The Internet, the State Library, and the Implementation of Statewide Information Policy: The Case of The New York State GIS Clearinghouse

Sharon S. Dawes, Center for Technology in Government

Sharon Oskam, New York State Library

This article appears in Volume 7, Number 4 of the Journal of Global Information Management, October-December 1999, pp. 27-33

The Internet, the State Library, and the Implementation of Statewide Information Policy: The Case of The New York State GIS Clearinghouse

Geographic Information Systems (GIS) are used by government, researchers and businesses in a wide range of domains including economic development, environmental management, education, health, human services, infrastructure management, and disaster response. Most experts agree that the most expensive part of a GIS program is the creation of spatial data. Some estimate that as much as 80 percent of the cost of any application is attributable to the expenses of acquiring and geo-coding information (Thapa and Bosler, 1992) . Often the information needs of different GIS applications overlap and data created by one organization can be used by others. Data sharing can therefore help reduce costs of GIS application development and yield considerable benefits and efficiencies. To achieve this purpose, the State of New York has implemented a GIS Coordination Program which features an Internet-based GIS Clearinghouse operated by the New York State Library (Dawes and Eglene, 1998). In this program, the Library acts as a critical implementer and value-added facilitator of an important new state information policy that has influence over spatial data development, exchange, and use at all levels of government and in the private and not-for-profit sectors.

The Clearinghouse provides the conceptual framework and operational platform for a fully functioning data cooperative which is the heart of the New York State GIS Data Sharing Policy. The Library-based Clearinghouse has become the essential portal to many newly identified information resources. It organizes the data descriptions, provides a publicly available and easy-to-use means of access, promotes sharing, points the way to education and other services, and generally makes possible the vision of a living data resource.

LIBRARIES AND GIS INFORMATION RESOURCES

Library services related to GIS are a recent development and have been the subject of some research and much experimentation during the 1990s, mostly as an extension of traditional library functions. Much of the literature focuses on providing GIS services directly to library patrons (see for example, Boisse and Larsgaard, 1995; Abbot and Argentati, 1997). Soete (1995) notes key decisions that library planners must make about GIS services: what kind of service, how to build collections, staffing, learning and education programs, partnerships, data storage methods, and costs. In making these decisions, libraries need to attend to both general public (Gluck, 1995) and non-traditional (Argentati, 1995) user needs, to building relationships with other GIS experts (Cobb, 1995), and to providing convenient means of access to spatially referenced information, as well as primary and secondary literature on GIS (Longstreth, 1995). Others emphasize the shift that GIS represents from "documents" to "datasets," and discuss the importance of collecting, describing, and accessing spatial data (Lamont, 1997; Hunt & Joselyn, 1995) through use of the national standards for geo-spatial metadata (Domartz, 1995).

Very recently, the Internet has become a major factor in the provision of spatial data and software to Library patrons. A variety of Internet-based tools now offer both access to remote data and interactive analysis (Bergen, 1995; English and Margulies). The advent of interconnected networks also makes libraries a player in the development of the National Information Infrastructure (NII) (Lutz, 1995). Three major examples of NII-type GIS resources are the National Spatial Data Clearinghouse operated by the Federal Geographic Data Committee (Domartz, 1995), the federal Government Information Locator Service (Moen, 1995) and

cooperative efforts between libraries and government agencies in the US Global Change Data project (Hill, 1995).

In 1997, *The Journal of Academic Librarianship* published a special issue devoted to the questions and choices libraries now face (Hernon, 1997). These include the level of staff expertise in GIS, the geographic and temporal coverage of library GIS holdings, and the range and depth of service to patrons. Emerging networks of relationships and information sources pose an interesting choice for libraries: should they focus on direct provision of GIS information and services or should they serve as guides to information housed elsewhere? (Stephens, 1997) The effort described here shows how libraries might do both. It builds on the traditions of librarianship, but also illustrates how a non-traditional role for the library can add considerable value to the entire infrastructure of publicly available information.

EVOLUTION OF THE NYS GIS COORDINATION PROGRAM

In the early 1990s, New York State lagged behind most other states in term of GIS coordination and was one of only four states without a formal or ad-hoc coordinating body (Healy, 1994). However, New York State benefited from many geographic data resources, deep pockets of GIS expertise, and a number of localized coordination efforts. The central issue facing New York was how to organize and sustain a collaborative effort across all levels of government and with the private sector that would take advantage of the analytical power of GIS to improve government services, drive down costs, and stimulate economic development. Significant barriers to GIS data sharing in NYS were identified in a 1995 study by the Center for Technology in Government (CTG) (Kelly et al, 1995: 29-36):

- Lack of awareness of existing data sets led to duplicate data development and failure to pursue projects for which agencies did not have their own data.
- Lack of or inadequate metadata did not allow potential users to easily determine the suitability of a particular data set for a particular purpose.
- Lack of uniform policies on access, cost recovery, revenue generation, and pricing resulted in an inconsistent mixture of free access and fee-based pricing.
- Lack of uniform policies on data ownership, maintenance, and liability made agencies reluctant to share their data freely.
- Lack of incentives, tools, and guidelines for sharing left agencies to re-invent the rules for each new sharing project.
- Absence of state-level leadership prevented New York from leveraging a considerable array of uncoordinated assets, and from participating in the national movement to create a spatial data infrastructure.

To demonstrate some possibilities for addressing these problems, CTG, in cooperation with many state and local agencies, produced an Internet-based prototype spatial data clearinghouse that contained a metadata repository and search capability. Selected spatial data sets maintained by a variety of state and local agencies were described using portions of the Federal Geographic Metadata Standard and loaded into the prototype database. By using the search and query capabilities of the prototype clearinghouse, a user identified a dataset of interest, and linked to the full metadata document to obtain a fuller understanding of its properties. The distribution section of the metadata contained instructions for obtaining the dataset. Those instructions, supplied by

the metadata provider, could include on-line file transfers, electronic order forms, or instructions for ordering by phone or mail. The prototype Clearinghouse was well received within the GIS community and experience in building and using it led to specific recommendations (DiCaterino, 1995) for building a permanent system.

In a parallel development, the State Legislature established a temporary state GIS coordinating council charged with reporting to the Governor and the Legislature recommendations for improved coordination of GIS in New York State. Among the Council's highest priority recommendations was the creation of a permanent GIS coordinating body and the establishment of a clearinghouse for spatial information (Temporary GIS Council, 1996). Accordingly, the NYS GIS Coordination Body was established as a standing program of the newly established New York State Office for Technology (OFT) and charged with a host of policy-oriented goals--and the development of a spatial metadata and information clearinghouse at the New York State Library.

The first statewide policy on GIS was issued by OFT in September 1996 (NYS OFT, 1996). It established a framework for the development of a statewide GIS Program and created a broadly representative GIS Coordinating Body drawn from state and local government and the private sector. Working Groups and Advisory Committees were initiated to focus sustained attention on such issues as data sharing, education, communication, and private sector concerns.

The Data Sharing Policy and Cooperative

The Data Coordination Working Group of the Coordinating Body developed an overall Data Sharing Policy for GIS (NYS OFT, 1997). This policy directs that a NYS GIS Data Sharing

Cooperative be established in order to provide an organized mechanism to share GIS data easily. It further directs that all NYS agencies join the Cooperative by signing the *NYS GIS Cooperative Data Sharing Agreement*, created by the Legal Working Group. Through the Cooperative, public agencies gain access to GIS data of all the members at virtually no cost. Agencies do not need to own data to join the Cooperative; however, as Cooperative members, they are obligated to contribute corrections and enhancements that they make to any data set obtained through the cooperative. Each data set has only one Primary Custodian designated by the Coordinating Body. The designated agencies are responsible for the maintenance of these data sets as well as their distribution to other agencies needing to use them (Johnson, 1997). A comparable data sharing agreement for local governments and not-for-profit organizations was released in February 1998 and all local governments were invited to join. Agreements with federal government agencies and several other states have also been signed. Data sharing agreements between public agencies and consultants are currently under development. More than 150 agencies had signed agreements by mid 1999.

EVOLUTION OF THE NYS GIS CLEARINGHOUSE AT THE STATE LIBRARY

The NYS GIS Clearinghouse, created and established on the World Wide Web (http://www.nysl.nysed.gov/gis/) by the New York State Library, is the lynchpin of the data sharing cooperative. It includes a metadata repository describing GIS data sets held by many different organizations as well as information about how to obtain the data; in selected cases the data resides in the Clearinghouse itself. It also has extensive information about New York's GIS Data Sharing Coordination Program, information on and links to GIS education and training

opportunities, other state and federal GIS resources, GIS user groups throughout New York; and GIS-related listservs.

The Metadata Repository, an enhanced version of the Center for Technology in Government prototype, was created within the Clearinghouse to allow producers of geographic data to describe the data sets they have available so that users can identify existing data before they attempt to create new data sets. Data producers describe their data sets using the Federal Geographic Data Committee Standard for Digital Geospatial Metadata. It includes information about who produced the data, the geographic area covered, the data set category or theme, scale, accuracy information, and how to obtain the data sets. Users access metadata by doing a search online. A list of data sets is returned as the result of a search and the complete metadata record for each of these data sets can be viewed to determine the relevance of the data to the user's need. Users can then contact the data owners to obtain the data they want.

The Metadata Repository and all the ancillary services are available to anyone who visits the Clearinghouse on the Internet. In addition, members of the Data Sharing Cooperative can have direct access to selected data sets at the NYS Department of Transportation and several other organizations who have made their GIS data available through the Internet.

Why the Library?

The New York State Library (NYSL) has made special GIS services available free of charge or at minimal fees since 1992 when the Association of Research Libraries and ESRI entered into a partnership to bring GIS technology into libraries (Strasser, 1995). The Library's early involvement in GIS services for its patrons brought its expertise and services to the attention

of state agencies involved in GIS and gave the Library a substantive role in the discussions of the Temporary GIS Council and the subsequent GIS Coordinating Body.

The Library, with its expertise in collection management, cataloging, and description of information resources, also had key information management skills that existed in no other public agency. More importantly, NYSL was the logical place to host the Clearinghouse because of its neutrality in the territorial environment that can sometimes occur in state government and because it carried no negative 'history' with any state agencies. The Library staff are seen as capable information professionals without an agenda to push. None of the state agencies which are GIS users wanted to see the Clearinghouse become the program of another operating agency, since they believed that the Clearinghouse might confer special status and give the impression that the agency which operated it is "the leading" GIS agency in the state. Since the Library's mission is information dissemination and services to the public, not GIS applications, it was not considered a rival, and, in fact, was regarded as the best choice at a very early stage.

NYSL was enthusiastic about hosting the Clearinghouse because it coincided with a priority goal to increase statewide access to electronic information. Library administrators also felt that NYSL involvement with the Coordination Program and the Clearinghouse built on existing experience with GIS and could take the Library to another level of service to the people of the State. Lastly, GIS data was viewed as another form of government information. NYSL has been disseminating government information since the 1800's through its New York State Document Depository Library Program; it is also a Regional Depository for United States Government information and a central repository for New York State Government information. Hosting the Clearinghouse allowed the Library to augment its role as a provider of government

information by implementing the Clearinghouse within the Government Documents unit.

When the Library first agreed to host the Clearinghouse, it was not clear what kind of support the site would need in terms of staff or equipment. There is no designated funding for either the Coordination Program or the Clearinghouse to hire staff or purchase equipment and software. The concept of "recycle, reuse," which is the basis of the Data Sharing Cooperative, was therefore carried over into establishment and maintenance of the Clearinghouse Web site. The Library added the Clearinghouse site to its existing Web site server and managed it with existing software or with software downloaded without charge from the Web.

This same concept of "recycle, reuse" was also applied to staffing. The Associate Librarian responsible for the Government Documents Unit within NYSL became the Coordinator for the site. Her responsibilities include overall supervision of the site at NYSL, outreach to state agencies and local governments, promotion of the Coordination Program and Clearinghouse, and liaison to members of the Data Sharing Cooperative. Technical expertise comes from the Associate Librarian for Automation, a Computer Programmer/Analyst and a Senior Librarian. Neither the Senior Librarian nor the Computer Programmer/Analyst had prior experience with Web development or GIS. They used tutorials available via the Web and materials available at the Library to gain the necessary expertise to update and maintain the site. Their responsibilities include general maintenance of the site such as updating pages, creating new pages, and verifying information and links on the site.

NYSL staff also developed the New York State Metadata Entry System, which is a modified version of the form available from the Federal Geographic Data Committee (FGDC), through which users can enter metadata records into the Metadata Repository where they will be

searchable through a Z39.50 search engine. Clearinghouse technical staff also work closely with the agencies and local governments that are storing their data on the Clearinghouse to ensure that it is accessible and that any necessary instructions or tools are included in the description of the data set. Currently, the equivalent of 2 full-time professionals work on the administration and maintenance of the Clearinghouse site.

Initially NYSL agreed to host only the metadata repository, but it soon became apparent that the ideal situation would allow users to download some data directly from the Clearinghouse. To facilitate this exchange of information, NYSL offered to house data on its server for those agencies or local governments that either did not have a Web site or were not able to handle the volume of requests for their data. In order to house the growing number of datasets, the Library has purchased a new larger server along with extra disk space.

THE VALUE OF THE CLEARINGHOUSE

The key goal of the Clearinghouse is to promote use and re-use of spatial data. Use of the Clearinghouse and the datasets available through the Clearinghouse has therefore been of paramount importance both to NYSL and to the GIS Coordinating Body. In addition to publicizing the establishment of the site within the New York State GIS Coordination Program and via the NYS GIS listserv (GISNY-L), the Clearinghouse was registered with all the major search engines of the Web to increase its visibility. Visits to the site are logged on the front page and nearly 50,000 visitors were counted in its first two years. Usage of the site has increased steadily as it has become more well known throughout the state, with peaks occurring when there have been major additions to the site, such as the addition of datasets from the Department of

Transportation, the Office of Real Property Services, the Adirondack Park Agency, and the Department of Health.

It is vital for Clearinghouse staff to be able to monitor not only how many visitors to the site, but what pages are being visited regularly. These statistics are kept on a monthly basis and are sorted by the different pages on the site. As can be expected, the most popular pages are those related to what data is available and where the user can obtain it. The most frequently and regularly visited pages are those relating to the Data Sharing Cooperative. These pages include general information on the Data Sharing Cooperative concept, frequently asked questions, and information on the participants and their data inventories. The Metadata Repository Pages are also visited on a regular basis with the browseable index to the metadata being very popular. The Site Map, a chart of the major categories of information on the site including links to the pages related to those categories is quite popular. It offers users a quick way to see all areas covered on the site and to go directly to the desired topic. The Related Sites Page and the Education and Training Pages are also visited very frequently.

As the key to implementation of the statewide spatial data sharing policy, it was imperative that NYSL develop a way to monitor the usage of the datasets available through the Clearinghouse. Daily statistics are kept on information such as what dataset is being downloaded, how often it is being downloaded, and who is accessing the data. These statistics are sent weekly to the Primary Data Custodian and also to the Chair of the Coordinating Body. This information is of vital interest because, for the first time, the actual cost-benefit of reusing data can be quantified. A key assumption behind the Clearinghouse is that it is more cost-effective to reuse existing data. These statistics now offer hard data to begin to test and refine that assumption. It

was also essential to develop a log with information on who is accessing the data because, as part of the Data Sharing Agreement, users who download data and make improvements to that data are required to send those enhancements back to the Primary Custodian of the data set. The primary custodian can then make improvements to the original data set, which then benefits all future users of the data.

The Clearinghouse continues to expand in its scope and vision. In September 1998, the Clearinghouse became a gateway to the Cornell University Geospatial Information Repository (CUGIR). CUGIR is the repository for data from the Department of Environmental Conservation as well as data on topics relating to agriculture and the environment. Through the Clearinghouse Z39.50 gateway, users are able to search for metadata from both the NYS GIS Clearinghouse and CUGIR.

With the cooperation and assistance of many of the state agencies, the Clearinghouse has added many new features to its original design. Clearinghouse staff have developed a clickable county data map of New York State. Through this map users can click on any county in the state to display a list of the datasets available for that county or links to metadata records in the New York State Metadata Repository. More recently, Clearinghouse staff have been working on a digital image map of the State. This map displayd digital raster graphics (DRGs) of New York State. The CD ROMs containing the DRGs were loaned to NYSL from the New York State Department of Health and were loaded onto the Library's servers. The map shows each county within the state and divided into quadrangles matching those stored on the Library's servers. Users can click on a specific quadrangle and view the actual image. They also have the option to download the image and data files that go with it. This map will be the basis for continued

expansion into the display of digital orthophotos on the Clearinghouse.

Strengths and Weaknesses of the Clearinghouse

The single greatest strength of the Clearinghouse is that it has done what it was intended to do: provide "one-stop-shopping" on GIS in New York State. It is designed to allow users to find and obtain data and other resources quickly and efficiently. The Clearinghouse gives users the ability to identify and access spatial data sets, and in some cases download them directly. It eliminates the excessive time and effort previously spent attempting to identify and locate, or in some cases re-create, existing geospatial data.

In just its first year, the Clearinghouse accomplished its fundamental goal to become the focal point for the Statewide GIS Coordination Program. It is the cornerstone for implementing a statewide policy for the transfer of GIS data easily among State and local governments and others at minimum or no cost. It is the one place that users can go to find out what data sets are available in the state and to download data directly from the site or from custodial sites.

The many electronic forms make it simple for users to create and submit metadata online, update personal or organizational information, or correspond with Clearinghouse staff. The listings of user groups and Coordination Program Participants provides a way for GIS users across the state to communicate and network with each other and with members of the Coordination Program. The Clearinghouse also provides links to GISNY-L and other GIS related listservs to keep its users informed. The Education and Training pages offer links to educational opportunities both on-site and online, as well as GIS related publications and resources.

The constant expansion of the site is another strength of the Clearinghouse concept. A

great deal of effort goes into exploring ways to improve the site, whether through new features such as the image map or suggestions from users, such as new user groups or links to new resources. Many of the improvements made to the site are based on ideas from members of the Cooperative or requests from its users which contribute to the effectiveness of the site in meeting user needs. Because it is a virtual, rather than a physical, resource it is possible to make changes and enhancement quickly and to respond readily to user needs and suggestions.

The success of the site was recognized in May 1998 when the Clearinghouse received the Urban and Regional Information Systems Association's (URISA) Exemplary Systems in Government Award in the National Spatial Data Infrastructure-Data Partnerships Category.

The Clearinghouse is not without weaknesses, however. The lack of formal funding for the Coordination Program and Clearinghouse is a double-edged sword. On the one hand, lack of formal funding fosters greater cooperation and collaboration between Clearinghouse staff and other state agencies and local governments to continue to make the site viable. However, without dedicated funding, the site is dependent on the continuing support of Library administration in terms of dollars and human resources. State agencies have been very cooperative in sharing their resources, but the Clearinghouse would become more institutionalized and could develop more user services if it had dedicated staff and funding.

While state agency participation is high, the much more minimal involvement of local governments and the private sector can be viewed as a weakness not only of the Clearinghouse, but of the entire Coordination Program. Local government information has traditionally been difficult to find and make accessible (Durrance, 1988). In this case, local governments have viewed the Data Sharing Cooperative with some skepticism and have been slower to join. There

are opportunities for local governments to showcase their GIS projects on the Clearinghouse, but few have done so in the first two years. This reluctance is accounted for by two main reasons. First, some local government GIS programs are reluctant to make their data freely available and are advocating for the ability to charge user fees. Second, while GIS professionals in local governments are often enthusiastic about the Cooperative, they still need to educate their administrators and elected officials about its value and implications before formal data sharing agreements can be signed. The Clearinghouse and Communications Workgroups have recently been combined with greater representation from both the private sector and local government. With increased representation, and more experience, the interests of these groups may be more fully addressed.

The relatively slow accumulation of metadata records in the Metadata Repository (about 200 at the end of 1998) has been a concern. The original metadata records from the Center For Technology In Government's prototype were converted at the start and some records were added quickly, mainly by Westchester County and the New York State Department of Transportation. To encourage agencies to describe their data holdings, the Clearinghouse offers its users multiple choices for submitting metadata and there is always the opportunity to talk with Clearinghouse staff about how to convert in-house or legacy systems. The Coordination Program has also received a grant from the Federal Geographic Data Committee (FGDC) to assist in the development of metadata. The grant includes funds for training and technical assistance for state and local governments in the form of paid interns to assist agencies in preparing metadata records. During 1999, five interns were placed in state and local government offices. Eight metadata training sessions were held across the state with more than 400 participants. The benefits of this

effort have been immediately realized: the number of metadata records doubled to about 400 by mid 1999, and data owners show increased interest in creating metadata in the future. While the Metadata Repository does not yet truly represent what GIS data is available in New York State, these efforts are clearly helping the inventory grow. The ultimate goal is for all State and local government agencies that hold GIS data sets to create metadata records and submit them to the Clearinghouse.

Future Directions for the Clearinghouse

The New York State GIS Clearinghouse has come a long way in the two years since its inception, but a number of new initiatives are underway.

One goal is to make all major GIS datasets for New York available online. This will mean more follow-up with agencies that are Data Sharing Cooperative members, but have not made their data available electronically (either through the Clearinghouse or on their own accessible sites linked to the Clearinghouse). It also means more promotion and outreach to local governments and not-for-profits that have not yet joined the Cooperative since they hold many of the important GIS datasets.

Another goal involves digital orthophotos. Although these photos have existed for many years, advancing technology has brought them into prominence. Clearinghouse staff have already created an image map which allows users to access and download DRGs generated by the United States Geological Survey (USGS). In the coming year, the Department of Transportation's digital quadrangles for New York State will also be available through the image map on the Clearinghouse. The ultimate goal for the Clearinghouse is to have digital orthophotos for all of

New York State available online, in an easily-distributed format.

The Clearinghouse is also being used to help New York address Year 2000 concerns. Key datasets have been targeted by the New York State Disaster Preparedness Commission and are being delivered to the Clearinghouse. These datasets pinpoint the locations of hospitals, schools, armories, state and other facilities with fuel supplies, and utilitity service areas that could be used in an emergency. Clearinghouse staff are working with the primary custodians of these files to ensure that the data is geocoded and is as accurate as possible. Metadata is also being created and added to the Metadata Repository for these high-priority datasets which will be made available for direct downloading through the Clearinghouse.

The Clearinghouse staff are also exploring the capability of providing simple GIS viewing online. This option would allow users to pull GIS data into a map server and be able to see an actual map and perform simple GIS operations such as zooming in and out, or querying the database.

CONCLUSION

The mission of the New York State Education Department, as identified by the Board of Regents, is to "raise the knowledge, skill, and opportunity of all the people of New York." NYSL's work in making GIS data available is helping to exploit the considerable resources of this exciting new technology for the benefit of New Yorkers and others who use the New York State GIS Clearinghouse.

The Clearinghouse provides the conceptual framework and operational foundation for implementing New York State's GIS Data Sharing Policy. This policy pertains to datasets in

active use by government agencies for a myriad of public purposes and, as such, most of them change frequently and are not candidates for traditional library collections. The State Library therefore serves as the gateway to rich data sources held by an extensive network of primary data custodians. It organizes the data descriptions, provides easy public access, promotes sharing, and links to education and other services. By playing this lynch pin role, the Library enhances the ability of scores of other organizations to use information to do their own jobs better. Although much remains to be done to completely achieve the State's vision, this non-traditional role played by the New York State Library is clearly a success - for the Library, for state government, and for the GIS community.

About the Authors

Sharon S. Dawes is Director of the Center for Technology in Government at the University at Albany/State University of New York. Sharon Oskam is Associate Librarian for Government Documents and Coordinator of the New York State GIS Clearinghouse at the New York State Library.

References

Abbott, L.T. and C.D. Argentati. 1995. "GIS: A New Component of Public Services," *Journal of Academic Librarianship* Vol. 21, Issue 4, p. 251-256, July.

Argentati, C.D. 1997. "Expanding Horizons for GIS Services in Academic Libraries," *Journal of Academic Librarianship*, Vol. 23, Issue 6, p.463-468, November.

Bergen, P.E. "Interactive Access to Geographic Information Systems and Numeric Data on the World Wide Web," *Journal of Academic Librarianship* Vol. 21, Issue 4, p. 303-308, July.

Boisse, J. A. and M. Larsgaard. 1995. "GIS in Academic Libraries: A Managerial Perspective," *Journal of Academic Librarianship* Vol. 21, Issue 4, p. 288-291, July.

Cobb, D.A. 1995. "Developing GIS Relationships," *Journal of Academic Librarianship* Vol. 21, Issue 4, p. 275-277, July.

Dawes, S. and O. Eglene. 1998. "New Models of Collaboration: GIS Coordination in New York State." Center for Technology in Government, Albany, NY.

DiCaterino, A. 1995. The New York State Spatial Data Clearinghouse Technical Report. Center for Technology in Government, Albany, NY: 1995.

Domartz, M. 1995. "Finding and Accessing Spatial Data in the National Spatial Data Infrastructure," in *Geographic Information Systems and Libraries: Patrons, Maps, and Spatial Information*, p.31-40. University of Illinois Graduate School of Library and Information Science, Urbana, IL.

Durrance, J.C. 1988. "Providing Access to Local Government Information: The Nature of Public Library Activity," *Government Information Quarterly*, Vol. 5, Number 2, p. 155-167. April.

English, J and J. Margulies. 1995. "Expanding Library Horizons Through Use of the Internet" Growth of the Internet, Past and Future," *Computers in Libraries*, Vol. 15, Issue 8, p. 41-45, September.

Gluck, M. "Geospatial Needs of the General Public: Text, Maps, and Users' Tasks," in *Geographic Information Systems and Libraries: Patrons, Maps, and Spatial Information*, p. 151-172. University of Illinois Graduate School of Library and Information Science, Urbana, IL.

Healy, D. 1994. *Survey of State GIS Coordination Bodies, Summary Results and Recommendations*. National States Geographic Information Committee, Calais, VT.

Hernon, P. 1997. "GIS as a Service Option," *Journal of Academic Librarianship*, Vol. 23, Issue 3, p. 235-237, May

Hill, L.L. 1995 "Spatial Access to, and Display of, Global Change Data: Avenues for Libraries," in *Geographic Information Systems and Libraries: Patrons, Maps, and Spatial Information*, p. 125-150. University of Illinois Graduate School of Library and Information Science, Urbana, IL.

Hunt, L. and M. Joselyn. 1995. "Maximizing Accessibilitly to Spatially Referenced Digital Dat

Johnson William. 1997. "The NYS GIS Data Sharing Cooperative: An innovative New Model for Data Sharing and Partnerships." http://www.nysl.nysed.gov/gis/coop_gis.htm

Kelly, K., and T.A. Pardo, S. S. Dawes, A. DiCaterino, W. Foderingham. 1995. "Sharing the Costs, Sharing the Benefits: The NYS GIS Cooperative Project." Center for Technology in Government, Albany, NY.

Lamont, M. 1997. "Managing Geospatial Data and Services," *Journal of Academic Librarianship*, Vol. 23, Issue 6, p. 469-474, November.

Longstreth, K. 1995. "GIS Collection Development, Staffing, and Training, " *Journal of Academic Librarianship*, Vol. 21, Issue 4, p 267-274, July.

Lutz, M. 1995. "Making GIS a Part of Library Service," *Information Technology and Libraries*, Vol. 14, Issue 2, p. 77-78, June.

Moen, W.E. 1995. "The Government Information Locator Service: Discovering, Identifying, and Accessing Spatial Data," in *Geographic Information Systems and Libraries: Patrons, Maps, and Spatial Information*, p.41-67. University of Illinois Graduate School of Library and Information Science, Urbana, IL.

NYS GIS Clearinghouse: http://www.nysl.nysed.gov/gis/

NYS Office for Technology. 1996. "Technology Policy 96- 18." September. http://www.irm.state.ny.us/policy/tp_9618.htm

NYS Office for Technology. 1996. "Technology Policy 97-6." July. http://www.irm.state.ny.us/policy/tp_976.htm

Soete, G.J. 1997. *Transforming Libraries: Issues and Innovations in Geographic Information Systems*, Volume 2. Association of Research Libraries, Office of Management Services, Washington, D.C.

Stephens, D. 1997. "Managing the Web-enhanced Geographic Information Service," *Journal of Academic Librarianship*, Vol 23, Issue 6, p. 498-504, November.

Strasser, T. 1995. "Desktop GIS in Libraries, Technology and Costs: A View from New York State," *Journal of Academic Librarianship* Vol. 21, Issue 4, p. 278-282, July.

Temporary Geographic Information Systems Council. 1996. "Geographic Information Systems: Key to Competitiveness. "Submitted to Governor George E.Pataki and the New York State Legislature. Albany, NY.

Thapa, K., and J. Bossler. 1992. "Accuracy of Spatial Data Used in Geographic Information Systems." *Photogrammetric Engineering and Remote Sensing*. Vol. 58, Issue 6, p. 835-841, June.

Center for Technology in Government
University at Albany / SUNY
1535 Western Avenue
Albany, NY 12203
Phone: 518-442-3892
Fax: 518-442-3886
info@ctg.albany.edu
www.ctg.albany.edu