Planning For GIS In Libraries: Decisions, Choices and Opportunities*

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Internet. National Research and Education Network. Information Superhighway. Information Age. National Spatial Data Infrastructure. Geographic Information System. Almost every library and librarian is trying to deal with changes and questions about the future. Map librarians and libraries are no different. Mentioning the words Geographic Information System or its abbreviated form, GIS, in a group of map librarians these days will elicit one of three reactions. One response is to eagerly accept and acquire the equipment and software needed to operate a GIS in a library. Another is to totally ignore this new technology; this response often comes from people who believe that if the data used with a GIS were worth anything, the government would print it (a somewhat short-sighted reaction, because electronic access to this data facilitates its use and analysis). The third possible response is the one most of us adopt: we are aware of the new technology and will introduce it some day, but we have some questions that need to be answered before we proceed. The questions concern the technology, systems, functions, and hardware that are needed in a map collection, and the map librarian's role regarding electronic map resources. These questions should be answered while planning for the electronic map library.

I started thinking about the map library of the future when I was asked to plan a new facility. I began by reading articles on electronic libraries and taking GIS classes. Then, a patron from a local consulting firm called to request a slope map for a specific area of Wyoming. Although the United States Geological Survey (USGS) did produce a few slope maps, the only ones I had seen were labeled as experimental products, and none had been published for the area of interest. After this reference exchange ended, I realized that with what I had learned in my GIS classes, and considerable time on the Sun workstation, *I* could produce a slope map. This prompted the first of many questions related to GIS in Libraries:

- *What is the role of the map librarian with respect to this new technology?*
- *Should the librarian generate specialized maps on request or allow patrons to generate their own?*
- *What impact does this have on the training we receive in library school?*

What is the role of the map librarian with respect to this new technology?

On discussing the second of these questions with my GIS professor, he asked whether I wanted to be a librarian or cartographer. After a bit more contemplation, I posted these questions to the listserve Maps-L to generate some discussion. Since then, I have been trying to develop a vision of the map library of the future and to make some necessary decisions about the choices that are available.

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TECHNOLOGICAL CONCERNS

The first decision that must be made about GIS in libraries is whether to acquire this new technology. Given the variety of digital spatial data available on CD-ROM and the Internet, it appears that this choice has already been made. Libraries will have to accommodate new technology in order to survive. Those that choose not to acquire GIS technology will probably just circulate data on CD-ROM and may offer Internet access, but personnel at these libraries will not be expected to assist patrons using the data. Libraries that adopt this model of service to electronic information will soon find that they are warehouses rather than information providers.

SYSTEM CONCERNS

Librarians faced with choosing a geographic information system need to answer a number of questions before selecting a system. The primary question deals with defining the functions needed for the library. ESRI's *Understanding GIS* (1990) states that a GIS is "An organized collection of computer hardware, software, geographic data and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information." Given this definition, libraries interested in acquiring this technology need to choose whether to acquire a full or partial geographic information system for patron use. With a full system, patrons would be able to create, access, retrieve, process, analyze, and store cartographic data. Patrons using a partial geographic information system would be able to select, view, and combine data, as well as rotate, scale, and transform images. Patrons using either full or partial systems would also be able to print maps if they wish. The decision to acquire a full or partial GIS for a library should be made based on the library's goals. If the goal of the library is to provide the information and technology needed to use and analyze all forms of spatial information, then a full GIS workstation will have to be acquired. Libraries that wish to allow patrons to access digital data from various sources to create maps may prefer a partial system. In either case, some specialized functions might also be useful. Many collections that maintain copies of all current 7.5-minute U.S. topographic maps might be able to eliminate less-used maps if this topographic data were available via the Internet. At present, creating topographic maps from digital elevation models can be done only on UNIX-based systems.

If the goal of the library is to provide the information and technology needed to use and analyze all forms of spatial information, then a full GIS workstation will have to be acquired.

A full geographic information system includes a workstation running either UNIX or DOS, one or more digitizers, a scanner, one or more laser printers with graphics capabilities (both black and white and color), a plotter, and the equipment needed to both access and store data sets. On this system, users would be able to create new coverages, select, display and overlay coverages, perform analyses, and create and print maps. Before opting for a full system, the potential users and their needs should be analyzed. The library should provide the level of service needed by its primary patrons. However, providing for the needs of other library users, such as patrons from local consulting firms and information brokers, should be based on the library's goals and priorities to provide service to these patrons. If the system will be located in a university library, and similar equipment is accessible in a laboratory for student and faculty use elsewhere on campus, a full GIS may not be needed in the library.

Libraries that make a full GIS available to all patrons will have to set some policies concerning its use. These policies should address the length of time a patron can use the equipment in a single day, fees for use by non-primary patrons, and services (such as digitizing data and generating maps on demand) that will be offered by the library and its personnel. The library might also wish to adopt some rules on whether copies of new

coverages or files created using library scanners should be retained by the library for its collection.

Libraries and map collections that do not have space or budgets to supply all walk-in patrons with the equipment to digitize and analyze data will probably adopt more limited goals, such as providing access to digital spatial data and the technology needed to use it. This data may be on a compact disk issued by the Government Printing Office (GPO), in a dataset created by a state government agency, or in a database that is accessed via the Internet. Patrons in these collections will be able to select, view, and combine data and print maps but will not be able to create new coverages. The ability to do complicated analyses might be blocked or eliminated entirely.

HARDWARE CONCERNS

In addition to deciding about software, choices will have to be made concerning the hardware to be acquired. The major choice on equipment is whether a DOS or UNIX system will be purchased. The type of system selected should be based on local needs. Three-dimensional capabilities used to analyze topography, slope, and aspect are only available on UNIX workstations. Data storage is also a concern. A map library may opt to acquire its own server to store data or access data on a server maintained by others. If the collection acquires a separate server, the equipment, and the data on it, will have to be maintained by the library. Files on a server may have to be backed up on occasion. If the library does not have an in-house systems person, other options, such as contract personnel, will have to be available. The decision about a main storage device should consider all possible factors. In addition to a main storage unit, peripheral storage devices will be needed because even simple coverages are sometimes too large for a floppy disk. The library might need equipment to enable patrons to save files on tape cartridges or optical disks. Providing equipment to store data on these media is another expense.

The final hardware decision is whether the library will maintain plotting and printing equipment capable of outputting high-quality maps or use printers and plotters in another facility, such as a campus computing or reproduction center. This decision should be made based on the number of patrons that will be using the library facility and its equipment. University libraries may wish to use plotters available elsewhere on campus, at least at first, because demand may not be high enough to justify the purchase of a high quality plotter for the library. The ability to share access to plotters, rather than purchase them, assures the library that its patrons will always have access to the most current equipment. Smaller printers with graphical capabilities will also have to be available. Laser printers can be used for many applications, including printing of small maps, so a laser printer should be available in the collection. However, color printers, like plotters, can be acquired or shared, depending on local demand. The library's cost of printing or plotting a map should be recoverable, no matter how maps are printed.

SOFTWARE CONCERNS

Once a decision has been made about the hardware needed by the library's primary patrons, selection of software can begin. The steps involved in choosing software include:

1. Determine the functions and other criteria needed on a library-based geographic information system.

2. Identify the geographic information systems capable of performing the functions and meeting other criteria determined in step 1.

3. Test the potential systems identified.

4. Select the software with the best performance.

Although each librarian will have to develop her or his own selection criteria, some general specifications can be identified. Ideally, a library-based geographic information system should be user-friendly, capable of accommodating new data sets, connected to the Internet/NREN (so that data from other sites can be accessed and acquired), and have a reasonable cost. The definition of the words "user-friendly" varies greatly. User-friendliness needs to be judged by patrons and library personnel not computer programmers. Since new datasets received from GPO or other sources need to be installed, the system should be able to accommodate new data sets easily. The library should also be able to add disclaimers for data received through GPO, state governments, or government-run file servers. In urban areas, information brokers might attempt to download files from digital databases in a library and offer them for sale. Since data received through the Depository Library Program is not copyrighted, patrons who download datasets or produce specialized maps from that data with the intent to sell them should receive a warning from the system that the data and maps cannot be sold. However, both the patrons and library personnel should be allowed to charge a reasonable rate for the time required to download data or create maps.

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The major functions needed to perform specific tasks are easily identified, but additional functions might be added to the "wish list." For example, a map collection could use a GIS to help patrons locate maps by creating a graphical index to the collection. Use of a GIS to provide such an index would streamline the reference process in the map collection. The index could be developed from the 034/255 fields of MARC records or by creating entire data files on the map collection. Patrons would simply outline the area of interest, specify the range of scales and subjects for the maps desired, and retrieve a list of maps held by the library for that area. Alternatively, a GIS might also be interfaced with an on-line catalog to provide a similar map reference system.

THE MAP LIBRARIAN AND LIBRARY SERVICES

Whether we like it or not, digital spatial data and geographic information systems are redefining the role of the map librarian and the services we provide. We are fast approaching the age of the electronic map. The electronic map librarian will be required to identify, locate, obtain, and create access to coverages, and may be asked to create maps on demand, install new datasets, and provide reference service or clearly written guides on use of the hardware and software available in the library. If a library has a full system, the map librarian will have to be an expert in that system. These expectations will probably be added to our present job descriptions. Cartographic information specialists will have to carefully monitor their workloads, because responsibility for electronic map technology will be an additional duty; normal activities will not decrease because of electronic map formats.

CONCLUSION

Before a library invests in the GIS technology required for the ever-increasing number of spatial databases available, several questions need to be answered. To choose a system, basic knowledge of the capabilities of geographic information systems is needed. The functions needed in the library should be determined based on the goals of the library and the collection. Once defined, other criteria need to be considered, including the ability to adapt the system to local needs and requirements, user-

friendliness, and cost. Map librarians and libraries will have to analyze their needs to choose the system that best meets the local requirements. Additional work needs to be done to evaluate the capabilities of specific geographic information systems and their suitability for library settings. Alternatively, librarians should work with GIS vendors to help them develop systems that will meet the requirements of libraries or create interfaces that could be used in libraries on existing geographic information systems.

REFERENCE

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What You'll Need To Know To Use GIS in 2001*

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A student who enters a college or university in 1998 will, in the normal course of events, graduate, and, one hopes, seek gainful employment in 2001. Many students who major in geography will specialize in geographic information systems (GIS) and related skills because of their interest in life after college. GIS is currently a fifteen billion dollar industry that barely noticed the recent recession and that gives every promise of continued rapid growth over the next decade.

Training to use geographic information systems varies greatly at the moment. Although most college and university geography programs offer GIS instruction, it is also provided in departments of agronomy, computer science, electrical engineering, forestry, geology, landscape architecture, planning, and surveying engineering, among others. Some progress toward standardization of GIS curricula has begun under the leadership of the National Center for Geographic Information and Analysis (NCGIA), but variations in GIS curricula will and should continue to exist. Geographic information systems are supple tools, and different applications will continue to demand different curricula.

I will, therefore, suggest what geography students should be taught beginning in 1998. There will doubtless be considerable commonality between what I will suggest and what a forester or a planner might propose. Less overlap would be evident between the curriculum a computer scientist would prefer and my specifications. Because 1998 and 2001 are a long way off in industry and technological terms, I will focus primarily on general classes of attributes rather than on specific skills.

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