THE PLACE OF GEOGRAPHIC INFORMATION SYSTEM SERVICES IN A GEOSCIENCE INFORMATION CENTER

DERKSEN, Charlotte R. M., SWEETKIND, Juliet K., and WILLIAMS, Meredith J., Branner Earth Sciences Library, Stanford University, Stanford, CA 94035, cderksen@stanford.edu

Abstract--Geographic Information Systems (GIS) services have begun to appear in many academic institutions over the past decade. Is the library, specifically the Geoscience Information center or library, a proper place for them to be sited? What factors should be considered? When appropriate, what types of services are should be started? What types of GIS services should be provided by academic departments rather than by libraries? What types of services should libraries try to provide? What costs are involved? The answers should be institution specific, driven by the local needs and the mission.

Since GIS is a computer-based tool that allows for mapping and/or spatial analysis of the Earth's features and events, the Earth Sciences library seemed an appropriate location for placing these services when the Stanford library administrators were approached with such a request by Earth Sciences faculty. First steps in setting up the GIS services in the Earth Sciences Library included talking with the interested faculty, investigating software, and acquiring data as appropriate to serve research and teaching projects already in place. The map librarian learned how to use the products at the same time that we were beginning to provide services. The service started as a very small one, but increased rapidly as demand escalated. Campus-wide services provided now include: two staff members; four workstations in the Earth Sciences and Map library, plus two in the main library; a campus-wide license for software, which is available on library workstations, via ftp from a server, or as CD-ROMs to check out; many data sets, which are cataloged, some of which are mounted for use, and some of which can be checked out. Many questions from users are answered electronically. A web page (http://www-sul.stanford.edu/depts/gis/gishome.html) is maintained to assist users; bibliographic instruction for GIS is provided, but GIS courses are not. The collection policy for the map collection has been expanded and refined to include GIS software, datasets, and literature. Processing, cataloging, and circulation procedures have been redefined to accommodate the particular licensing and format needs of GIS materials. Faculty and students from an ever-increasing number of disciplines are finding GIS useful for teaching and research.

INTRODUCTION

The purpose of this paper is not to explain what Geographic Information Systems (GIS) are, but to lay out the rationale for why Stanford's Branner Earth Sciences Library and Map Collections added GIS to its services, outline what services are included, and detail some of the costs. Also covered are adjustments, which the library as a unit, has made to take on the additional workload and procedures.

Background

Stanford's Earth Sciences Library primarily supported instruction and research for the Departments of Geological and Environmental Sciences, Geophysics, and Petroleum Engineering, as well as the multi-disciplinary Earth Systems Program. Collections in the library have historically been format blind, and in October of 1989 the collection included about 125,000 maps. After the 1989 Loma Prieta earthquake seriously damaged the main library's map room, the Earth Sciences Library was asked to add the central map collection to its holdings. Subsequently the library has included all of the maps collected by the library system. Since that time, of course, the library has also supported the cartographic needs of the campus as a whole, in addition to the Earth Sciences needs. (Two collection development policies were drafted and maintained, one for the Earth Sciences Library and one for the map collection.)

Since the mid-1980's the library staff had been collecting digital materials appropriate to the collection and watching, with interest and some initial skepticism, the development of GIS data and software. With the addition of the central map collection, however, all thoughts of expanding into GIS were temporarily put aside in order to move, assimilate, weed, and begin cataloging the now-combined map collections, totaling approximately 250,000 paper maps. This was the state of affairs when a Geophysics faculty member made

a formal request to the Earth Sciences Library and, through it, to the administration of the university's libraries, that the libraries should initiate a GIS program to be sited in Branner Library. The Geophysics Department had introduced GIS into their graduate and major programs. However, the classes were open, of course, to all students at Stanford. The result was an influx of other students into the GIS classes and laboratories to the point where the Geophysics students were apparently not getting sufficient access to the equipment and labs. Thus the Geophysics department approached the library requesting two things: 1) acquisition of software and data for them and others using GIS on campus and 2) provision of a workstation within the library for non-Geophysics students to use, so that the Geophysics laboratory could be more available to Geophysics students. Since GIS is a computer-based tool that allows for mapping and/or spatial analysis of the Earth's features and events, the Earth Sciences library seemed an appropriate location for placing these services. Thus meeting these two requests seemed to fit into and be a logical extension of the library's mission to support "instruction and research for the Departments of Geological and Environmental Sciences, Geophysics, and Petroleum Engineering." Unfortunately, this request was made the same week that then map librarian, J. K. Herro, resigned in order to go back to graduate school.

Overt planning for GIS was put on hold while the search for a map librarian commenced. The departure of this staff member facilitated examining the current staffing pattern within the Earth Sciences Library and also the Science libraries as a whole, in part influenced by the request for GIS services. The result was a redesign of staff positions and the transformation of the map librarian and the senior specialist map positions, via various stages, into a GIS & Map Librarian, and a half-time map cataloger, plus a GIS technical staff member (fig.1).

First Real Steps in Providing a GIS program

The Geophysics Department was willing to be patient for a time, while we worked to fill the map librarian position. Almost as soon as the new librarian, Jean Kan, was in place, the Electrical Engineering department decided that they wanted to use GIS in one of their graduate level courses. They approached the Earth Sciences Library about housing a GIS workstation and purchasing software, if the EE department would purchase the workstation. Thus the desired GIS workstation was installed almost as soon as the new librarian was on-board, rather than waiting for the slowly grinding mills of library process.

Fig. 1. EVOLUTION OF STAFF POSITIONS WITHIN EARTH SCIENCES

(From earliest to most recent)

A. Map Librarian and Senior Map Specialist
B. .5 FTE Map Cataloger (temporary - during search) plus Senior Map Specialist
- Addition of Student Assistant with degree in GIS 8 hours per week

C. GIS and Map Librarian and .5 FTE Map Bibliographer
- GIS Technician 20 hours per week

D. GIS and Map Librarian and .5 FTE Map Bibliographer
- Plus .5 FTE Staffing from Science Libraries' Staff Reorganization
- GIS Technician 40 hours per week

E. GIS and Map Librarian and .5 FTE Map Bibliographer
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By the end of that first year, it was clear that there was enough interest from Geophysics, Geology, and three other departments on campus, to approach the library administration about providing the funding for a campus-wide ESRI license.

FACTORS CONSIDERED

Initial Factors Considered

The three factors considered in initiating the service were need, location, and interface.

a) There was a user driven need for and interest in GIS as a service that the library might provide. Even during the time that the Map Librarian position was vacant, we continued to get questions from interested faculty. The decision clearly became not if we would provide the service, but when.
b) Likewise, the best location for GIS services in the libraries seemed clearly to be the Branner Earth Sciences Library, as we served the two first departments interested, we housed all of the cartographic materials for the library system, we were one of the few units to collect digital information, and we were one of the first to provide access to such titles for end-users.
c) The selection of software to acquire took a bit more time. The decision was quickly made that there was neither staffing nor monetary resources to support more than one software program. We investigated several programs and settled on ESRI products. ESRI was, and still is, the leading producer of GIS software offering a wide variety of mapping tools and extensions. Because of their dominance in the marketplace, much data is produced in a format compatible with their software.

Procedural Factors Considered

Once it was decided that we would do more in GIS than collect some important data sets and circulate them, we had to work out some procedural questions. Some of these procedures required several iterations before we had workable plans.

a) Who was to catalog the new materials? The 1.5 FTE of map librarians cataloged all maps and atlases for the library system, but the cataloging department cataloged digital materials.
b) Should the CD-ROMs and data sets circulate? The library already had a sizeable selection of magnetic tapes, floppy disks, and CD-ROMs, most of which circulated; these latter were mostly government published. Many of the GIS products were licensed, necessitating new procedures.
c) How should the CD-ROMs be processed and marked so that student assistants could shelve them accurately? Who would do that processing?

Procedural Factors That Should Have Been Considered, But Were Not

a) Where would the manuals be shelved? We were taken by surprise by the number of manuals and tutorials that appeared with the software. Like most libraries, we had been out of space and needing to do constant shifts for some years.
b) Who would answer the consequent reference questions? Reference for the Earth Sciences and the map collections had always been integrated; whoever got the question tried to answer it. However, it quickly became apparent that we would need, at least for the near term, to separate out GIS reference.

STAFFING

In order to understand how the implementation of GIS services impacted the work of the unit as a whole, think of the Branner library as being composed of two parts or sections: The Earth Sciences Collection, and the GIS and Map Collection. The current GIS and Map Collections section of the Branner Library consists of 3.2 FTE of staff. (See fig. 1 again for changes in staffing pattern over time.)

1. GIS & Map Librarian and GIS Bibliographer 1 FTE (See Appendix 1 for Position Description)
2. Map Cataloger & Selector .5 FTE (See Appendix 2 for Position Description)
3. GIS Specialist 1 FTE (See Appendix 3 for Position Description)
4. GIS Student Assistant .2 FTE (approximately)
5. Map Student Assistants .5 FTE.

The above figures do not give the whole picture. Part of the work done by and for the section is integrated into the work done in other parts of the Earth Sciences unit and the library system, as sketched in the following sections.

Acquisitions
The .5 FTE Earth Sciences Acquisitions staff member processes book and CD-ROM acquisitions for the GIS and Map Collections. Ordering of GIS and map materials is done directly by the GIS and Map librarians, via the main library's Technical Services Acquisitions Section. Some GIS data is taken from Web and FTP sites by the GIS Bibliographer and the GIS Specialist. Additional materials are received on deposit, as gifts, or by exchange. The map student assistants do processing and receipt of GIS materials.

Cataloging
Cataloging of books, journals, and ESRI product software is provided by central Technical Services. The GIS & Map Librarian catalogs all digital data and maps.

Cataloging the ESRI software and manuals proved to be particularly challenging. The manuals often went out of date, making the cataloging extremely staff-costly, and it was difficult for patrons to find the correct manual to use with the edition of the software that they were using. After some time, it seemed to make the most sense to break down the cataloging into three categories: ESRI ArcView programs and extensions with manuals, ESRI ArcView stand alone products with manuals, and ESRI dataset with manuals.

ESRI ArcView programs and extensions receive their own catalog record, one per program. The record describes the program itself with a 590 field (local note) to reference the accompanying manual. A set record was created that describes all of the manuals for these programs and extensions in one cataloging location. In the local note is a description of the program that accompanies the manual. ESRI ArcView stand-alone products are cataloged in much the same way with separate cataloging records for the programs and their accompanying manuals. Again, local notes are used to tie the two records together. The ESRI datasets with accompanying manuals have one cataloging record that describes both the program and the manual. If the shelving locations are different for the software and the manual, a local note describes the location of the two items. See Appendices 4 and 5 for examples of the cataloging records.

Circulation
The Earth Sciences staff handling circulation (an estimated .5 FTE worth of staffing effort of the people working in the unit as a whole) and student assistants provide all circulation of GIS materials via the automated circulation system. Staff members are all trained to recognize for which items they must get a license disclaimer form (fig. 2) before circulating the item.

Fig. 2. DISCLAIMER FORM

End User license agreement concerning ESRI (Environmental Systems Research Institute) products.

I am currently affiliated with Stanford University. I understand that products provided under this agreement are to be used only for instructional, research, or administrative purposes. Use of the licensed Programs for profit, private gain, or other Commercial use is an express violation of the agreement. ESRI software can only be installed on campus-owned computer(s) and/or specific computer network(s).

Signature:
_____

Printed Name:
_____

Date:
_____

Status: UG Grad PostDoc Faculty Staff

Training remains an ongoing task within the unit. In an effort to make it easier for staff working the circulation desk, each item requiring a disclaimer form is color tagged and every effort is made to ensure that the correct circulating information (non-circulating, one-day, four-weeks, etc. per patron category) is loaded in the circulation records. Shelving of GIS related books (including manuals) and CD-ROM products is done by these student assistants.

Software Installation and Maintenance and Equipment Maintenance

The GIS Specialist and the GIS Student Assistant are responsible for the four GIS workstations, plus the GIS software and products on the end-user MAC. Some desktop computing support is provided by the GIS Specialist to the Branner Library staff. Non-GIS, digital cartographic materials are made available via the Earth Sciences section end-user workstations.

SERVICES OFFERED

Most of the GIS services provided are those typical of any traditional public services units (fig. 3). Faculty and students are made aware of the services via the web site http://www-sul.stanford.edu/depts/gis/overview.html.

Fig. 3. TYPES OF GIS SERVICES CURRENTLY OFFERED

- Data Collection or Collection Development
- Reference
- Teaching
  - Access to Tutorials
  - Bibliographic Instruction
  - Coordination with TAs for GIS in classes
- Access to Licensed Software
  - Campus Site Licensed
  - Limited Access Software and Data
- Maintenance of Web Page
- Cross communication of the GIS community - a multidisciplinary group

Collection Development

Officially the map collection development policy states: "The Map Collections and the Geographic Information Systems units within the Earth Sciences Library support the spatial data research and instructional needs of all Stanford University departments plus administrative units." (See Appendix 6.) In fact, for the first few years of the service, much of the data acquisition was user request driven. In the last two or three years data has also been acquired in anticipation of demand by one of the research programs. While the library cannot afford to buy all data appropriate to campus programs, much is purchased for the local area, California, the adjacent states, and other areas of major Stanford research interest, such as China and Mongolia. However, in a medium that is constantly being updated (both the technology and the data), we are hesitant to buy too much without direct programmatic need.

Reference Services

Only the GIS & Map Librarian and the GIS Specialist provide GIS reference. This service is provided 2PM to 5PM Monday through Friday (or 7.5 hours of reference time per week per FTE). If the current GIS Student Assistant has sufficient background he or she also provides minimal reference assistance. The GIS & Map Librarian also has about 6 hours of Earth Sciences Reference duty. During slower parts of the Academic quarter, she is scheduled for both kinds of reference duty at the same time, with back up from other staff.

Many reference questions are for data (paper or digital) about a certain area, at a given time, which will show particular kinds of information (elevations, environmental data, demographic data, etc.), perhaps from a particular kind of sensor or platform (specific LANDSAT flights and spectral bands). These searches can be difficult and time consuming and involve a variety of databases (Melvyl, World Cat, RLIN, National

Geological Map Database, GeoRef, etc.). Frequently the search references a multiplicity of web sites, or may involve contacting other cartographic materials collections to obtain the material on interlibrary loan (ILL), getting in touch with vendors for purchase, or advising users where it may be available. Filling needs via ILL is rare, because most purchased data has licensing restrictions. Most users need assistance with using GIS products and software in the library, ask for advice on creating or editing digital cartographic products of their own, or need assistance in integrating varying types of data into their specific projects.

Bibliographic Instruction
The required first step for any Stanford student wanting to begin working with GIS is to learn the basics of GIS by using onsite tutorials or taking ESRI virtual classes. After becoming familiar with the software, they are encouraged to visit the Branner GIS web pages that detail how to find data and start a project. Technical assistance is available to aid students in getting their projects off the ground.

In addition to one-on-one and small group reference interactions, the GIS & Map Librarian and the GIS Specialist make several presentations each year to classes, at the request of the faculty members, and to many small groups (both on-campus groups and visitors, administrative and academic). Each presentation is specifically tailored for the group.

The original Electrical Engineering class is still a heavy user of GIS. In order to handle the heavy reference load from this class, the library staff worked with the faculty member to have the TA based in the library each afternoon in order to handle the bulk of the questions. GIS staff work closely with the TA to prepare for the course. We have used this class as a model for handling other courses interested in utilizing our GIS services.

Access to software
Software and datasets are available for download from a server, through CD-ROM's checked out from the library, and also loaded onto workstations within the library.

Web Page Construction and Maintenance
The GIS & Map Librarian and the GIS Specialist share the work on the GIS pages, with some assistance from the GIS Student Assistant. In addition to making the services and collections more user self-reliant, these pages form an integral part in the maintenance of the ESRI site license procedures.

PROGRAM COSTS
Staffing costs have been very significant. We were not so fortunate as to get incremental staff for this additional service. As part of some staff reorganization within the department, we were able to come up with a GIS Technical Specialist position in addition to the GIS & Map Bibliographer Position. Part of the cost of the new service is that some maps are not getting cataloged at all, minimal records are produced for others, and some copy cataloging has been pushed to student assistants. Other costs included less computing support for staff across the science libraries and more reference hours per librarian and senior specialist, in spite of a reduction of reference hours offered to faculty and students.

Staff Training
Because of the complexity and frequent upgrades of GIS software, it is critical that the GIS & Map Librarian and GIS Specialist attend vendor-supplied training and professional meetings. We estimate that $5,000 -$7,500 is needed annually to support the two of them.

Equipment
We currently have four Windows NT and one Macintosh workstation to provide student and faculty access to GIS software and data. Two staff machines also contain GIS software and data. For input/output of GIS materials, we have one 8x14 Jade Scanner, one HP Laserjet B/W Printer, and one Techtronix Color Printer. See figure 4 for details.

This equipment is not adequate to support the program. We also need a plotter, a scanner, and significantly more server space. Users may download GIS programs from our web site; we are currently using about

550Mb of server space. In addition to software, a limited amount of our GIS data is stored in this same server space. GIS data files are usually large, so all of the current, appropriate data cannot be made available for download. This creates inefficiencies for both GIS staff and for patrons; having access to our digital data via the web saves patron and staff time. This frees more time for technical support and data acquisition.

Fig. 4. IN LIBRARY GIS WORKSTATIONS

- There are 4 Pentium PCs dedicated to GIS in Branner. (See below for Computer specs)
  - ArcInfo, ArcView GIS and its extensions are installed on each.
  - Each computer runs Win NT 4.0 and requires an account & password for use.
  - Patrons must sign up for computer time. Sign-up sheets are available beside each computer.
- There is one HP LaserJet 5M B/W printer and one Tektronix Color Laser printer for final maps.
- There is 1 Color Scanner -- 1 mac scanner attached to the Mac G3, which also has ArcView GIS.
- There is 1 Cd-Writer Drive (External): This drive is for duplication of site-licensed ESRI CD-ROMs. Any patron wishing to have personal copies of ESRI software for on-campus use may access this drive upon request.
- There are 2 Zip 100 Drives, one on "GIS2" and one on "GIS 3".

Machine Specifications:

Machine:	**GIS1:**	**GIS2:**	**GIS3:**	**GIS4:**
Pentium Pro	333 MHz	200 MHz	300 MH	500MHz
RAM	128 MB	128 MB	256 MB	128MB
Hard Disk Space	8 GB	9 GB	22 GB	6GB
Windows NT:	4	4	4	4
Local Drives	C,Q	C,F,G, D-Zip	C,E,K	C
Mapped Network	F,G,E,K	E,K,Q	F,G,Q	E,F,G,K,Q

Another critical issue is machine upgrades, particularly for the GIS workstations, which need to be very large and fast, due to the sizes of the files and the software. We have requested that all of the machines be upgraded at once, since if the machines are acquired at different times they will be different; different machine configurations require that the software be loaded separately. It would be much more efficient for staff to set up one machine with all of the software packages and then ghost that image onto the other three machines.

CONCLUSIONS

On the negative side, it has proved difficult to carve out a new service from the existing staff, with no lessening of the previous workload, even though our staff is larger than that of many Earth Sciences Branch Libraries.

On the positive side, the use of GIS services has continued to grow, consistently outstripping the resources available. There are workstations now sited in both the Earth Sciences Library and in the new Social Sciences Research Center in the main library. The in-library GIS services are being used primarily by undergraduate majors, graduate students, faculty, and others involved in research. Relatively few classes are making much use of these library workstations and software; software distribution to workstations, via the web and cd-rom checkout, is meeting most classroom and other group needs. We don't have statistics

on how many students or faculty have used GIS to further their research, but we do know that as of January 31, 2001, 255 different users have downloaded one or more ESRI products to their Stanford classroom, laboratory or office workstations. These users are from every school at the University, except for the Law School (see fig. 5). Each site of downloaded software may represent several users in a laboratory, classroom or research group setting. The two largest groups of users who are using GIS on their workstations outside the library are from geology and biology, so the Earth Sciences Library is serving our primary clientele directly despite our original concerns. Thus the program is definitely meeting a need for spatial information resources and is properly part of the services of the Earth Sciences Library and Map Collections.

Fig.5. CURRENT NUMBER OF WORKSTATIONS WITH ESRI PRODUCTS WHICH HAVE USED DOWNLOAD OPTION

School/Administrative Unit	***Number of Workstations**
University Administration	21
School of Business	4
School of Earth Sciences	95
School of Education	6
School of Engineering	24
Humanities: School of H&S	1
Social Sciences: School of H&S	6
Sciences: School of H&S	45
School of Medicine	7
Stanford University Libraries	24
Other	2

*1 Workstation may be serving several people in a lab. or workgroup.