network under which individual sites would develop site-specific guidelines for data access.
 - At the 1997 Information Management meeting, data managers recommended that the example data policy developed in 1990 be accepted as the official LTER network policy, all LTER sites would implement the policies with the following modifications:
1. **KEEP IT SIMPLE!** The four types of data (from the 1990 policy) accessibility would be collapsed into 2 Types: **Type I** (data that is freely available within 2-3 years) with little or no restrictions and, **Type II** (Exceptional data sets that are available only with written permission from the PI/investigator(s)). Implied in this timetable, is the assumption that some data sets require more effort to get on-line and that no "blanket policy" is going to cover all data sets at all sites. However, each site would pursue getting all of their data on-line in the most expedient fashion possible.
 2. The data managers would like to emphasize that the number of data sets that are assigned TYPE II status should be small and that this should be a rare occurrence. The justification for exceptions must be well documented and approved by the lead PI and site data manager. In addition, it was felt that all data sets created by graduate students at each site, would most likely be by default in the TYPE II status and would not require justification. (Note: It would not be acceptable to have 80% or more of a site's data be TYPE II.)

To alleviate concerns about the possible unethical use of data sets resulting from this policy, the data managers recommend the following actions:

- The LTER network community will actively pursue parallel actions that would alleviate concerns about unethical use of data sets.
- LTER will encourage professional societies (e.g., ESA) to develop a "code of ethics" that scientists/investigators would follow if they use data they have not collected themselves.
- Each site, with possible help from the Network Office, may want to pursue the concept of a Data License that the user agrees to follow when they download data from the WWW; e.g., to make sure that the person downloading the data understands that they do **NOT** own the data, but they are simply using the data as specified in the data license and their signature or email endorsement signifies that they will conduct themselves professionally.
- Funding agencies (NSF, USDA, NASA, etc.) should develop mechanisms that would reward/acknowledge

scientists who put their data on-line, (e.g., specify that a list of data sets that the PI has put on-line from their past funding awards be included as part of the grant applications).

- Funding agencies (especially NSF) must recognize that complying with this policy will place an increased burden on each of the sites' already limiting resources. More resources will need to be allocated to this activity as a long-term commitment.
- "User Be Aware" policies should be pursued and may be part of the license agreements. This warning is not intended as a means to reduce site QA/QC effort as a site, but rather simply imply that if data are rushed to on-line status prematurely before adequate QA/QC, users need to be aware. Also, and equally important, ecological data sets are dynamic and may change over time.
- Sites will be encouraged to continue to place metadata on-line with no access restrictions. Extensive metadata will advertise the existence and wealth of data, and encourage other interested researchers to contact PI/scientists to pursue research opportunities and possibly share publication authorship.

4.2 LTER Online Data Policies (K. Baker (PAL))

The consideration of data policy postings in conjunction with online data posting is on going as LTER data managers and scientists consider methods that support development of online data management given the NSF recent emphasis on release of data within two years. Discussions to date considered issues regarding the posting of data while an overview of how data policies are posted is more recent.

Appendix C shows how some of the issues with respect to the online presentation of data policy have been implemented by LTER sites when data is accessed via the web. The first column of the table shows

sites that do reference a site policy(X), a site pledge(P) or the network policy(N). In fact, the majority do have a site-specific data policy. A few sites give disclaimer information about the data while one specifically calls attention to copyright. A reminder to give acknowledgement for data use is frequently given while in seven of these cases, specific words for grant acknowledgement are provided. The posting location of the information about external use of online data is summarized in the 'location' column. A variety of locations are possible including on the site home web page(0) (but not on the data catalog page), on the data catalog page as a hotlink (1), on the catalog as text (2), on each file as a hotlink (3) or

on each file as text (4). These strategies are numbered in order to emphasize how readily apparent the information is where 0=least apparent and 4=most apparent. The providing of reprints by data users is stated as necessary (X) or optional (O) in some cases. A minority of sites request (N) or require (R) notification from the data user prior to data downloading. Finally, two sites currently mention specific

legal rights with respect to data use. As sites continue to participate in development of the Network Information System and to share development information, this summary table is expected to change.

This summary table is online (<http://www.crseo.ucsb.edu/lter/dm/datauseraccess.97>).

5.0 A Visit with Scott Collins (NSF) (S. Stafford (AND))

Scott Collins, Program Officer in Long-Term Studies from the Biological Sciences Directorate at NSF joined us at the end of our meeting. Scott reiterated that he recognizes and appreciates the efforts of the Information Managers. The IM Committee is one of the most organized groups in the network. He recognized that mandates from NSF are impacting our lives. Scott would like to see IM's more involved in executive-level decisions and have a "voice at the table" at

each of our sites.

With the move to New Mexico, the Network Office has established a different direction. Goals, as stated in the Network Proposal, are "impressive and difficult". It is Scott's view that the Network Information System (NIS) should take pressure off the sites. We discussed the October 1, 1997, 2-year data policy email that "shook the world". Scott saw the concept of a data license toward this end as a good solution. He had no problem with the general idea of a license but did have some concerns about requiring authorship (Note: CDR has a co-authorship requirement for some categories of requested data.)

We discussed the issue of QA/QC and having data on-line with caveats about QA/QC. As IM's, we see potential problems if PIs rush to get data on-line too quickly before adequate QA/QC has been done. But sites don't want to be penalized for delays. Scott felt that 5 years is NOT a reasonable time for QA/QC and is merely an excuse for keeping data unavailable. We discussed ways for the LTER Site Data Management policies (first written in 1990) to be updated with more specifics. Scott could see how some data could be kept longer, but exceptions need to be justified. All of a site's data CANNOT be an exceptional case. We asked if the "within 2 years with a minimum of exceptions" was written in stone? Scott responded by saying that "2 years" is a widely used number. At one point he tried to get the network to choose a number, but there was no real response, so he chose the number. If we can provide solid justification for a different number, he/NSF would consider another number.

What will NSF do if data is not made available? NSF only has two opportunities: 1) renewal and 2) site visits. If things are not progressing, NSF will take steps on their end. NSF would consider withholding continuing increments if necessary but would like to avoid doing so, since it threatens long-term research. NSF would prefer a REASONABLE policy agreed upon by the LTER Network. As a note, NSF as a whole is working on a data policy and will be moving toward a more specific policy. Scott doesn't know details at this point but if NSF's general policy is more lenient than LTER's, then LTER will go with NSF's general data policy.

Are there opportunities for rewards (i.e. 5 good quality, online datasets equal to 5 publications)? The community seems to be moving in this direction as review panels typically LIKE seeing datasets on-line. We asked about putting places on NSF proposal forms for listing the 5 most important/recent datasets the PI put on-line? Scott said it sounded good, but you should also be able to cite people who have used your data. These issues apply to the larger scientific community, not just LTER.

We asked Scott when does a dataset begin and end? He didn't know if he could answer that. But as an example, all the KNZ datasets have the date something began. We could also do it on some sort of field season basis. We just need to make it clear what we are doing.

On the issue of Data Publication, we and NSF want to give PIs more incentive for working up datasets. A better credit mechanism would be helpful. This could include "data citations". NSF would like to see societies get behind this concept. We need to promote the concept that "data are a resource, not a possession". ESA is beginning to take steps in this area and is working on an ethics policy. Scott felt LTER could provide some input to this policy. Scott didn't believe that someone could "scoop" someone and get away with it. We, as Information Managers, also felt that ESA should play a role on an ethics policy. See Section 4.1 for John Briggs's report on a revised Site Data Management Policy.

We asked Scott Collins if there was anything we could do to make his life easier. Scott said that we didn't make his life difficult! He would like to see more Data Managers getting involved from the beginning, as this will help PI's, improve site-science, and reduce time spent on data. The danger is that IMs may get sucked into actually managing data collection and this should be avoided. This should always be a collaborative effort.

We told Scott that we are always interested in what NSF is doing. He mentioned the "KDI (Knowledge and Discovery Initiative) money" and how we could help NSF "define" what this actually means and then write proposals to get some of these dollars. There are no specifics on KDI currently. The deadline will probably be in January 1998. Jim Gosz mentioned that the NET office people (including the IM) will have their salaries partly dependent on their ability to raise funds through proposals. These NET Office positions are all 9-month appointments. Scott asked about the other open NET positions and Jim Gosz mentioned that the position at San Diego Supercomputer Center (SDSC) will not be

at Ph.D. level. Also the systems maintenance position will also not be at the Ph.D. level. There are good opportunities for collaborative proposals and the NET office will be much more aggressive in generating support.

In terms of baseline LTER site budgets, Scott mentioned that NSF is still getting their budgets together. The next round of proposals will be funded at \$700K. We asked about any plans for more augmentation? Scott mentioned that if they can't get the budgets up, they will pursue supplements. There is lots of support in the front office of BIO for the LTER program, but still it is still a challenge to figure out how to get a good response from BIO.

There will be another Science and Technology Center (STC) competition. It will be an open competition and the original group will recompet. What opportunities exist for LTER in this arena is unclear at the present time.

On the LMER competition, Scott is in the process of putting together a panel. He anticipates 2 LMER sites will be converted to LTER sites. The plan is for 2 now (1998) and 2 more in 2000. We asked what would happen if an existing LMER goes into the LTER? Scott said that DEB will make awards for two

LMERs in this competition, regardless of whether existing LMERs are successful.

We asked about program officers on deck for future years. Gus Shaver is currently in the slot for Long-Term Studies rotator slot and will be there for an additional year. Tom Frost and John Keilly are also in Ecology program slots. Probably Frost or a new Ecosystem person will help out with Long-Term Studies Program. Jim Beach, Database Activities Program, will be leaving and moving to USGS Biological Research Division (BRD). A replacement is being worked on "as we speak". Jim Brown, Division Director, in Division of Biological Infrastructure, formerly Biological Instrumentation and Resources (BIR) is retiring in September, 1997. Tom Brady, an incredible supporter of LTER, and former Acting Division Director in DEB, is moving to U.T.-El Paso to become Provost. He will certainly be missed.

6.0 Web site survey for the LTER Network (E. Melendez (LUQ))

Introduction:

In reading the summer 1990 issue of Databits, we learn the LTER data managers were very busy developing database management programming capabilities for their individual sites. The question seemed to be whether to become a Mr. Unix or a Dr. DOS. Our greatest concerns were data acquisition and storage, GIS overlays, making long-term data accessible, and establishing connectivity. By the next issue, the LTERnet had already appeared as one of the principal subjects. The LTER Network office had become the host of centralized lists like the Personnel Directory and Data Catalog. In the summer 1993 issue, we read about the procedures and problems of establishing WAIS and Gopher (predecessors of the World Wide Web (WWW)) at the site level. Currently, we are engaged in the task of building web pages for sharing ecological data and other site information with the world. We are also using web technology to develop a Network Information System for LTER.

Our intention in assessing the development of our web sites serves two purposes: 1) to give an indication of progress in the development process, and 2) as with the software survey, to share general information and identify individual site technical skills and resources available for assisting other sites.

This results of this survey for all LTER web sites is available online (http://sunceer.upr.clu.edu/auto_doc/webdta2b.htm). The actual survey is online as well (http://sunceer.upr.clu.edu/auto_docs/webdevin.htm).

Results:

PLANS TO UPDATE WEB DATA

Nine of the 15 reporting sites plan to or actually update their changing data sets regularly, six of which do it automatically. Three plan to update the data annually and one reported that raw data must be made available. Only two

reported no plans for data update.

PLANS TO ADD MORE DATA TO THE WEB

The types of plans to add more data to the web vary more among the 15 reporting sites than the plans to update the existing data. Only two actually add or plan to add data automatically (both use NTsql data bases). Five reported they will add data in stages or yearly, four will do it when possible, and one will add data as required. Three reported no plans for this action.

USE OF FORMS IN THE WEB

Web forms are very useful tools for the Data Manager. Forms allow researchers to enter information such as publications, abstracts, and reports, and to update lists. They are also suited for a wide variety of other purposes. A summary follows:

- Performing usual data entry and management tasks (9 sites)
- Entering file requests, data documentation, and citations (5 sites)
- Collecting abstracts, methods, and reports (2 sites)
- Retrieving data (2 sites)
- Entering and updating data (1 site)
- Notifying investigators when their data have been downloaded (1 site)
- Interacting with site's databases such as bibliography, personnel, and data sets (1)
- Reporting the use of data (1)
- Collecting general information (1).

MAJOR CHANGES EXPECTED ON THE WEB SITE

The time, effort and utilization of computer resources required to just add and update data on an existing web site is not trivial. Even more resources are needed to make a change in structure, adding searching and database capabilities, or even designing forms to collect information. These are tasks that require further computer programming knowledge. Only four of the reporting sites interactively query a database from a web form, and two of them have more than one person in charge of the creation of the HTML's at the site. Of the eight sites that have sql capabilities on the web, five have more than one person in charge of the creation of HTML's at the site.

Nine of the 15 sites reported plan to do a major change on their web pages. Seven plan to add more searching and/or database capabilities, two reported they will add major amounts of data and metadata, one will link bibliography and data sets, one will add more forms, one is converting an existing Gopher site to a Web site, and the new sites expect to have web pages running by October and November.

EFFECT OF WEB SITES ON NUMBER OF DATA REQUESTS RECEIVED

Only four sites reported on the quantity of requests received during the last five years. One of those sites clearly shows an increase in the number of requests for data that are not automatically downloaded. Another site shows a decrease in such requests. As more and more data is put online, the number of requests handled manually by the data manager should decrease. On the other hand, the number of requests handled automatically by web downloads will likely increase dramatically.

7.0 "Data and Information Management in the Ecological Sciences" Workshop (J. Briggs (KNZ) and B. Benson (NTL))

William Michener (from the Jones Ecological Research Center) gave a brief presentation about the upcoming workshop (August 8-9, 1997), Data and Information Management in the Ecological Sciences, that is co-sponsored by

NSF, OBFS and the Long-Term Studies Section of ESA. Fourteen of the twenty scheduled presentations are associated with LTER sites. In addition, Bill encouraged the data manager group to contribute other manuscripts for publication in the proceedings which will be titled *EcoInformatics Guide to Ecological Research*. Workshop proceedings will be available on the WWW, (<http://www.vcrllter.Virginia.EDU/dimes/>) but there is not enough funding in the grant for producing hard copies. The data managers felt that although having copies of the workshop on the WWW was a good idea, there still exists a need to produce limited hard copies of the proceedings. It is advantageous to have a source which can be cited for these LTER contributions to the field of Information Management. Thus, the data managers recommend to the Network office and especially the Publication Committee that they support the publication of this important document as part of the LTER Network Publication Series. We would encourage and demand if at all possible, that the publication be peer-reviewed by the scientific community.

- LTER network office support is recommended for the publishing of hard copies of the proceedings of the "Data and Information Management in the Ecological Sciences" workshop.

8.0 Election of new DataTask Members (D. Henshaw (AND))

Karen Baker (PAL) and Susan Stafford (AND) will complete their current DataTask term on December 31, 1997. Gil Calabria (CWT) will be leaving the LTER this fall concluding his term as a DataTask member. By a majority vote, (one vote per site in attendance) Susan Stafford (AND) was re-elected, and Darrell Blodgett (BNZ) and Michael Hartman (NWT) were elected to their first 3-year terms. The current DataTask members (with year elected) as of January 1, 1998 are Susan Stafford (AND, 1997), Darrell Blodgett (BNZ, 1997), Michael Hartman (NWT, 1997), Chris Wasser (SGS, 1996), John Porter (VCR, 1996), Don Henshaw (AND, 1995), and Rudolph Nottrott (NET, ex officio).

We want to especially thank Susan Stafford for her leadership role within the Information Managers and for continued involvement in DataTask. Susan has been active within the LTER and active at IM meetings for over 15 years, and deserves much of the credit for the success and high visibility of the IM Committee within LTER. We also wish to thank Karen Baker for her work on DataTask the last three years, and want to wish Gil Calabria and his family the best of luck in future endeavors.

9.0 Plans for Future Meetings (S. Stafford (AND), T. Foresman, and C. Steele)

The plan is to convene the 1998 DM meeting in Baltimore, MD the weekend ahead of the ESA meeting on the campus of University of Maryland, Baltimore County. Tim Foresman and Chris Steele have generously offered to help host this meeting at their site.

Here are two tentative schedules depending upon length of meeting, and if we want to include any formal presentations to NSF or take in a field trip:

Thursday, July 30 Evening Mixer LTER IM (travel day for most)

Friday, July 31 LTER IM Business Meeting

Saturday, August 1 LTER IM Business Meeting

Sunday, August 2 DataTask / Report completion / Writing assignments / Departure/ ESA mixer

M-Th, August 3-7 ESA Meeting, Baltimore, Maryland

Or,

Wednesday, July 29 Evening Mixer LTER IM (travel day for most)

Thursday, July 30 LTER IM Business Meeting

Friday, July 31 LTER IM Business Meeting

Saturday, August 1 Fieldtrip / Tours / NSF briefing(?)

Sunday, August 2 DataTask / Report completion / Writing assignments / Departure/ ESA mixer

M-Th, August 3-7 ESA Meeting, Baltimore, Maryland

Potential initial agenda items offered by Tim Foresman and Chris Steele include:

- How remotely sensed data are obtained, handled, stored, and shared at the sites and in cooperation with the LTER Network Office.
- The role that the Global Change Master Directory may play in the LTERnet.
- Due to the proximity of NSF Headquarters we might consider to arrange program overviews/briefs that folks at NSF might benefit from and vice versa.
- What is the future of web-based mapping for external and internal communications/searches for the LTERnet?
- How do LTER's establish, utilize, and maintain "wired" relationships with local community groups, schools, et cetera?

LTER connections to the San Diego Super Computer Center should be in place later in 1998. San Diego as well as NCEAS should be considered as a potential site for a DataTask planning meeting or a future IM meeting.

APPENDICES

A. List of Participants

(Note: For e-mail, use the usual LTERnet naming scheme, e.g. dhenshaw@LTERnet.edu.)

AND: Don Henshaw

AND: Susan Stafford

ARC: John Helfrich

BNZ: Darrell Blodgett

CDR: Clarence Lehman

CWT: Gil Calabria

HBR: NONE (Site flash provided by John Campbell)

HFR: Rich Lent

JRN: John Anderson

JRN: Ken Ramsey

KBS: NONE

KNZ: John Briggs

LUQ: Eda Melendez

MCM: Denise Steigerwald

NET: Jim Gosz

NET: Rudolf Nottrott

NET: John Vande Castle

NSF: Scott Collins

NTL: Barbara Benson
NTL: Robin Stubbs
NWT: Michael Hartman
PAL: Karen Baker
SEV: NONE (Site flash provided by Gregg MacKeigan)
SGS: Chris Wasser
VCR: John Porter
VCR: David Richardson
BALTIMORE: Christopher Steele
BALTIMORE: Timothy Foresman
PHOENIX (CAP): Peter McCartney

B. 1997 LTER Site Flashes

Andrews Experimental Forest (AND): Don Henshaw, Gody Spycher, and Susan Stafford

We have chosen SQL server on NT to manage an expanded set of information using a redesigned global metadata database. The metadata describe the data objects including spatial data that reside on UNIX, non-spatial data, and publications. We plan to supplement our metadata for non-spatial data using the recommendations of the FLED committee. We have worked with commercial consultants to overhaul our metadata with the following objectives:

- normalization (one fact in one place), prompted by rampant redundancies in our existing metadata, for example in the area of domains, such as location codes, that are shared by multiple databases
- implementation of keyword and location catalogs (missing in our existing system) to support searches by these categories
- inclusion of metadata for spatial data and publications to enable searches for any available data object in a single normalized database

To help us design our new metadata database we have purchased ERwin from Logic Works, Inc. This is a data modeling tool that creates a logical model of the database and builds entity-relationship diagrams. It also provides forward and reverse engineering facilities to most of the common database systems.

We are exploring existing keyword systems (Global Change Master Directory is the current favorite) that may serve our site and the Network to provide ready access to our databases, publications, and personnel. Our initial effort is to update our publication list and make it keyword searchable online. We will also experiment with location hierarchies similar to keywords such that a data search over some geographic unit would also yield objects for its smaller sub-units.

An Andrews team of information managers and scientists have been reorganizing our webpage and the 800+ files it contains to make it easier to use and more attractive. Recently we have increased our efforts to provide content and access for public and land manager users in addition to scientist peers and students, major users of our webpage. We have also established a "Current Weather" webpage that dynamically updates information every hour in the winter for three meteorological stations and two stream gauging stations.

Our Quantitative Sciences Group received a big lift with the hiring of a new Unix Administrator, Terralyn Vandetta. This position had been vacant since last July.

Stafford and Henshaw are invited speakers at an NSF-funded, data management workshop focusing on the needs of member stations of the Organization of Biological Field Stations. See <http://www.vcrlter.virginia.edu/dimes> for online papers and presentations presented.

Arctic Toolik Lake (ARC): Jim Laundre

We continue to add datasets to our on-line database and to make improvements in our web access. Access to the data follows the LTER guidelines for data management. Most of our data management time is spent getting current datasets into the database. However we continue working on getting historical datasets into the database. We also have plans to compile a series of datasets that are more useful for the general public. These would include summaries of production, biomass, physical variables for each of the major system we are studying. These would give students, teachers and others easy access to important long term data from our sites.

The ARC bibliography is now searchable using EveryWare Development Corp's Tango Enterprise for FileMaker. We also plan on adding web database access for key datasets such as climate. Also available from Carl Richards at the University of Minnesota, Duluth are data linked image maps for the Toolik area. These are being developed for a project: Landscape control of Arctic Alaskan food webs, Anne Hershey principle investigator. This project is looking at geomorphic controls on trophic levels in arctic lakes. The URL is <http://www.nrri.umn.edu/nrri/toolik/toolik.html>.

Field season is going well. Camp improvements are progressing. This year fiber optic cable is being laid from Fairbanks to Prudhoe Bay. Once installation is finished computer communication from the field station will be improved. Currently it is not possible to transfer large files over the existing radio/microwave hookup.

This year Jim Laundre was not able to attend the data manager's meeting. Late July and beginning of August is peak field season for the ARC site. John Helfrich attended instead. John has worked at Toolik field site during the 'early years'. He currently works on TEM (Terrestrial Ecosystems Model) project and is very familiar data access and management questions.

Bonanza Creek (BNZ): Darrell Blodgett

MSQL 2.0 has been adopted as the relational database management system at the Bonanza Creek LTER.

Our first task was to move the site bibliography from a stand-alone procite database to a MSQL table, making our bibliography accessible via the World Wide Web(WWW). A simple search mechanism was provided, as well as a single output format. In the future we hope to : 1)enhance the existing code, 2)create an advanced searching module, and 3)provide for more output formats.

We have established MSQL tables for site descriptions, project descriptions, dataset descriptions and personnel information and created W3-MSQL scripts for viewing, entering and modifying these tables via the WWW. Additions and modifications to records are made by end users, which write to a temporary database. The data manager reviews the temporary records, and then submits them to the main Bonanza Creek database, and removes them from the temporary database.

The database allows us to link people to their publications, projects and datasets in a much more efficient manner that was previously possible.

We brought a new WWW server online to host the database, which will soon be accessible at <http://www.lter.uaf.edu>. (currently accessible at <http://bonanza.lter.uaf.edu>). Hydrology datasets from the Caribou Poker Research Watershed (CPCRW) are new on this server. The metadata for these datasets was entered into their corresponding MSQL tables entirely via the web.

Within the last two weeks, our university changed their domain name from alaska.edu to uaf.edu. This created some problems for us as we fall under their domain. We will be changing our hosts, and email addresses over to the new domain name: lter.uaf.edu in the near future, though the old addresses should work for another few months.

Cedar Creek (CDR): Clarence Lehman, Charles Bristow

This year has been a smooth continuation of the last, with us adapting and polishing things introduced earlier, rather than creating completely new software. We did create a new format for all of our data, which is the format we have used on the Web, and we did completely rewrite our program to download data from the hand-held field computers, but largely we simply perfected what we already had. This year we greatly expanded our web site with the help of

talented student programmers Angela Moshier and Erin Bartlett. At the same time, Trung Nguyen, our faithful Unix guru who had been with us part-time for some years, finished his Ph.D. in computer science and moved on, leaving something of a hole in our Unix system coverage.

One of our formerly unsung strengths has been a very substantial insect collection and corresponding data base, built and maintained by John Haarstad. This year new relationships among insect body size, abundance, and diversity were uncovered in these data, which are said to represent the most thoroughly sampled ecological community to date (Siemann, Tilman and Haarstad, *Nature* 380:704-706).

The large biodiversity experiments we started in 1994 continue to yield results, and fortunately seem to require less manual maintenance (weeding) than in previous years. Connections between biodiversity and resistance to disease and resistance to invasions have become evident. Moreover, using our central Sun computer for simulations, we have examined theoretically why these biodiversity experiments should yield some of the results they do. That is, why higher ecosystem diversity can be expected to result in greater productivity and lower nutrient leaching (Tilman, Lehman, and Thomson, *Proc. Natl. Acad. Sci.* 94:1857-1861).

One of our earliest projects led to an unexpected finding related to global change that could only have been discovered through long-term study. Nitrogen deposited on land from air pollution---through agriculture and the burning of fossil fuels---has been hypothesized to allow increased storage of carbon by native ecosystems, thereby reducing concentrations of the greenhouse gas carbon dioxide in the atmosphere. Unfortunately, the very nitrogen pollution that can increase carbon storage leads to the extermination of those plant species---in our case native prairie species---that are best at carbon storage, thus reducing or eliminating any hypothesized benefit of nitrogen pollution (Wedin and Tilman, *Science* 274:1720-1723).

This summer we established a large-scale project specifically to study three major components of global change -- elevated carbon dioxide, elevated nitrogen, and reduced species diversity -- how they interact and how they might affect ecosystem functioning. It is planted, growing, and will begin formal operation next spring. This project is supported on the TECO program by DOE, with Peter Reich being the lead PI from the Cedar Creek LTER group.

This fall we will be replacing our weather station, with the intent of getting more timely weather data into our database. Currently, these data are collected by the meteorology department at this University, then transferred to us. Limited resources at their end slows this process down. We are setting up a direct link from the new weather station to a computer at the field station, with, we expect, automatic uploading to our web page.

Finally, we just finished our site review, which appears to have been successful.

Coweeta (CWT): Gil Calabria

IMS REDESIGN

In the past few years the Coweeta Information Management System (IMS) has been using SAS as its data archival and QA/QC engine. This system has proven to be very successful. However it lacks some of the capabilities of a relational information system. Hence during this past year, our personnel have been redesigning and implementing a new IMS based on the mSQL engine.

We have concentrated our efforts in two related projects: creating mSQL tables for (1) a structured data set warehouse, and (2) a new bibliography database. We are currently in the process of populating these relational tables. Like other LTER sites, we are also building a Web-centric front-end for our new IMS. In our case, we are taking advantage of a Perl-to-mSQL gateway to create web pages on-the-fly. We chose this strategy to take advantage of Perl's date manipulation functions, and to control how information is disseminated.

We still have quite a bit of work ahead of us, but we are excited that we have finally found tools which give us all the benefits of SQL, without the unnecessary complexity of commercial products (i.e., OpenIngres).

GIS EFFORTS

During the past year we have entered into an agreement with the University of Georgia School of Forest Resources, Department of Geography, and Information Office to cooperatively operate and maintain our Geographic Information System (GIS). This agreement has enabled an increase in our hardware and software capabilities, while significantly reducing our operation costs.

Following the leadership of Co-PI, Paul Bolstad, and due to the close integration of our Land-Use Change, Socio Economic, and Terrestrial Ecology Projects, several GIS layers and maps have been created to help us move from our traditional watershed scale to a broader landscape level.

One product has been the development of striking maps which show that the largest movement of land between cover classes (agricultural, forested, and open/cleared) in Macon County, NC from the 1950's to the 1990's was from agricultural to forested. In addition, two years of intense carbon flux pools data collection coupled with digitized maps of land cover have yielded relationships for the effect of slope position, aspect, temperature, and seasonal morphology on foliage, woody, soil, and litter carbon fluxes. Hence, we are excited about the development of a first generation carbon model.

NETWORK IMPROVEMENTS

Since April of last year, we have been enjoying a 56Kb leased line at our field station. This single connectivity improvement has dramatically facilitated the link between Coweeta and UGA research. Besides the obvious logistic improvements, it has considerably shortened the cycle from data collection to data archival. For instance, it has allowed us to develop web pages that create SAS programs on-the-fly to summarize, graph, check, and archive new data sets -- all with the ease of "clicking" a few buttons.

HURRICANE OPAL

In October 1995, Hurricane Opal destroyed the overstory of one of our monitoring slopes. Though our initial reaction was of frustration, project scientists were soon relieved to know that areas upslope from both the treatment and hurricane impacted slopes were intact and functioning as control locations. Soil lysimeter, microclimate, decomposition, sulfur dynamics, and other variable collections were continued and provided a rare opportunity of both hurricane and treatment comparisons, complete with two years of pre-disturbance data.

PEOPLE

On our team front, Theodore Gragson (Co-PI and Anthropologist at the University of Georgia), has been brought on board to study and understand the motivation for and values of people's land use. Population studies include both people native to the Southern Appalachians as well as those that constitute the large influx of new permanent as well as seasonal residents of the Southern Appalachians. Gregory Arthaud, former Co-PI with the socio-economic group, has left the University of Georgia to take an academic position at Yale University.

After eight years as the Coweeta's Information Manager, Gildo (Gil) Calabria has accepted a Systems Analyst position with BellSouth Information System. Gil will leave his duties on October 31st. Gil has given us over three months notice, and we hope this will give us enough time for some overlap between Gil and his replacement.

We would very much appreciate the help from this group in helping us find a good replacement.

Harvard Forest (HFR): Richard Lent

The Harvard Forest Web site (<http://LTERnet.edu/hfr>) has been extensively reorganized and expanded during the past year. The number of HFR on-line datasets has grown from zero prior to July 1995 (inception of our Web site) to over 100 currently. Datasets are provided on-line as ASCII files, managed via HTML pages, and organized by research topic. Topics currently include: Forest Ecology and Dynamics; Forest Ecosystem Structure and Process; Net CO₂ Exchange in Forests; Experimental Manipulations; Regionalization Studies and Modeling; Software Development; Comparative Studies Across LTER Sites; Species Lists; Weather Data; and Related Experiments at Harvard Forest

(collaboration with the National Institute for Global Environmental Change). Currently under development is a keyworded, searchable dataset catalog that will be maintained in MiniSQL. This will serve as our dataset "table of contents" and will allow users to find datasets that meet a specific set of criteria. The catalog will be queried via a Web page form interface to the MSQl server. We are also in the process of standardizing our metadata requirements for all datasets, which are distributed across several Internet servers and local computers. In addition, we are expanding our project management and tracking system as it relates to production, documentation, and delivery of datasets. We are upgrading our computer workstations to the Windows 95 operating system, a major benefit of which is the ability to perform peer-to-peer networking, with high-speed file transfer and backup, among our local users at the field station.

In addition to on-line research datasets and our data management policy and procedures, the Harvard Forest Web site now provides much additional information about our field station, research programs, and educational activities. This includes an introduction to the Forest with a detailed personnel directory and clickable image maps that provide text and graphics about the physical layout and major experimental sites; descriptions of our varied educational programs and opportunities for students; guidelines and application materials for prospective researchers; the background, rationale, and design of the HFR LTER program; comprehensive bibliographies of HFR research publications; descriptions and schedules of the Fisher Museum of Forestry and other Harvard University museums; annual reports, ecology symposium proceedings, and other on-line documents; and links to Web servers of other related institutions. The Harvard Forest Web site played an important role in providing information, documents, and logistical details to the LTER review team during our site review in June. A password-protected section of our Web site was established to assist authors and editors in the process of outlining and writing the Harvard Forest LTER synthesis volume. Internet and WWW technology will continue to be a significant facilitator of ecological synthesis.

Harvard Forest is the steward of an extraordinary temporal and spatial database of research in forest biology dating to 1903. Because of this unique scientific heritage, combining traditional scientific record-keeping and modern digital technology, we have taken an unusually broad view of data management. The newly-rennovated Harvard Forest Archives facility is the focal point of our data management and information system. Work is proceeding to integrate data management in this and other facilities through multiple searchable databases. These include a full index of the research files stored in the Archives, library and reprint collections, map catalog, and sample archive in addition to our datasets currently available over the Internet. Historical datasets in the Archives exist in a diversity of media: paper research files, original handwritten field notes, publications, research proposals, student papers and theses, maps, photographs, slides, correspondence, deeds, etc. Because much of this material is irreplaceable, we are planning a program of archival backup onto new media. Some of the options being considered include photocopying, microfilming, and scanning. Of these options, scanning would allow the resulting digital images to be cataloged into a searchable database with keywords stored on CD-ROM. Users of the CD-ROM database, which could also be provided over the Internet, would then search for and print out archival materials. The original archival materials would be moved to an off-site storage location, with the CD database forming the active working copy. A database of samples stored in the new sample archive facility is also being designed. These databases are linked to the original research files in the Archives and to a master project database by means of a common project access code. The sample archive database will serve both as a catalog of samples stored on shelves and as a record of any subsampling that is performed.

Data management at Harvard Forest will continue to focus on electronic cataloging of historical archival materials and the migration of data stored on traditional media into machine-readable formats. We will increasingly integrate the datasets produced by research projects with physical samples stored in the Archives and with spatially-explicit databases stored on geographical information systems. This will enable users to view datasets organized by their spatial location in the field in addition to the current organization by project or research topic. Our Web site will also become more dynamic, with the ability to interactively query and visualize remote databases maintained on SQL servers, in addition to the current method of retrieving ASCII data files.

Hubbard Brook (HBR): John Campbell

Much of our recent database management efforts have focused on the creation of a web page for HBR. At the annual Hubbard Brook cooperators meeting, an Information Oversight Committee (IOC) was formed to organize several existing independent web pages and to establish communication among the cooperators. The IOC also decided that an

"umbrella page" would be developed to serve as an official gateway to all editorially-approved homepages within the HBES. The newly created web page is nearing completion, and the address will be made available upon the approval of the IOC. Previous methods for obtaining on-line Hubbard Brook data have been discontinued as a result of changes in technology. These methods included the Source of the Brook "direct dial" system (disconnected in January 1997) and the Hubbard Brook gopher site (disconnected in June 1997).

Web page development has been conducted remotely on a server at the University of New Hampshire. However, we are currently in the process of getting a UNIX-based server installed in the USDA Forest Service building in Durham, NH as part of a new Forest Service-wide contract with IBM. As a result of this contract, use of the current Data General system will be discontinued and all existing HBR data will be put into an Oracle database on the new IBM system. In addition, all existing QA/QC programs that were run on the DG were converted to a PC environment.

In June of 1997, John Campbell was hired by the USDA Forest Service to fill the Data Manager position at HBR. Since this position has been vacant for two years, a priority was to update existing data sets. Work progresses with our spatial database which currently consists of 20 GIS coverages, with corresponding metadata, that can be viewed and downloaded through the new web site. The Hubbard Brook bibliography was also updated and put on-line and we are currently in the process of making this a searchable list. In addition, samples that had been accumulating in our archive building were bar-coded and added to the database. This database can be accessed with a search engine on the web using keywords.

Jornada (JRN): John Anderson

Ken Ramsey joined the Jornada LTER as Data Manager in May 1997. His experience with and knowledge of hardware and software is greatly appreciated in the continuing effort to provide project support to staff and researchers.

We switched to a new server in November 1996. This is a 166 MHz Compaq ProLiant 1500R with dual processors, 164 Mb RAM and 16 Gb on Hot Plug-able Fast Wide SCSI-2 drives. We are currently running Novell NetWare 4.10 but will be upgrading to Novell Intranetware this fall. Backup of server and workstations is made using an Exabyte EXB-10h tape library which utilizes 10 8mm magnetic tapes (160 meter) . Each holds 7 to 14 Gb depending on compression rate. Cheyenne's ArcServe is used to fully automate backup jobs of file server and workstations.

The Jornada successfully endured the rigors of an NSF site review team, July 14-15, as we reached the midpoint of our current LTERIII funding cycle. Very positive comments were made on our information management system including our data tracking system and metadata documentation.

Efforts continue to expand online data and metadata on our web site with significant additions expected this fall and winter with the reduction of demands of summer researchers.

In 1995, Agricultural Research Service scientists mounted a periodic series of remote sensing campaigns designed to link point scale studies to large area processes and to evaluate the energy and water fluxes active on the Chihuahuan desert at the Jornada Experimental Range. This project (titled the JORNada Experiment, or JORNEX) focused on black grama dominated grassland, mesquite duneland, and the transitional zone between these two types. During five campaigns over two years, conventional vegetation and micrometeorological measurements supplemented ground-, airborne- and satellite-based remote sensing measurements for algorithms for development of landscape scale energy flux models.

In 1996, at the NASA/LTER Sun Photometer Workshop, the Jornada LTER in cooperation with the USDA ARS Jornada Experimental Range offered to support NASA's effort to validate EOS, based on the JORNEX instrumentation in place, existing ARS and LTER ground measurements and planned AVIRIS and TIMS flights. A joint meeting was held in January 1997. An intensive data collection effort was conducted collaboratively among 20 agencies including Jornada LTER, Sevilleta LTER, USDA-ARS, MODIS, MISR, and ASTER personnel in May 1997. AVIRIS and Landsat TM data were acquired at both the Sevilleta and Jornada in May and TIMS was acquired at both sites in June. This intensive campaign was titled PROtype Validation Exercise, or PROVE. Further campaigns are planned through 1998.

Acronyms used: EOS: Earth Observing Satellite; MODIS Group at NASA and sensor: MODerate-resolution Imaging Spectral radiometer; MISR Group at NASA and sensor: Multi-angle Imaging

Spectral radiometer; ASTER Group at NASA. and sensor: Advanced Spaceborne Thermal Emission Reflection radiometer; AVIRIS Sensor: Airborne Visible Infrared Imaging Spectrometer; TIMS Sensor: Thermal Infrared Multispectral scanner; TM: thematic mapper sensor (on LANDSAT 5).

Konza Prairie (KNZ): John Briggs

We continue to use the WWW (<http://climate.konza.ksu.edu>) as a outlet for the data files of the Konza Prairie LTER program. Our policy is to have the files on-line as soon as possible and hopefully within two years of data collection and after quality control. At present 85% of the Konza Prairie LTER data sets (1982-95) are on-line. The exceptions to this include the remote sensing data, which are limited in their WWW distribution by copyright laws. Most of our data files are collected on a calendar-basis (Jan-Dec) and the most heavily requested files (based upon past years requests) are on-line within 6 months. These files included the Konza Prairie burn history, weather information, aboveground biomass, soil moisture and the list of publications from the Konza Prairie research program. Based on ten years of data requests from non-Konza Prairie LTER researchers, these data sets represent 95% of all requests. Thus, these data are placed on-line as soon as possible.

This past year we developed a "point and click" interface for exploring the burn history of Konza Prairie. If this method of interface proves to be useful to our scientists, we will expand its application to remainder of our data sets. We are also requesting that users of our data provide us with information via an on-line form. Hopefully, this will encourage more users of our data to acknowledge the Konza Prairie LTER program. We also use the WWW as a communication tool for our scientists. Minutes of the LTER CC meeting are now placed on our server and abstracts and figures from our annual Konza LTER workshop are distributed over the WWW (<http://climate.konza.ksu.edu/general/workshop96/workshop96.html>). As in past years, we place the minutes from our bi-weekly meetings on-line as well. Efforts planned for the next year is to use the WWW as a front-end for the use of our spatial (GIS files) data bases. New software through ESRI should allow us to accomplish this task. In addition, we will explore the possibility of using SQL with our WWW, as it is obvious many scientists want summaries of data sets, not the complete raw data set.

We have recently received word that funding has been secured for the establishment of a T1 line to our field site. This increased communication link plus the addition of a new computer lab at our field site, will provide visiting investigators complete access to their home institutions.

Luquillo (LUQ): Eda C. Melendez , Robert B. Waide, and John Thomlinson

The Luquillo LTER, in its 9th year of operation, continues to focus on the goal of integrating studies of the effects of disturbance on the physical environment and the response of the biota to these effects. The Luquillo program continues to demonstrate high productivity, with over 247 peer-reviewed publications, three books, and five special features in journals resulting from our research. In addition, 17 students have received doctorates and 23 have received Master's degrees for studies associated with the LTER program.

The 41 scientists who contribute to the Luquillo LTER continue to share a common research theme and to demonstrate a high degree of interactive inquiry. We have recently initiated investigations on the functional role of biodiversity in our system and the ecology of vectors of emerging diseases. Through three grants from NASA we have been able to extend LTER studies of land use and the effect of disturbance on ecosystem processes to other areas in Puerto Rico. All of these initiatives have been aided greatly by a strong group of undergraduate and graduate students.

Physical facilities available to the LTER program will undergo a major expansion in the next few years. With funding from NSF, we will acquire a system for voice and data transmission that will provide e-mail and internet services to the El Verde Field Station. We will also construct living quarters for 18 researchers at the field site. In addition, the University of Puerto Rico is in the process of purchasing a building near the Luquillo Experimental Forest to provide office and housing space for LTER investigators. New offices for the Institute for Tropical Ecosystem Studies are scheduled for completion on the Rio Piedras campus in 2002.

ITES Bytes - SPATIAL DATA:

Our most impressive achievement so far this year was coming up with a catchy name for our lab: Spatial Analysis Training Laboratory of the Institute for Tropical Ecosystem Studies (SATLITES por sus siglas en ingles). Another milestone was the submission of a purchase order (in process) for a new Sun SPARC station (an Ultra 2) which will make our UNIX-based processing much more efficient. Sunceer will remain primarily for our www page and email. We have also purchased three new Pentium 200s, a Trimble Pro-XR GPS receiver and a fairly high-dollar laptop to take in the field with it, and we have ordered a Hewlett-Packard rollfeed 755CM inkjet plotter to replace our aged Calcomp pen plotter. In terms of software, we are in the process of adding five licences each of PC-Imagine for image processing and ArcView for GIS work.

We have actually done a little research too, including studies on the use of fractals to determine landscape patterns and land-use change, patterns of reforestation, and yet another attempt to classify forest types at Luquillo. Two masters theses have been completed (LAI from remotely sensed data and soil erosion in the Lake Carraizo watershed), as have three senior theses (soil erosion in one of the tributaries of the Rio La Plata, identification of serpentinite geology through remotely sensed data, and spectral unmixing of satellite image pixels).

We continue to seek new (and improved) imagery of the island, currently pursuing some existing multiband thermal and airborne TM simulator data. At UPR-Mayaguez they have added capabilities for capturing AVHRR imagery, and they are erecting an antenna to acquire data from Landsat-7 after its launch next year. This should considerably improve the capabilities of our lab to study the LEF remotely.

DATA MANAGEMENT

The DM department was entirely devoted to the revision and update of the LUQ LTER Web Page for the purpose of meeting, at least, the minimum requirements to be prepared for the site review that was successfully held last June 6. We changed structure and added around 30 data sets.

During the last 7 months we contacted the local vendors to get quotations for the establishment of the El Verde Field Station communications facilities, without much success. Finally, the existence of a project of the University with one of the new local companies in the communications business made it possible for us to receive a quotation and some preliminary engineering tests will be performed during the month of august.

McMurdo Dry Valley (MCM): Denise Steigerwald and Ken McGwire

The McMurdo site review occurred in January, with the review team visiting the McMurdo Dry Valleys field site. On their way to the field site, Dr. McGwire presented a review of the data management activities that had been performed in the 9 months since he assumed the data manager role from the previous data manager, Jordan Hastings. The review of the data management effort was positive, and highlighted 1)the importance of a closer working relationship between the site PIs and data management, and 2)increased financial support of the data management function. However, a month after the review, it was announced that Robert Wharton, the project leader at the Desert Research Institute (DRI), was planning to step down. The PIs decided that the data management function should reside at a site where a principal investigator maintained a vested interest in the project. It was decided that the Institute for Arctic and Alpine Research (INSTAAR) would become host to the data management activities for McMurdo.

Denise Steigerwald started working full time as data manager on June 1, taking over the responsibilities of Dr. McGwire, who had a 25% allotment as data manager. Because Dr. McGwire is based at DRI in Reno, Nevada, but Denise is working at INSTAAR in Boulder, Colorado, the transfer is a little bit complicated and requires:

1. setting up a web-server based out of Boulder rather than Reno,
1. copying files from the system at DRI to the system in Boulder,
1. contacting principal investigators located around the country regarding missing data and documentation to represent in the McMurdo database and web page,
1. adjusting the format of files received so they can be used effectively in a relational database,

1. entering the data into Microsoft Access, and making sure that the resulting tables are complete in both design/layout and content/values represented.

So far, steps 2, 3, 4, and 5 are well underway. The data processed in Boulder, however, is not yet represented on a web page set up at INSTAAR. Until that does occur, the DRI web page will represent the McMurdo LTER site. At this time it appears unlikely that there will be continuity of the approach which Dr. McGwire had established in the period leading up to the site review. In the interest of making the system more user-friendly, it was decided to re-design it using a software package from a company that offered support/consulting if desired or needed. It is desirable to eventually do this through Oracle. However, since Oracle has not yet been obtained, data is currently being entered into Microsoft Access. Version 2.0 is being used, but upgrading to Access 97 and Windows 95 will make it relatively easy to read into Oracle, as well as to link to a web page.

At present, the core data and related documentation are being processed in order to present it on the web page to meet NSF's guidelines. This involves a lot of correspondence between Denise and those collecting/analyzing the data. Following that, focus can be made on links between the data and related materials such as images, graphics, and publications. Software such as Visual Foxpro and Arc-Info is currently being considered for regular use.

Network Office (NET): Rudolf Nottrott

The Network Office is presently in a transitional phase during which all its functions will be transferred from the University of Washington (UW) to the University of New Mexico. After an extensive national search and presentations by two finalists to the Coordinating Committee at the Andrews LTER site in April, Bob Waide has been chosen as the new Executive director of the Network Office. He will move from Puerto Rico to New Mexico and start his new position in October. Because Bob Waide, from his past work as the director and PI of LUQ, is thoroughly familiar with the LTER network, we can expect not only the new initiatives and directions that he envisions, but also the continuity that a mature network needs to continue with day-to-day operations.

Rudolf Nottrott, the present Network Information manager is not able to move to the new Office location for personal reasons. An advertisement for the new Network Information Manager has been published in Science magazine. The position is expected to be filled in September.

Other positions at the new Office have been filled with new personnel: Patty Spratt is the new Publications Coordinator and Louise Williams is the new Administrative assistant

John Vande Castle moved to Albuquerque on July 25 and he has begun transferring some key equipment to the new Network Office location at UNM. The equipment transferred so far includes a file server/satellite archive with approx. 80 GBytes of disk storage, a Sparc 10 that is presently being configured to perform LTERnet communications and networking functions, on a temporary base and for testing the switch-over of Internet domain LTERnet.edu from the UW to UNM. New equipment to expand or replace most of the existing hardware is being acquired by the Office under a grant from NSF to facilitate the transition. The LTERnet Connectivity Station has also been transferred to UNM and is available for use in "netless" locations, e.g. a potential International LTER information management workshop in Brazil later this year. In addition to moving our distributed SQL capability to NT servers, a new Connectivity Station has been implemented on an NT server for easier portability and maintenance. Although the Office is planning to maintain a strong UNIX capability, the move to NT has clearly gained some speed.

We have developed an NT/MS SQL server implementation of LTER Personnel Database including a Web interface for querying and maintenance. This database is close to being complete, with the bulk of data transferred to it from the existing Ingres server on LTERnet, except for the part that automatically generates the email forwarding and group aliases. The NT/SQL server-based system will be transferred to a NT server in Albuquerque to serve as a major component in the new LTERnet system. The next step will be to work with volunteer sites that have ODBC/SQL server capability to find ways to use remote database tables on the net and integrate them into the system for performance and other tests. I am very excited to hear that AND has found a high-level data modeling tool that also does reverse and forward engineering.

Niwot Ridge (NWT): Michael Hartman

The slow but steady march of technology will hopefully continue to proceed up the mountain, with the planned installation of fiber optic lines to the Saddle area of Niwot Ridge (3525m). The underground cables were installed last summer and the lines are to be pulled to the "Tundra Lab" this summer. The lab has been receiving line power since last autumn, but the fiber optics have only been pulled as far as the subalpine climate station (3018m) so far. The connection to that station has been successfully used in conjunction with the NWT LTER WWW page to provide current meteorological data on-line. It is anticipated that the same can be done for the Saddle as soon as the lines are in place, and there has even been discussion with a local television station about installing a "mountain-cam" at the site to provide live video images.

The Ingersoll et al. paper describing the data management program at NWT appeared in the May issue of BioScience, and is now available on-line (<http://www.aibs.org/bioscience/vol47/may97.computer.lter.html>) [note: there were a couple of mistakes made during their conversion to HTML -ironically in the link to our home page and in my e-mail address!].

In addition to a continued increase in the number of available on-line data sets, the NWT LTER WWW page has continued to expand its functionality. Our "Investigator Only" password protected areas are being used to help prepare our upcoming renewal proposal. And all Research Applications for the 1997 field season were submitted via WWW forms this year, as were all summer REU applications.

This past spring, the existing WWW NWT LTER data system was used in the development of on-line homework assignments for several undergraduate Biology and Geography courses at the University of Colorado. The NWT data management staff worked closely with teaching personnel from CU, developing additional WWW-based data retrieval and analysis tools for the assignments.

North Temperate Lakes (NTL): Barbara Benson and Robin Stubbs

DATABASE DEVELOPMENT

During the past year we put more data sets into the Oracle database including: the historic Lake Mendota zooplankton, groundwater well levels, and monthly meteorological data from Minocqua, WI. A series of planning meetings were held with researchers to design the Oracle tables for the LTER and Little Rock Lake zooplankton data. Additional planning meetings have occurred to incorporate more data from the Madison Area lakes into the LTER database.

Extensive work was done in designing and implementing an international database on lake ice (Lake Ice Analysis Group). Ice phenology and descriptive data for 688 lakes and rivers have been added to the Oracle database. We have developed scripts to produce derived files and screen the database for errors. A World Wide Web (WWW) page has been created which provides access for LIAG researchers to data (via dynamic database queries), the results of error screening, and a database update log.

HARDWARE/SOFTWARE UPGRADES

Significant extension of our computing capabilities was made available through the University of Wisconsin-Madison capital equipment funds. The Sun workstation was upgraded from a Sun Sparc10 to an UltraSparc2 and the operating system was upgraded to Solaris 2.5. Under the same funds, we will be upgrading to Oracle 7.3 and installing Oracle Web Server. Oracle Web Server will be a crucial part of the dynamic database queries from the World Wide Web.

FISH SAMPLING AUTOMATION

We have developed a fish sampling automation system (FishSamp) to improve the efficiency of fish sampling while at the same time improving the reliability of the data. The system can be broken down into two major areas: 1) on-board physical equipment, 2) data recording. We will be using the new system for this year's fish sampling.

Data recording has changed most dramatically. Formerly, a data recorder sat in the boat with the fish measurers and recorded fish measurements on paper sheets. Now, the crew in the boat makes a cellular telephone call to the recorder,

who is located either on shore or at the laboratory and seated at a computer. As the crew calls out measurements, the recorder enters these measurements into a Windows '95 software program, FishSamp, written specifically for this purpose. As data are entered, FishSamp automatically performs error checking and provides feedback to the measurers regarding the need for additional weight measurements and scale collection. At the end of the sampling session, data are exported from FishSamp and imported into the main LTER database, thus eliminating months of data entry and error checking that formerly were required at the end of the field season.

INTERSITE INFORMATION MANAGEMENT ACTIVITIES

NTL-LTER data management staff have been active in the intersite data management working group developing an intersite climate database. Robin Stubbs has developed the prototype intersite database along with the World Wide Web interface (<http://limnosun.limnology.wisc.edu/climdb.html>) for accessing the data.

Palmer Station (PAL): Karen Baker

The sixth field season from November 96 to March 97 at Palmer Station and the fifth January cruise off the Western Antarctic Peninsula have been completed. As a continuing data management synthesis project, the season end summary reports in the form of Antarctic Journal Articles have been drafted for both the January 97 cruise and the USAP 96 - 97 season. Also, field methods have been documented including articles on our bio-optical instrument profiler, a Palmer Station zodiac instrumentation, and the season sampling routine. Field research was detailed in the NSF-sponsored educational activity 'Live from Antarctica' broadcast during the season's LTER ship cruise and resulting in an educational video.

The new satellite link to Palmer station provided two 3-hr per day windows of field internet connectivity. This new connectivity did improve logistic support, data analysis and data archive. FTP from the field as a daily activity was time consuming with methods for improvement under development.

The data manager continues to serve as group historian through creation and maintenance of the bibliography, a visions timeline and milestone timelines. Meeting preparations for an LTER archeoclimatology meeting followed by a Palmer LTER paleohistory workshop this month have finalized. Preparations for an upcoming LTER CC meeting in October hosted at Santa Barbara followed by our site steering committee visit have begun with web pages including online registration. Participation as an invited speaker in the NSF funded Data and Information Management Workshop preceding the August 97 Albuquerque ESA meeting includes presentations on a Palmer site data management overview update and another on software tools which will include a roundtable discussion.

An analysis of satellite sea ice data, defining sea ice indexes in order to make the timing and magnitude of ice events available to all components, was accepted by Bioscience. A fuller report using the same analysis but including a wide variety of Antarctic regions is in progress.

A web catalog presentation of the online data sets was implemented. Development of dynamic web pages provided a low cost method to present our hierarchical study and dataset structure. A non-interactive retrieval of documents is performed by a cgi script via www, gopher and ftp servers. The study catalog includes study documentation, maps, and participant lists in addition to data set documentation and data. Also, the Palmer LTER home page on the www was modified to co-ordinate and highlight selected topics. Topics include the bibliography with the Antarctic Research Series book preface and synthesis chapters on-line, an overview analysis and impacts of ice with annotated bibliography in addition to upcoming meetings with agendas and hot links. The addendum modification to our new proposal cycle included a new data policy as required. Each component was assisted in meeting the data policy requirement of putting data online within two years of study completion. Summary data tables were created and updated to overview progress. Progress was made on work with the National Oceanographic Data Center (NODC) to develop procedures for archiving an online archive making use of existing webspiders.

Sevilleta (SEV): Gregg MacKeigan

This has been a challenging year for the folks at the Sevilleta. There have been changes in personnel and computer systems, a national conference, a site review and of course, the relocation of the LTER Network Office.

Most of you know that James Brunt left the data manager role here to test the waters in private industry. To fill the vacancy, Gregg MacKeigan was promoted from system administrator. Two part-time computer science students were hired to fulfill Gregg's duties.

Our central file server was migrated from a DECstation 5000 (Ultrix 4.3) to a Sun Ultra SPARC (Solaris 2.5.) This change had been in preparation for many months, but as those of you who have lived through one know, a system migration is never easy. The primary benefit is that all of our 32 UNIX hosts at the Sevilleta now run the same version of the same operating system.

The 1997 ESA conference has held in Albuquerque and kept all of us extra busy with preparations. The conference was a success and we at UNM Biology were proud to serve as the host. The activity was helpful in getting ready for a mid-grant site review just a few weeks subsequent.

The site review went reasonably well, and information management passed with a clean bill of health. To provide the site review team with a concise description of the program prior to their arrival, we used the

opportunity to refine our web site design. Drawing from our experiences over the last three years, we attempted to improve the organization and modernize the presentation while specifically fulfilling the requests of the reviewers.

In the early months of relocating the LTERnet Office to UNM, the Sevilleta Information Management staff spent many hours supporting the new location. The transition is now maturing and the Albuquerque office has become largely self-sufficient. We look forward to working in closer partnership with our new neighbors.

Despite all these comings and goings over the recent months, we actually achieved some research progress at the Sevilleta. Our 1997 Annual Report is viewable on the web at <http://sevilleta.unm.edu/overview/reports/1997/>

Short Grass Steppe (SGS): Chris Wasser

PROGRESS TO DATE

In a continuing effort to bring all of our datasets in line with NSF's 2 year public accessibility guidelines, we have opened 10 datasets to the public. Currently 114 of 209 datasets are open to the public and nearly all of the closed datasets were received by the data management staff in the past two years. These datasets are available via our website (<http://sgs.cnr.colostate.edu>). We continue to contact principal investigators on a regular basis regarding the status of their datasets. Along with this effort we have uncovered metadata for older datasets from the International Biome Project (IBP). In this ongoing project we are attempting to locate all of the metadata related to these datasets. To date we have located complete metadata for 17 of the 65 IBP datasets and partial metadata for all 65 IBP datasets. One of the goals of the SGS data management program is to utilize our website as our primary communication tool within our group and to the public. To this end we have redesigned the data access portion of our website to include more flexible searching tools and easier access to our datasets and metadata. In addition, we are currently building a link between our datasets and our bibliography. Last, we have entered over 350 abstracts into our bibliographic database and plan to have these available via our website.

GOALS FOR THE UPCOMING YEAR

In the upcoming year we plan to focus on three aspects of data management: improving the presentation and storage of weather data, linking the bibliography and datasets, and improving the information content of our website. First, we plan to provide tools to access monthly summary values of our meteorological data along with graphs of the most widely used parameters. This will be an important addition to our data management program, since these data are consistently used for modeling efforts which require monthly meteorological data. Second, we plan to enable the link between our datasets and our bibliographic database. This will allow visitors to our website the ability to search for information by either data or by publications. Lastly, we plan to rebuild the species database, develop searching tools, and link this new species database to the 452 images we have collected in the past year. Ongoing activities include:

opening more datasets to public access, entering the abstracts of older publications, and improving our website.

Virginia Coastal Reserve (VCR): John Porter and David Richardson

Its been a busy and productive year at the VCR LTER. The VCR/LTER Information Management System was moved to a WWW interface. Although the system has used the WWW for display and access since it came online in 1993, input to the system was via database software that was not WWW accessible. The new system allows investigators at seven institutions in four states to directly input and edit information about new datasets and to update information on older datasets without intervention by the site information manager. Changes in the database immediately show up in queries by data users.

The system uses a forms-based interface to a SQL relational database (Mini-SQL). The data model for the system is hierarchical. PROJECTS may have one or more DATASETS each of which has one or more VARIABLES which may have zero or more CODES. The database has links to an existing personnel database, so an that investigator's address information is automatically updated. The system has been enthusiastically received by investigators and graduate students. Additional training on using the system is planned for the fall of 1997.

Software designed for creation of annual LTER research reports using a WWW-form has had much wider use than originally anticipated. The software makes it possible to rapidly create an automated system for receiving and displaying information over the WWW. Data from the WWW form is pasted into a template document to create a new WWW page. An automatic table of contents for submitted entries is then generated. This software was used to obtain community input on LTER/LMER consolidation, develop the LTER Network Regionalization document and even for processing of abstracts for the AERS/SEERS meeting.

During late 1996 and 1997 we revamped and greatly expanded the site Biodiversity Database. Using a WWW interface, coupled to an underlying Mini-SQL database, 39 undergraduate students input over 6000 species observations to the system. You can examine the system (<http://www.vcrlter.virginia.edu/biod>).

In response to PI requests, we have moved to a license-based system for supplying investigator-collected data. After viewing metadata, a requestor clicks on the download link, reads the license and fills out a form that says who they are and what they want to do with the data. That information is then immediately mailed to the dataset contact and the requestor is granted immediate access to the data.

Outside of information management activities, we are undergoing a few changes at the site. Bruce Hayden (site PI 1993-1997) has gone to NSF as a rotator to serve as the Division Director for the Division of Environmental Biology. John Porter will be filling in during the time Bruce is in Washington D.C.

We are continuing work on developing a new field laboratory to replace the now-overloaded farm house we rent from The Nature Conservancy. University funds and private donations will be used to initiate laboratory construction, hopefully late in 1997 or early 1998.

C. Meteorological Metadata Database Schema (ClimDB)

A. LTER SITE LEVEL

LTER_CODE	LTER site code
CLIMATE_CONTACT_NAME	Name of the person to address questions about the climatic measurements
CLIMATE_CONTACT_EMAIL	Climate contact person email
CLIMATE_CONTACT_PHONE	Climate contact person phone number

DATA_CONTACT_NAME	Name of the person to address questions about dataset access
DATA_CONTACT_EMAIL	Data contact person email
DATA_CONTACT_PHONE	Data contact person phone number
QUALITY_ASSURANCE	Description of data quality assurance procedures applied to these data
PRIMARY_STATION	Name of the primary meteorological station at this site
SECONDARY_STATIONS	Comma separated list of secondary meteorological stations at this site that can potentially supply data for ClimDB
CLIMDES_URL	CLIMDES URL to site information
COMMENTS	Other relevant information such as documentation of significant gaps in the station’s record

B. WEATHER STATION LEVEL

LTER_CODE	LTER site code
STATION_CODE	Local name of observation station
LATITUDE	Latitude of station in decimal degrees (+/- 90 degrees, 4 decimal places)
LONGITUDE	Longitude of station in decimal degrees (+/- 180 degrees, 4 decimal places)
STATION_DESCRIPTION	Description of area within 100 m of sensor (e.g., nearby structures, vegetation etc.)
TOPOGRAPHY	General topographical location of sensor (e.g., valley, on a slope, etc.)
ELEVATION	Elevation of station
SURFACE_TYPE	Surface over which air temperature sensors are placed under non-snow covered conditions (e.g., grass, mineral soil)
EXPOSURE	Angle from horizontal to top of nearest obstruction (from station)
WIND_EXPOSURE	Angle from horizontal to top of nearest obstruction in the direction of prevailing precipitation-bearing winds
STATION_START	Date of station establishment
STATION_HISTORY	History (e.g., growth of nearby vegetation, heat sources such as cabins, known changes to exposure, etc.)
STATION_PHOTO	URL to WWW photo of this station located on the individual site’s server

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C. MEASUREMENT LEVEL

LTER_CODE	LTER site code
STATION_CODE	Local name of observation station
WHAT_MEASURED	Air temperature, precipitation, etc.
BEGIN_DATE	Beginning date of this measurement
LOG_INTERVAL	Data logger sampling interval (e.g., 15 seconds, 1 minute)
SUMMARY_INTERVAL	Time interval at which data is recorded or output (e.g., 15 minutes, 1 hour)
INSTRUMENT_HEIGHT	Height above ground of sensor (m) (e.g., for precipitation use height above ground of gage orifice)
MEASUREMENT_HISTORY	History of sensor-related changes (e.g., date and description of changes in location, instrument height, instrument type, or observation method)
OBSERVATION_METHOD	Field collection and data aggregation methods (include the type of data logger and describe any manual methods)
INSTRUMENT_TYPE	Instrument type and brand name of sensor (e.g., Campbell thermistor or Belfort tipping bucket). For air temperature include type of radiation shield for sensor (e.g. metal cones, louvered box). For precipitation, include diameter of gage orifice (cm), include description of placement if gage orifice is not horizontal
ACCURACY	Data accuracy (e.g., +/- 0.1 degrees C or +/- 10mm)
CALIBRATION_HISTORY	Date of current and all previous calibrations

D. LTER Online Data Policies (K. Baker (PAL))

Please see the policy at <http://www.crseo.ucsb.edu/lter/dm/datauseraccess.97>.

E. 1997 LTER Software Survey (K. Baker (PAL))

Please see the policy at <http://www.icess.ucsb.edu/lter/dm/softwaresurvey.97>.

type , plat , software , AND , ARC , BAL , BNZ , CAP , CDR , CWT , HBR , HFR , JRN , KBS , KNZ , LUQ , MCM , NET , NTL , NWT , PAL , SEV , SGS , VCR

site/beg , , , 81 , 88 , 97 , 88 , 97 , 83 , 81 , 88 , 89 , 83 , 89 , 82 , 88 , 92 , 91 , 81 , 81 , 91 , 89 , 81 , 88

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Prototyping Options for All-Site LTER Data Catalog

bibliogra,pc,papyrus	,---,ARC,---,---,CAP,---,---,---,HFR,---,---,---,LUQ,---,---,---,---,PAL,---,---,---
bibliogra,pc,procite	,AND,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
bibliogra,pc,refman	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
bibliogra,pc,wais	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
bibliogra,pc,wordperfect	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
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bibliogra,blnk,ref11	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
spreadshe,pc,excel	,AND,ARC,BAL,BNZ,CAP,CDR,CWT,---,---,---,---,---,---,---,---,---,---,---,---
spreadshe,pc,lotus	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
spreadshe,pc,paradox	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
spreadshe,pc,quattropro	,AND,ARC,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
spreadshe,pc,stata	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
spreadshe,pc,symphony	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---

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statistic,maçmatlab	,---
statistic,maçpowerpoint	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,LUQ,---,---,---,---,---,---,---,---
statistic,maçsas	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,KNZ,---,---,---,---,---,---,---,---
statistic,maçstatview	,---
statistic,maçsuperanova	,---
statistic,maçsystat	,---
statistic,unix,blss	,---
statistic,unix,cdrlibhs	,---
statistic,unix,idl	,---
statistic,unix,imsl	,---
statistic,unix,matlab	,---
statistic,unix,sas	,---
statistic,unix,splus	,AND,---
statistic,unix,spss	,---
statistic,unix,stata	,---
statistic,unix,statistix	,---
statistic,unix,superpaint	,---
statistic,unix,systat	,---
statistic,unix,xplot	,---
statistic,ibmbmdp	,---
statistic,ibmsas	,---

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drawing ,pc ,coreldraw	---	---	---	---	---	---	---	---	---	---	---	---	HFR	---	---	---	---	MCM	---	---	NWT	---	---	---	---
drawing ,pc ,freelance	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	PAL	---	---	---	---
drawing ,pc ,onyx-posters	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---
drawing ,pc ,slide	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---
drawing ,pc ,superpaint	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
drawing ,pc ,view	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
drawing ,mac ,aldus-freeha	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---
drawing ,mac ,adobe-illust	---	---	BAL	---	---	---	---	---	---	---	---	---	KBS	---	---	---	---	---	---	---	---	---	---	---	---
drawing ,mac ,adobe-photos	---	---	BAL	BNZ	---	---	---	---	---	---	---	---	KBS	---	---	---	---	---	---	---	NWT	---	---	---	VCR
drawing ,mac ,canvas	---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
drawing ,mac ,cricketdraw	---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---
drawing ,mac ,macdraw	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
drawing ,mac ,pagemaker	---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
drawing ,mac ,superpaint	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	PAL	---	---	---
drawing ,unix ,coredraw	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
drawing ,unix ,xfig	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---
drawing ,unix ,xvgr	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
database,pc ,4dimension	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---
database,pc ,access	---	---	ARC	BAL	---	CAP	---	---	---	HFR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
database,pc ,doublehelix	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---
database,pc ,datapervect	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---

Prototyping Options for All-Site LTER Data Catalog

database,pc ,dbase	,---,---,---,BNZ,---,---,---,HBR,HFR7---,---,---,---,---,NET,---,---,PAL,---,---,---
database,pc ,foxpro	,AND,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,pc ,ingres	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,NET,---,---,---,---,---
database,pc ,oracle	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,NTL,---,---,---,---,---
database,pc ,paradox	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,LUQ,---,---,---,---,---
database,pc ,sqlserver/NT,AND	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,NET,---,---,---,---,---
database,mac ,ingres	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,mac ,oracle	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,arcinfo	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,LUQ,MCM7---,---,---,---,---
database,unix,cdrlib	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,informix	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,ingres	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,NET,---,---,---,---,---
database,unix,kman	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,mysql	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,oracle	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,NTL,---,---,---,---,---
database,unix,postgres	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,rdp	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,sas	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,unix,sql	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---
database,vms ,ingres	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---

Prototyping Options for All-Site LTER Data Catalog

GIS	,pc	,arcinfo	,---	ARC	BAL	,---	,---	CDR	,---	HBR	,---	JRN	KBS	KNZ	LUQ	MCM	,---	NTL	,---	PAL	,---	SGS	VCR
GIS	,pc	,arcview	,---	ARC	BAL	,---	CAP	,---	,---	,---	HFR	JRN	,---	KNZ	LUQ	MCM	,---	NTL	NWT	PAL	,---	,---	VCR
GIS	,pc	,eppl72	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	NTL	,---	,---	,---	,---	,---
GIS	,pc	,erdas	,---	,---	,---	,---	,---	,---	,---	,---	,---	JRN	KBS	---	LUQ	---	,---	NTL	---	,---	,---	SGS	VCR
GIS	,pc	,erdasiamgin	---	,---	,---	,---	,---	,---	,---	,---	,---	JRN	---	KNZ	---	,---	NET	NTL	---	,---	,---	,---	,---
GIS	,pc	,grass	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	KBS	---	,---	,---	,---	,---	,---	,---	,---	,---	,---
GIS	,pc	,idrisi	,---	ARC	BAL	---	CAP	---	,---	,---	HFR	---	,---	,---	,---	,---	,---	NTL	NWT	---	,---	,---	,---
GIS	,pc	,inhouse	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	NTL	,---	,---	,---	,---	,---
GIS	,pc	,map	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	NTL	,---	,---	,---	,---	,---
GIS	,pc	,roots	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---
GIS	,mac	,arcinfo	,---	,---	,---	,---	,---	CDR	CWT	---	,---	JRN	KBS	---	LUQ	MCM	---	,---	,---	,---	,---	SGS	---
GIS	,unix	,arcinfo	,AND	ARC	BAL	BNZ	CAP	CDR	CWT	,---	,---	JRN	KBS	KNZ	LUQ	MCM	NET	NTL	NWT	PAL	SEV	SGS	VCR
GIS	,unix	,arcview	,AND	ARC	BAL	,---	CAP	,---	CWT	,---	,---	,---	,---	KNZ	LUQ	MCM	NET	NTL	NWT	,---	SEV	SGS	,---
GIS	,unix	,erdas	,AND	,---	,---	,---	,---	,---	CWT	,---	,---	JRN	KBS	,---	LUQ	,---	,---	NTL	NWT	,---	SEV	,---	VCR
GIS	,unix	,(e)las	,---	,---	,---	,---	,---	,---	CWT	---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---	,---
GIS	,unix	,ermapper	,---	,---	,---	BNZ	---	,---	,---	,---	,---	,---	,---	,---	,---	MCM	---	,---	,---	,---	,---	,---	,---
GIS	,unix	,grass	,AND	ARC	---	,---	,---	,---	CWT	---	,---	,---	,---	,---	,---	,---	NET	---	NWT	---	SEV	SGS	---
GIS	,unix	,idrisi	,---	,---	,---	,---	,---	,---	CWT	---	,---	,---	KBS	---	,---	,---	,---	,---	,---	,---	,---	,---	,---
GIS	,unix	,imagine	,AND	---	,---	,---	,---	,---	,---	,---	,---	,---	,---	KNZ	---	,---	,---	,---	,---	,---	SEV	SGS	VCR
GIS	,unix	,inhouse	,AND	---	,---	,---	,---	,---	CWT	---	,---	,---	,---	,---	,---	,---	NTL	---	,---	,---	,---	,---	,---

Prototyping Options for All-Site LTER Data Catalog

GIS	,unix,sips	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NTL	---	---	---	---	---
GIS	,vms,arcinfo	,---	---	---	---	---	---	---	---	---	---	---	---	KBS	---	---	---	---	---	---	---	---	---	---
GIS	,vms,grass	,---	---	---	---	---	---	---	---	---	---	---	---	KBS	---	---	---	---	---	---	---	---	---	---
imageproc	,unix,envi	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---	---
imageproc	,unix,erdas	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	SGS	VCR	
imageproc	,unix,ermapper	---	---	---	---	---	---	---	---	---	---	---	---	---	---	MCM	---	---	---	---	---	---	---	---
imageproc	,unix,idl	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	PAL	---	---	---	---
imageproc	,unix,pci	---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
imageproc	,unix,terascan	---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	PAL	---	---	---	---
dataentry	,pc,c	,---	---	---	---	---	---	---	---	---	---	JRN	---	---	---	MCM	---	---	---	---	---	---	---	---
dataentry	,pc,clarion	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry	,pc,dbase	,---	---	---	---	---	---	---	---	HFR	---	---	---	---	---	---	---	---	---	PAL	---	---	---	---
dataentry	,pc,declare	,---	---	---	---	---	---	CDR	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry	,pc,dentry	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry	,pc,excel	,---	ARC	BAL	BNZ	CAP	---	CWT	---	HFR	---	KBS	---	LUQ	MCM	---	---	NWT	PAL	---	---	---	VCR	
dataentry	,pc,ezentry	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---	---	---	---
dataentry	,pc,fortran	,---	---	---	---	---	---	---	HBR	---	JRN	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry	,pc,foxpro	,AND	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry	,pc,lotus	,---	---	---	---	---	---	---	HFR	JRN	KBS	---	LUQ	---	---	---	---	---	---	---	---	---	---	---
dataentry	,pc,paradoxscri	---	---	---	---	---	---	---	---	---	---	---	---	---	---	LUQ	---	---	---	---	---	---	---	---

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dataentry,pc,quattropro	,---	ARC	,---	---	---	---	---	---	---	---	JRN	KBS	---	LUQ	MCM	---	---	---	---	---	---	---
dataentry,pc,quickbasic	,---	---	---	---	---	---	---	---	---	---	JRN	KBS	---	---	---	---	---	---	---	SEV	---	---
dataentry,pc,sas	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry,pc,symphony	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry,mac,excel	,---	ARC	BAL	BNZ	,---	---	---	---	---	---	---	KBS	,---	LUQ	MCM	,---	NTL	NWT	PAL	,---	---	VCR
dataentry,mac,lotus	,---	---	---	---	---	---	---	---	---	---	---	KBS	---	LUQ	---	---	---	---	---	---	---	---
dataentry,unix,informix	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry,unix,ingres	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	NWT	---	---
dataentry,unix,sas	,---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry,unix,wwwform	,---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VCR
dataentry,vms,ingres	,---	---	---	---	---	---	---	---	---	---	---	KBS	---	---	---	---	---	---	---	---	---	---
dataentry,vms,spreadsheet	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
dataentry,blnk,inhouse	,---	---	---	---	---	---	---	---	---	---	HBR	---	---	---	---	---	---	---	---	---	---	---
modeling,pc,erwin/nt	,AND	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
modeling,mac,stella	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
web,web,gopher/srv	,---	---	---	---	---	---	---	---	---	---	---	KBS	---	LUQ	---	---	---	---	---	---	---	---
web,web,interntexpl	---	---	BAL	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
web,web,netscape/srv	AND	ARC	---	BNZ	---	---	---	---	---	---	HFR	JRN	KBS	---	LUQ	MCM	---	---	---	---	---	---
web,web,mosaic/srv	AND	ARC	---	---	---	---	---	---	---	---	---	KBS	---	---	MCM	---	---	---	---	---	---	---
web/html,mac,pagemill	,---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

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mail	,pc ,eudora	,AND,ARC,---,BNZ,---,CDR,CWT,---,HFR,---,KBS,---,---,---,---,---,NTL,NWT,---,---,---,SGS,VCR
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mail	,mac ,pathworks	,---
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mail	,unix,elm	,---
mail	,unix,emacs	,---
mail	,unix,pine	,---,ARC,BAL,---
mail	,unix,mailx	,---
mail	,unix,mh	,---
newsreade,pc ,newsyp		,---
newsreade,unix,nn		,---
newsreade,unix,rn		,---
revision,unix,rcs		,---
revision,unix,scsc		,---
acquisiti,pc ,erbaboy		,---

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other	,blink,cuseeme	,---,---,---,---,---,---,---,---,---,---,---,---,---,---,---,NET,---,---,---,SEV,---,---,---
other	,blink,geograpcalc	,---
other	,blink,mathcad	,---
other	,blink,reflex	,---,ARC,---
other	,blink,showme	,---
type	,plat,software	,AND,ARC,BAL,BNZ,CAP,CDR,CWT,HBR,HFR,JRN,KBS,KNZ,LUQ,MCM,NET,NTL,NWT,PAL,SEV,SGS,VCR