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Lessons from Practice

A Guidebook to Organizing and Sustaining Geodata Collaboratives

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Foreword

Geodata and Democracy

Daniel Kemmis

From 1881 to 1894, John Wesley Powell served as Director of the U.S. Geological Survey and thus as America's chief mapmaker. It still comes as a surprise to some people that Powell should, from a position that most people would think of as a highly technical post, have made far-reaching and still closely studied recommendations about land policy and governance. But Powell knew that the way we look at landscapes—the way we map them—has everything to do with how we inhabit them.

The same is true today, and we are still surprised that it should be true. Even more clearly than in Powell's day, the more we know about *where* we are, the better we understand *who* we are. Because of this, new ways of mobilizing and displaying geodata become important tools in the hands of citizens, enabling them to envision their places in new ways and to work together more effectively to realize those visions.

What is still a little surprising to a lay person like myself is that it is not only the users of geodata who are affected by its democratic implications, but that the professionals who assemble and display the data should also be discovering that they can serve those citizens more effectively if they themselves work together more cooperatively, bridging gaps and breaching barriers among different interests in much the same way that their work-products enable citizens to do.

This book provides a grounded, hands-on guide to those democratic practices among a set of professionals who play an increasingly crucial role in our democratic society.

Daniel Kemmis is Director of the Center for the Rocky Mountain West and author of *Community and the Politics of Place* (University of Oklahoma Press, 1990), *The Good City and the Good Life* (Houghton Mifflin, 1995), and, most recently, *This Sovereign Land: A New Vision for Governing the West* (Island Press, 2001).

Acknowledgments

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- FGDC (project funding and support)
- Kathy Covert, Secretary GeoData Alliance and the Federal Geographic Data Committee (FGDC) Partnership Coordinator (project concept and logistics)
- Randall Johnson MetroGIS Staff Coordinator, Metropolitan Council, Minneapolis–St. Paul Metropolitan Area (Project Manager, principal author, and MetroGIS chronicle)
- Zorica Nedovic-Budic, Professor, University of Illinois, Champaign–Urbana (project methodology and summary of previous research and bibliography)
- Bruce Oswald, Director, New York State Center for Geographic Information (New York State GIS Data-Sharing Cooperative chronicle)
- Mark Vander Schaaf, Chair, Ramsey County GIS Users Group (Ramsey County GIS Users Group chronicle)
- Gene Thorley, Science Advisor, Northwest Geographic Science Team—U.S. Geologic Survey (Pacific Salmon Information Network chronicle and the section on the relationship between National Spatial Data Infrastructure and the GeoData Alliance)
- Eric Jespersen, past President Pennsylvania Mapping and Geographic Information Consortium (PaMAGIC chronicle)
- Christine Clarke, Geodata Coordinator, Natural Resources and Conservation Service (National Cooperative Soils Survey Chronicle)

Other Contributors

- Chrysa Cullather (editing and production)
- Michele Keen, Boldface Design, Inc. (graphic design)
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- Craig Skone, GIS Technician, Metropolitan Council (map of project participants and MetroGIS map)

A Special Thank You from the Project Manager

Thank you, Kathy, for inviting me to share MetroGIS's story through this project. It has been an honor and a privilege to interact with the representatives of several other successful geodata collaboratives to share our collective stories. Thank you to FGDC for providing office space and living expenses to allow me to work full time on this project as a visiting scientist. Thank you Dr. Nedovic-Budic for agreeing to join the project team even though you were half way around the world on sabbatical. I appreciate that on your return, you participated during your limited preparation time for the upcoming school year.

My sincere thank you to my colleagues at the Metropolitan Council—Rick Gelbmann, GIS Supervisor, and Eli Cooper, Director of Growth Management and Planning—for granting my request to take on this project; the leadership of MetroGIS for supporting my request; and Trudy Richter,

Richardson and Richter Associates, and Alison Slaats and Rick Gelbmann, Metropolitan Council, all members of the MetroGIS support team, for accepting the challenge of keeping MetroGIS' critical needs on course during my absence.

Finally, thank you Robin, Alyson, and Katie, my wife and daughters, for giving me the go-ahead to say yes to this opportunity, even though it meant living far apart for nearly two months. Without your support, this project would not have materialized. My only regret is that more collaboratives did not accept our invitation to share their stories.

Randall Johnson, AICP
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Acknowledgment from Kathy Covert

Randy, on behalf of the GeoData Alliance interim council of trustees, I thank you for your significant, sustained, and selfless contribution to the beneficial use of geographic information. You committed your time, talent, and treasure to this endeavor, and I am deeply grateful to you for managing a challenging project with grace, intelligence, and good humor.

I join Randy in extending my personal thanks to the contributing authors—Zorica Nedovic-Budic, Bruce Oswald, Mark Vander Schaaf, Gene Thorley, Eric Jespersen, and Christine Clarke—for taking time to tell their stories, to the production team—Chrysa Cullather and Michele Keen—for creative collaboration, to FGDC staff for hosting Randy, and to Randy's family and the Metropolitan Council for sharing him with us for nearly two months.

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Executive Summary

In 1994, the National Spatial Data Infrastructure (NSDI) initiative was established to provide a base structure of practices and relationships to facilitate sharing of commonly needed geospatial data and to nurture its effective use by all who have an interest. Attaining the vision of NSDI requires numerous and disparate interests to work together to collectively address common geospatial issues and opportunities that are larger than any single interest. Much progress had been made but by the late 1990s, many people recognized that to attain the full vision, a more efficient mechanism was needed to foster and enhance communication and coordination between the disparate interests. This need was particularly critical for existing geodata collaboratives working toward their visions in their respective areas. In addition, many more collaboratives were needed in areas where work toward the NSDI vision had not yet begun.

The emerging National GeoData Alliance (GDA) was borne out of this recognition. In November 2000, GDA was officially established to "foster trusted and inclusive processes to enable the creation, effective and equitable flow, and beneficial use of geographic information." This guide is the first publication of the emerging GDA. Its purposes are (1) to begin the journey of assisting existing geodata collaboratives, the cornerstones of NSDI, to communicate better and (2) to complement ongoing academic research to assist champions of aspiring collaboratives better understand what it takes to establish and sustain a successful geodata collaborative.

This guide is not intended to be an exhaustive study of successful geodata collaboratives. Nor is it intended to be a scholarly paper drawing from thoroughly researched case studies. Rather, it is intended to encourage several successful geodata collaboratives to identify themselves and to document their organizational experiences in their own words and in the form of "practical tips for success" to share with others aspiring to create or enhance a geodata collaborative.

The six participating, self-identified geodata collaboratives represent diverse geographic extents and support diverse functions. They collectively identified 17 key practices to successfully creating and sustaining their respective collaboratives. Six of these "key practices" are common to all six collaboratives (no order of significance is intended):

- Broad support for vision and expectations
- Champion individuals/community support
- Knowledgeable, respected participants
- Frequent contact with national (higher order) organizations
- Proactive, open, and inclusive process/procedures to enable maximum participation/diverse perspectives
- Improved understanding/outreach

These six "keys to success" and several others identified are consistent with the findings of the academic community in recent studies.

This guide concludes with a proposal to foster the sought-after collaboration and transfer of knowledge needed to achieve the vision of NSDI. It calls for geodata collaboratives to join an effort to establish a mechanism, much the same as the National Geospatial Data Clearinghouse, to connect people and organizations with common geospatial interests.

1 Introduction

Purpose of this Document

Achieving the vision of the National Spatial Data Infrastructure (NSDI)[1] requires numerous and disparate interests to work together to collectively address common geospatial issues and opportunities larger than any single interest. Much progress has been made, but to realize the entire vision, an efficient mechanism is needed to foster and enhance communication and coordination between the disparate interests. This need is particularly critical for existing geodata collaboratives working toward their visions in their respective areas. In addition, many more collaboratives will be needed in areas where work toward the NSDI vision has not yet emerged.

This *Lessons from Practice* guide, the first publication of the emerging GeoData Alliance (GDA),[2] is intended to be one of many efforts designed to enhance communication among the cornerstones of NSDI—geodata collaboratives. Its purpose is simply to document the organizational experiences of several successful geodata collaboratives in their own words and to provide "tips for success" to share with others who are aspiring to form or expand geodata collaboratives.

Data sharing does not happen unless it is underpinned by a business need. Further, collaboration does not happen unless there is recognition of a common business need or needs. When organizations in the geodata community reach this understanding, many begin to search out models so they do not have to "reinvent the wheel." These organizations are the target audience for this guide of practical organizational tips for success.

The hope is that this project, and similar efforts that follow, will foster the collaboration needed to achieve the visions of NSDI and GDA, which, if attained, will significantly enhance our collective abilities to implement smart growth policies and to measurably improve our effectiveness as institutions. These outcomes will, in turn, create the environment in which to achieve the goal of more livable communities, to improve quality of life, and to encourage economic competitiveness.

NSDI and GDA: Their Relationship

The NSDI initiative was established in 1994 by Executive Order 12906.[3] The goal of NSDI is

> to improve quality and reduce costs related to geographic information; reduce duplication of effort among agencies; make geographic data more accessible to the public; increase the benefits of using available data; and establish key partnerships with states, counties, cities, tribal nations, academia, and the private sector to increase data availability.
>
> NSDI has come to be seen as the technology, policies, criteria, standards, and people necessary to promote geospatial data sharing and use throughout all levels of government, the private and nonprofit sectors, and academia. Its goal is to provide a base or structure of practices and relationships among data producers and users that facilitates data sharing and effective use of geospatial data. Much has been accomplished to further the implementation of NSDI, but there is still much to be done to achieve the vision of current and accurate geographic data being readily available across the country.[4]

Introduction

The Federal Geographic Data Committee (FGDC) was designated the role of coordinating federal leadership to achieve the objectives of NSDI. Recognizing the need for a nonfederal organization to foster geospatial data coordination, FGDC sponsored the initiative that led to the formation of GDA. The journey to GDA's establishment began with the acknowledgement by many interests that an open, inclusive, nonpartisan organizational structure, not dominated by any interest, was needed to accomplish the vision of NSDI. This acknowledgement led to a strong endorsement from the geodata community at the 1999 National GeoData Forum to investigate options for securing an organizational structure that could achieve these objectives. Subsequently, FGDC financed an initiative that included several multisector meetings to agree on expectations, a number of town meetings to discuss ideas and concepts, and a widely diversified drafting team[5] that met over a period of 8 months to craft GDA mission statement, guiding principles, and initial organizational structure.

In November 2000, GDA was officially incorporated as a freestanding, nonprofit organization. In its infancy as an organization, GDA is now seeking to grow its membership with individuals and organizations, encompassing all relevant and affected interests—those who believe there is a need for a better method to foster the collaboration needed to achieve the vision of NSDI and to improve the use of geospatial data. The first annual meeting of GDA is scheduled for November 2, 2001, in conjunction with the 2001 National GeoData Forum.

The MetroGIS approach is based upon the premise that collaborations must depend not simply on good will but on good sense—the investments required to assemble and manage aggregated data are real and cannot be justified on good will alone. The public officials that comprise the MetroGIS Policy Board provide the ultimate reality check!

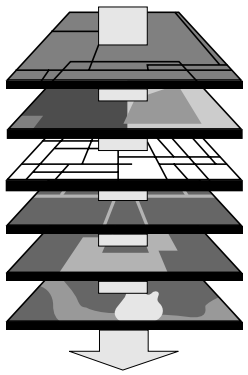
—David Arbeit

Benefits of Collaboration

GIS is an extremely effective tool to evaluate and illustrate relationships between features and occurrences that can be mapped, including roads and highways, land use, parcels, municipal boundaries, geography, and the environment (Figure 1). GIS provides benefits to organizations that incorporate the technology into their daily business functions. The most notable of these benefits include the following:

- Improved efficiency,
- Improved data management,
- Improved decision support, and
- Improved customer/constituent satisfaction.

Figure 1 **The Power of GIS**



Graphic Source: *ESRI*

More importantly, organizations that elect to collaborate with others on common geospatial needs and opportunities can benefit substantially more than those using GIS technology on their own. David Claypool, Surveyor and Coordinator of GIS Operations for Ramsey County, Minnesota, and a geodata collaboration visionary who has been an active participant in two of the collaboratives featured in this guide (MetroGIS and Ramsey County GIS Users Group), states it this way, "If someone is doing GIS on their own, they are not realizing the full potential of the technology." Additional benefits that can accrue to those who collaborate on common geospatial needs and opportunities include the following:

If someone is doing GIS on their own, they are not realizing the full potential of the technology.

David Claypool, Surveyor and Coordinator of GIS Operations for Ramsey County, Minnesota

- Reduced data costs
- Improved data quality
- Minimized data conflicts
- Improved participant operations
- Leveraged technology investments
- More widely understood benefits of data sharing
- Reduced project costs through collective bidding
- Strengthened rationale for commitment to standards
- Improved support for cross-jurisdictional decision making
- Strengthened working relationships fostering broader cooperation

In a 1999 study,[6] funded by an NSDI Benefits Grant, Dr. William Craig of the University of Minnesota Center for Urban and Regional Affairs and David Bittner, a graduate associate at the University of Minnesota, evaluated the effectiveness of MetroGIS. MetroGIS is a geodata collaborative that serves the seven-county, Minneapolis-St. Paul Metropolitan Area. A chronicle of its story, accomplishments, and future challenges is presented in Chapter 2. Dr. Craig's study, using MetroGIS as the focal point, investigated benefits realized from collaboration in terms of geospatial data and non–data-related measures and characteristics.

Two aspects of the MetroGIS story are summarized here to provide a context for Dr. Craig's study. As one of its early activities, MetroGIS facilitated creation (where they did not exist) of a GIS user group in each of the seven Minneapolis–St. Paul Metropolitan Area counties. These user groups provide a mechanism through which all local government interests within each county, and any other interests the group wishes to include, can come together regularly to address technical and institutional data–sharing-related needs and opportunities that require collective action to resolve. In addition to bringing GIS practitioners and program managers together via the county-based GIS users groups, MetroGIS's own activities, in the 4 years before Dr. Craig's study, had engaged approximately 150 practitioners, managers, and elected officials through its special-purpose workgroups, committees, and board functions. These groups share information and recommend policy and proven practices for the Twin Cities's geodata community.

Dr. Craig's findings documented that since the inception of MetroGIS, there was more data sharing occurring, more communication, and a better attitude about sharing. The study also clearly demonstrated that the non–data-related collaboration benefits enjoyed, in larger part due to the presence of MetroGIS, are perceived by the participants as at least equal to the benefits received from improved access to geospatial data. Providing an incentive for gathering people together in discussions about sharing data had, in

fact, led to an increased awareness of each other's situation, friendship, and trust. Other findings of the study included the following: nearly 70 percent of the respondents thought participation in MetroGIS was worth their time, 50 percent or more thought that MetroGIS had improved their work life by sharing communication about GIS and improving the attitude about sharing across the region, and, although, MetroGIS was at that time still in its formative stages, 50 percent of those who had sought data, had found it.

Chapter 2 documents the chronicles of six successful collaboratives. Each collaborative includes separate sections on the benefits attributed to collaboration, on solutions to common geodata needs and opportunities, and on keys to each collaborative's success.

Endnotes

[1] <http://www.fgdc.gov/nsdi/nsdi.html>

[2] <http://www.geoall.net/>

[3] <http://www.fgdc.gov/publications/documents/geninfo/execord.html>

[4] <http://www.fgdc.gov/nsdi/nsdi.html>

[5] <http://www.geoall.net/draftingteam.htm>

[6] The abstract for Dr. Craig's study is provided in the Minnesota section of the document at <http://www.fgdc.gov/ publications/documents/geninfo/funding98.pdf>. A summary of the study conclusions in the form of a slide presentation is available at <http://www.metrogis.org/organization/participant.htm>.

2 Successful Geodata Collaboratives: Their Stories

Project Methodology

This project was not intended to be an exhaustive study of successful geodata collaboratives. Nor was it intended to be a scholarly paper drawing from thoroughly researched case studies. Rather, the goal was to encourage several successful collaboratives to identify themselves and tell their stories in their own words to share with others aspiring to create or enhance a geodata collaborative. The project team did not critique the chronicles received. They were included as submitted. The academic community, using recognized research methods, is encouraged to more rigorously evaluate the similarities and differences among these collaboratives and the rationale for their actions.

On June 20, 2001, a letter of invitation (Appendix 2, Exhibit A) was sent to the 24 members of the GDA drafting team[1] who, in turn, were asked to forward it to their respective communities and colleagues. Fifteen collaboratives were also directly invited to participate. Prospective participants were asked to fill out an on-line questionnaire (Appendix 2, Exhibit B) to nominate their respective collaborative for consideration. A follow-up invitation was sent on July 20, 2001 to the originally targeted collaboratives that had not responded. Nine additional collaboratives (public and nonpublic) were also directly invited to participate.

The project team developed criteria (Appendix 2, Exhibit C) to define the diversity of geodata collaborative characteristics (e.g., geographic extent, functions supported, type of organizational structure) desired for the guide and to use as a basis to select from the pool of anticipated nominees. The project team selected nine self-nominated geodata collaboratives, and each agreed to submit an article to be include in the proposed *Lessons from Practice* guide. These nine candidates addressed the breadth of the selection criteria through different approaches and included public and nonpublic initiatives. Each of the nine selected nominees was provided a template (Appendix 2, Exhibit D) with a series of questions to answer and a specified format for the chronicles.

Only five of the nine selected collaboratives submitted chronicles. The project proceeded out of respect for the individuals who took the time and effort to write a chronicle and because these five collaboratives demonstrated most of the sought-after characteristics identified by the project team. A sixth collaborative, previously unidentified, asked to participate and was added later in the process.

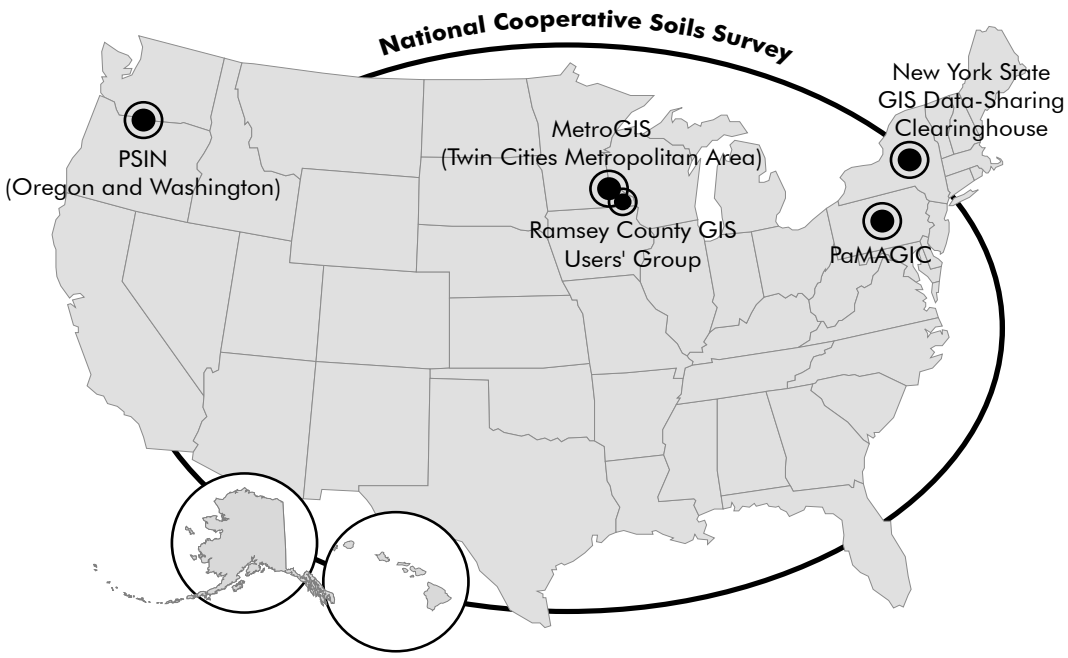
Chronicles of Successful Geodata Collaboratives

Geodata collaboratives take on many forms and exhibit diverse objectives and geographic extents. The six collaboratives whose chronicles are featured in this document provide some insight into this diversity. Their general geographic locations are illustrated in Figure 2. Their respective organizational characteristics are summarized in Table 1.

Successful Geodata Collaboratives: Their Stories

A brief comparison of the similarities and differences of the collaboratives is presented in the first section of Chapter 3, along with a synthesis of their practical tips for success. The chronicles of their stories follow in random order to symbolize there is no discernible continuum among geodata collaboratives. That is, the geographic extent and the number of stakeholders vary widely for collaboratives with similar functions. The type of organizational structure also has little or no relevance to the number, type, or complexity of functions supported.

Figure 2 **Participating Geodata Collaboratives**



Source: Craig Skone, GIS Technician • Metropolitan Council (Minneapolis–St. Paul Metropolitan Area)

The collaboratives listed below are chronicled on the following pages:

- New York State GIS Data-Sharing Cooperative
- Ramsey County GIS Users Group
- Pacific Salmon Information Network (PSIN)
- MetroGIS
- Pennsylvania Mapping and Geographic Information Consortium (PaMAGIC)
- National Cooperative Soils Survey (NCSS)

Table 1. Comparison of Organizational Characteristics—Participating Collaboratives

Name	Geographic Extent	Legally Recognized Structure	Purposes	Stakeholder Diversity
New York GIS Data-Sharing Cooperative	State+	No	2	1 [when nonprofit] 2 (a–d) (producers) 3 (producers)
Ramsey County GIS Users Group	County	Yes	1–5	2a (primary focus) neighborhood groups
PSIN	Two states	No	1	1–5
MetroGIS	Seven counties	No	1–6	2 a, b (primary focus) 1, 3, 4
PaMAGIC	State	Yes	1,3,5	1–5
NCSS	National: U.S. and territories	Yes	1–5	1, 2 (a–e, vary by state) 3, 4, 5 (mainly data users)

Key

Purposes:

1. Forum to network/transfer information/educate
2. Forum to share existing geodata program resources (e.g., data, data acquisition, equipment, applications)
3. Forum to resolve technical data sharing obstacles
4. Forum to resolve institutional data sharing obstacles, other than "area integrator"*
5. Forum to endorse proven practices important to collaborative purpose (e.g., standards, procedures)
6. Forum to achieve "area integration" of like-data from multiple sources

Stakeholder Types:

1. Academic
2. Government (a: local, b: regional, c: state, d: federal, e: tribal)
3. Nonprofit
4. For-profit
5. General interest

*An "area integrator" is an organization responsible for assembling like data from two or more primary producers into a data solution that covers the extent of the collaborative community. See p. 38 of the *NSDI Framework Guide* at <http://www.fgdc.gov/framework/frameworkintroguide/>.

New York State GIS Data-Sharing Cooperative

Bruce Oswald
Director New York State Center for Geographic Information
New York State Office for Technology

Introduction—History, Purpose, and Functions

In the last few years, issues that significantly inhibit GIS data sharing have been identified in New York (<http://www.nysgis.state.ny.us/gtcreport/001covr.htm>). Not surprisingly, many of these same issues have been heard in many other parts of the country as well:

- What GIS data are available?
- Where are the data?
- Whom do I contact to get the data?
- How do I contact them?
- How long will it take to get data?
- Why should I share my data? What's in it for me?
- If I share my data, do I have to reformat it?
- How do I develop a license to protect my interests?
- What about the Freedom of Information Act?
- What about the costs and the staff time required to distribute my data?
- What about the loss of my data sales?

In 1996, a significant amount of distrust and animosity existed between the proponents for open GIS data sharing and the proponents of GIS data licensing in New York state (NYS). State agency–specific licenses often took significant amounts of time to negotiate. License fees for some highly sought after data were generally considered very high. For more than 10 years prior to that, no consensus had been reached on data distribution. As a result, no one had a clear understanding of what data existed in New York, what entities had GIS data, and who to contact at those entities to discuss obtaining data. In March of 1996, the NYS Temporary Geographic Information Council issued a report discussing various issues related to GIS in New York and making several recommendations on their resolution. That spring, Governor George Pataki directed the NYS Office for Technology to implement those recommendations. As a result, the NYS GIS Coordination Program was put in place using a "driven," collaborative process with the expressed purpose of developing a statewide policy that would allow the transfer of digital GIS data easily between state and local governments at minimal or no cost (<http://www.oft.state.ny.us/policy/tp_9618.htm>).

Using this driven, collaborative process, members of the Legal and Data Coordination Work Groups developed a data-sharing framework for governments and not-for-profits, which became known as the NYS GIS Data-Sharing Cooperative. The concept was overwhelmingly endorsed by the NYS GIS Coordination Body, which in the summer of 1997 issued an NYS Technology Policy by the Governor's Office (<http://www.oft.state.ny.us/policy/tp_976.htm>).

The cooperative provides an arena in which governments and not-for-profits could share data at no cost under certain limited restrictions. Best of

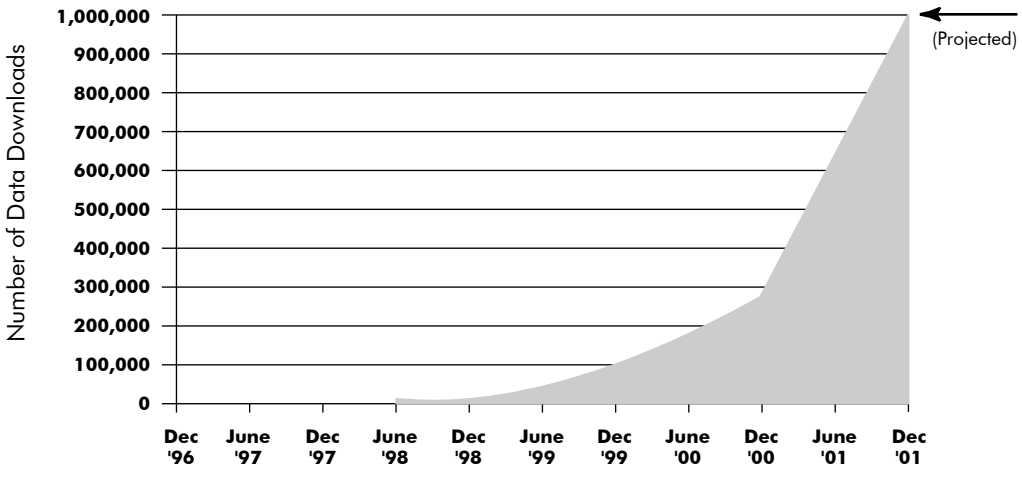
all, participants, or cooperative members, do not require data to join. By signing one standard data-sharing agreement, every member has access to every other member's data. The roots of the cooperative focus on respecting every member's ability to distribute its data outside of the cooperative in any manner it saw fit. Members are required to commit to sharing GIS data with other members. Each member has a clearly identified contact person. Each dataset has a clearly identified owner. Member contacts and their lists of datasets are placed on the NYS GIS Clearinghouse. The clearinghouse is available to everyone. Members are not required to place their data on line; however, they are encouraged to do so, and the state's two clearinghouses put the data on line for no charge. Members placing data on line decide whether to restrict access to data to only cooperative members by password protection or not. Most choose not to. All who have tried it find on line data sharing to be an easy and effective option. For more information on the cooperative, please refer to <http://www.nysgis.state.ny.us/datacoop.htm>.

Prior to the establishment of the cooperative, best estimates indicated that 800 to 900 GIS datasets were exchanged each year in New York between the major data holders. In 1998, cooperative member data were placed on line at New York's clearinghouses for the first time. This resulted in 8,500 datasets being downloaded valued at $2 million. The cooperative grew quickly. In 1999, more than 98,000 datasets were downloaded valued at $7.8 million. In 2000, 280,000 datasets were downloaded valued at more than $14 million. For the first 6 months of 2001, more than 400,000 datasets were downloaded. Projections for data downloads in 2001 are currently approaching 1 million (Figure 3).

The cooperative's membership is rapidly approaching 350 members. It includes 39 of New York's 62 counties, 10 federal agencies, 84 NYS agencies, 130 local governments, 72 not-for-profits, and 3 neighboring states (Figures 4, 5). One of our newest members is New York city (NYC), which has chosen to make its vast collection of high-resolution GIS data available to cooperative members via the state GIS clearinghouse. Not-for-profits include environmental organizations, planning groups, recreational

Figure 3 New York State GIS Data-Sharing Cooperative

Increases in GIS Data Sharing



groups, and religious groups such as the Archdiocese of Rochester. Members also include 13 NYS/NYC universities, 4 community colleges, 7 private colleges, 2 high schools, and 1 middle school.

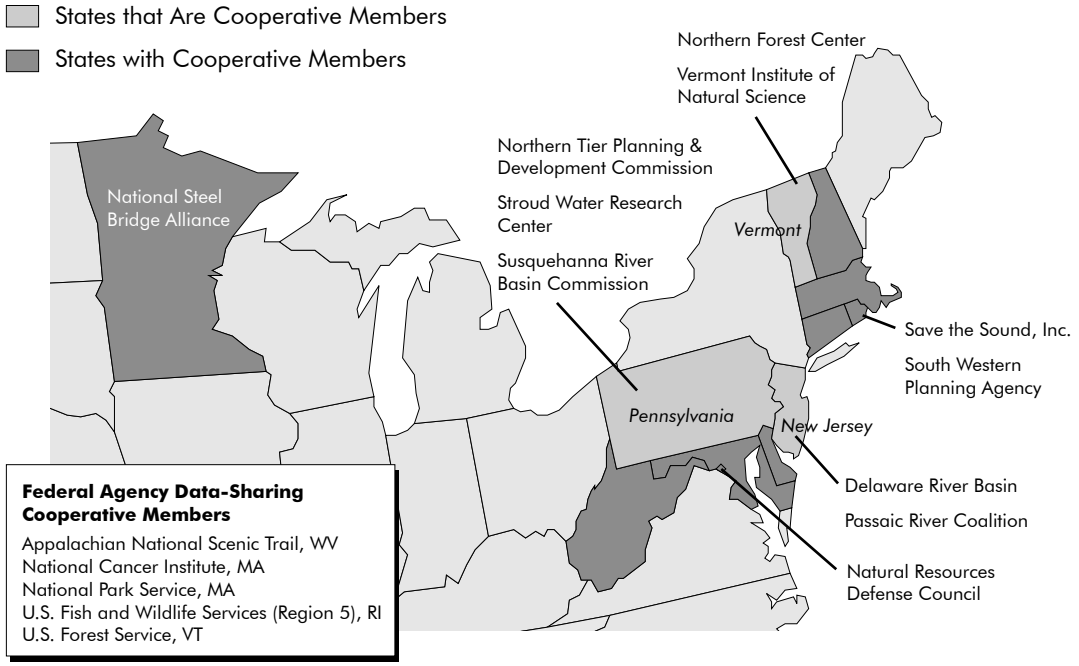
Sharing is a learned concept. It comes easier to some, much harder to others. The NYS GIS Data-Sharing Cooperative established a framework for data sharing for governments and not-for-profits. It provided the most detailed inventory of GIS users and datasets in New York history available to everyone and, most importantly, enabled the flow of GIS data to save money and improve government services (<http://www.nysgis.state.ny.us/cooplist.htm>).

We all are aware that data creation and maintenance are by far the largest cost in developing a GIS. For that reason alone, the sharing of existing data resources is extremely important. New York's problems with data sharing were not unique. Many entities have tried various solutions that have provided varying degrees of success. The federal government's open access policy has made some coarse data available to the public, but the policy has resulted in minimal interagency sharing to date. Likewise, bureaucratic data licensing requirements by some state, county, and local government agencies have greatly limited access and distribution of data.

Access to GIS data is a problem that exists at the federal, state, county, and local government levels. Many of the issues that New York faced are the same across the country. In New York, they centered around animosity, fear, distrust, institutional or organizational politics, and cost.

Figure 4

New York State GIS Data-Sharing Cooperative
Organizations from Other States



The major hurdle to data sharing is rarely technical. It is almost always institutional. While the answer that New York arrived at may not be the answer for everyone, we believe that the collaborative process used to arrive at that answer is for everyone.

Major Accomplishments

- Bringing together parties who could not agree on whether data should be given away or sold and establishing an environment that helped to create a willingness to work collaboratively with others having divergent views
- Creating a trusted environment to encourage data sharing
- Developing an inventory of more than 4,400 major datasets in New York state
- Identifying an owner of each dataset
- Listing contacts for each of these datasets
- Placing more than 4,200 datasets on line
- Increasing data sharing from fewer than 1,000 files per year in New York to 280,000 files valued at more than $14 million in 2000 and possibly reaching 1 million files downloaded in 2001
- Saving taxpayer dollars, making data sharing easy, and improving the efficiency of government in New York state

Structure

- *Organization:* The cooperative can be thought of as a large "sand box" in which all members are equal and must play by the "sand box"

Figure 5 New York State GIS Data-Sharing Cooperative

County Data-Sharing Cooperative Members

rules. The NYS GIS Coordinating Body, composed of an equal number of county and local government members, state agency members, and a combination of private sector and academia members oversees the cooperative and is responsible for settling any disputes. To date, none have arisen.

- *Members:* Members of the cooperative currently include colleges, community colleges, high schools, middle schools, environmental groups, religious groups, libraries when not-for profit, villages, towns, cities, counties, state agencies, other states, federal agencies, recreation groups, regional planning commissions, fire departments, soil and water conservation districts, metropolitan planning organizations, economic development corporations, land conservancies, legal groups, watershed organizations, YMCAs, neighborhood organizations, housing preservation organizations, and the United Way. The NYS GIS Data-Sharing Cooperative was created from participants from academia, government, and nonprofit organizations using a driven, collaborative process.
- *Legal authority and scope:* The cooperative is open to government and not-for-profits. Its legal authority is derived from the data-sharing agreement that all members must sign (<http://www.nysgis.state.ny.us/coop/locldata.htm>). Currently, although the rules for all members are the same, slightly different versions of the agreement have been developed for state agencies, county and local governments and not-for-profits, federal agencies, other states, and Indian nations. All members are equal. Overhead is kept to a minimum; each member is responsible for providing access to the data for its staff or members and ensuring the security of the data for data owners. As such, members are required to share their cooperative membership within their own level of government (county or local government), within their own agency (state or federal government), and within their own organization (not-for-profits).
- *Resources:* Funding and staff to operate and administer the cooperative are provided by the NYS Office for Technology.

Sharing is a learned concept. It comes easier to some, much harder to others....The cooperative can be thought of as a large "sand box" in which all members are equal and must play by the "sand box" rules.

Policies and Procedures

- *Decision making and conflict resolution:* All decisions or conflicts are brought to the NYS GIS Coordinating Body where they are resolved through a collaborative process. Minor adjustments have been made to the cooperative since 1997, but to date no major conflicts have arisen.
- *Data:* Every dataset has a member who is considered its primary custodian (owner). Every member who borrows a dataset is considered a secondary custodian and, as such, has certain responsibilities. Among these responsibilities are reporting any errors or omissions found in the data and providing a copy to the primary custodian of any improvements made to the data. No member assumes any risk, liability, or responsibility for the accuracy of data or the metadata. Members provide all data to other cooperative members in their native format. Members are required to provide data to other members on request. Members are encouraged to place their data on line.
- *Technology:* The NYS GIS Clearinghouses are the primary sources of data distribution (<http://www.nysgis.state.ny.us/> and <http://cugir.mannlib.cornell.edu/>).
- *Human resources:* Since 1996, innumerable individuals across the state from county, local, state, and federal governments as well as academia and the private sector have volunteered to provide input to the development of the concept and to provide legal advice. Administration has been

primarily limited to a small portion of a project manager's and a secretary's time and has been paid by the NYS Office for Technology. A significant effort has gone into "selling" the concept across the state, and all GIS training workshops, conference presentations, and the like emphasize the benefits of the cooperative and the collaborative process that created it.

- *Rules of the cooperative:*
  - GIS data are not needed to belong.
  - The cooperative does not cost anything to join.
  - Signing the one Cooperative Data-Sharing Agreement provides members access to all other members' data.
  - Agreements for the cooperative are processed within 2 weeks.
  - Outside the cooperative, members are free to distribute their data as they see fit.
  - Members cannot redistribute another member's data without specific permission.
  - If a member discovers an error or omission in another member's data or updates that member's data, the user is obliged to notify the data owner and provide the owner with copies of any improvements to the data. The original data owner can then decide whether to update its dataset.
  - A member can designate another member to act on its behalf to provide GIS services and to collect and distribute GIS data on its behalf.
  - A member can unilaterally leave the cooperative if it chooses. (None have chosen to leave to date.)

Keys to Success

- *Well-defined issues:* In the fall of 1995, New York state brought together a group of more than 80 highly regarded individuals from across the state who had a knowledge of issues surrounding GIS in New York. This group, established by the NYS legislature as the NYS Temporary Geographic Information Systems Council, represented all affected sectors. It was charged with examining the issues around GIS in New York and providing a report identifying those issues as well as recommendations to resolve them. In March 1996, the council issued a detailed report that outlined each major issue affecting the development of geographic information technology in the state. While this report is directed specifically to issues in New York, many of those issues apply to other parts of the country as well (<http://www.nysgis.state.ny.us/gtcreport/001covr.htm>).

- *A driven, collaborative process with a well-developed work plan and many visible, short-term deliverables:* Under the direction of Governor George Pataki, the NYS Office for Technology was asked to implement the recommendations of the Temporary Council. This newly formed agency was a new and different kind of state agency. It was predicated on a philosophy of collaboration, not control. It was committed to fast-paced but purposeful change and a belief that program needs drive technology, not the reverse. All of the work of the office was accomplished through work groups, councils, and leadership cadres. Work groups included all affected parties as well as the government and private sector expertise needed to solve the issue at hand. Under the GIS Coordination Program, each work group was given a schedule of deliverables with short, sometimes

uncomfortable, but achievable, time frames. "Practical, implementable results" were required. An overall project director was assigned who was required to provide "deliverables" to the Director of the Office for Technology on a weekly basis. The goal of this process was to prove success, to achieve results, and to build momentum among the participants and the GIS community as a whole (<http://www.oft.state.ny.us/oft/index2.htm>).

- *Commitment:*
  - *A committed GIS community*. Without the commitment of the NYS GIS community, none of the successes achieved by the cooperative and other initiatives could have been possible. New York had a pent up demand for action in this arena. This demand, fueled by years of frustration, fired the passion of the participants who volunteered for this effort to achieve results. To some extent, it was as if everyone felt it was "now or never" for GIS in New York. Because of that, many people devoted themselves to the process.
  - *A committed nonpartisan champion*. The person made responsible for this program had no prior knowledge of GIS, no staff to assist on the program, no budget, and a number of other very highly visible projects to manage. Most saw this as a formula for disaster. However, it provided the program with a leader who had no preconceived prejudices on data sharing and who was required to use all available volunteer expertise through a collaborative process to resolve issues. All good project managers are committed to their projects. Over time, the commitment of the GIS community drove the manager to a total commitment to this effort. Multitudes of presentations across the state were built on delivering the message on data sharing and joining the cooperative. This message was first delivered in the fall of 1997 and continues today. The champion must be able to "walk the walk" as well as "talk the talk."
  - *A committed executive*. The NYS Office for Technology has been gifted with visionary leadership and a full commitment to assisting its staff members' efforts. However, by producing a track record of meeting deadlines and continuously delivering products, this commitment to the development of geographic information technology has continued to grow and strengthen. The commitment of executive or upper management support for such an effort is invaluable.

- ***Knowledgeable, recognized, and respected participants representing all affected parties:*** For any process to be accepted by others not directly participating in it, it is exceedingly important that they recognize, respect, and trust the individuals involved. While nonparticipants may not have the opportunity to fully understand and accept the process used to provide the results, they must be able to believe that the participants directly involved have produced a high-quality product.

- ***A good, understandable business argument for achieving the goal:*** An example includes data sharing can save time and money and can significantly improve decision making. GIS has struggled for years to come up with an easily understandable and acceptable business case argument for its implementation. While information in this area continues to improve (<http://www.nysgis.state.ny.us/costanal.htm> and <http://www.nysgis.state.ny.us/montana/montana.htm>), the argument for data sharing is easily made. Insistence on quantifiable results for efforts such as this remains extremely important for long-term upper management commitment.

Hard work, clearly defined issues and goals, great planning, commitment, expertise, and good business arguments are essential for the success of this kind of initiative, but luck is also an important factor. There is no substitute for being in the right place at the right time with the right folks.

- *Luck:* Yes luck! Hard work, clearly defined issues and goals, great planning, commitment, expertise, and good business arguments are essential for the success of this kind of initiative, but luck is also an important factor. There is no substitute for being in the right place at the right time with the right folks.

Costs and Expenses

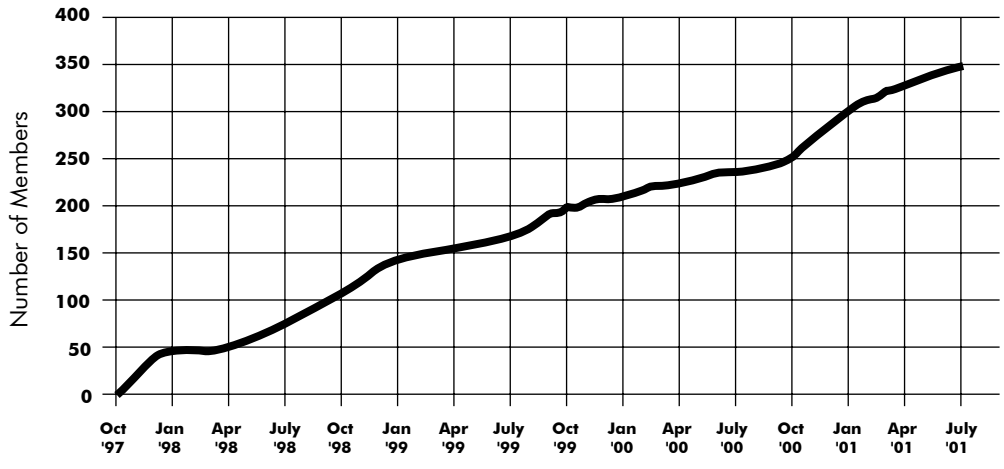
- For the first 6 months, costs incurred were by those 12 to 15 volunteers who served on each of two work groups that met almost every other week for 2 to 3 hours.
- Legal time to create a "standard" data-sharing agreement was donated by private sector and government members of the Legal Work Group as well as by legal staff in the NYS Office for Technology, the NYS Attorney General's Office, and the Office of the NYS Comptroller.
- Two or more staff at the NYS GIS Clearinghouses place cooperative members' contact information, data inventories, metadata, and GIS data on the clearinghouses.

Benefits

- By requiring all members to provide a brief inventory of all their datasets and posting this information on the NYS GIS Clearinghouse, the first major inventory of GIS data was created and is actively maintained.
- By requiring all members to designate a contact with phone, fax, and e-mail (where available) and posting this information on the NYS GIS Clearinghouse, the first network providing easy access to major data holders in New York state was created and is actively maintained.
- By placing NYS GIS data on line, 24-hour, 7-day-a-week access to this data was made possible for the first time in New York state.
- As noted previously, GIS data sharing in New York state increased astronomically from fewer than 1,000 datasets in 1996 to 1 million datasets in 2001 (projected). The cooperative membership has grown to nearly 350 members in mid-2001 (Figure 6).

Figure 6 New York State GIS Data-Sharing Cooperative

Growth in Cooperative Membership



- Data owners with a variety of views on data distribution came together and learned how to share, pool their resources, and work collaboratively in several other areas.

Shortcomings (What Would You Have Done Differently?)

- The cooperative, as currently developed, precludes for-profit firms from membership. This decision may prove problematic in the future as data sharing continues to grow in New York, particularly where public and private partnerships may wish to participate. Other entities wishing to use this model should closely examine the issues surrounding this decision before developing their models.
- To date, the return of data improvements by members borrowing data has been sporadic. More emphasis will be placed on this area in the future.

Challenges Ahead in 2002 and Beyond

Since New York state began this odyssey called the NYS GIS Data-Sharing Cooperative, we have learned a significant amount about working in a driven, collaborative process—one in which all individuals are respected but one in which the outcomes of the process are seen as just as important to the participants as the collaborative process that they are using. Without demonstrable successes, the process used, as wonderful as it may be, cannot survive. With successes come momentum and with momentum comes increased opportunity to meet the ultimate goals.

In 2001, most data owned by cooperative members were open to all individuals on our state GIS clearinghouses. In 2002 and beyond, we will begin to provide access to GIS data owned by cooperative members who may wish to sell it to nonmembers through a "data mart" concept. Ultimately, our goal is to ensure that all New York state GIS data are made accessible on line 24 hours a day 7 days a week either for free or for a fee.

The NYS GIS Data-Sharing Cooperative began with well-defined issues and recommendations. The process used to arrive at the conceptual solution was collaborative but clearly driven—requiring a practical solution. The solution emphasized identifying the barriers of data sharing and systematically dismantling them. The solution arrived at was a compromise, but one that has shown great success in New York state.

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Ramsey County GIS Users Group

Geodata Interests Serving Ramsey County, Minnesota
A Joint Powers Agreement

Mark Vander Schaaf
Chair, Ramsey County GIS Users Group

Introduction—History, Purpose, and Functions

- The Ramsey County GIS Users Group was formed in May 1995 to
  - Create a cost-sharing collaborative across the county, municipalities, and other governmental agencies in Ramsey County to purchase aerial photography and physical feature data (Figure 7)
  - Provide a method for municipalities and other governmental agencies in Ramsey County to receive regular updates of parcel data in a GIS format
  - Provide systematic input to the county regarding stakeholder needs for county GIS data
  - Enable newcomers to GIS to get "up and running" as quickly and cheaply as possible
  - Promote data and knowledge sharing among members
  - Cooperate with metropolitan and regional organizations in the promotion of GIS
- The most recent mission statement was adopted in March 2001: "Provide effective and efficient public services using GIS."
- Ramsey County GIS staff had been cooperating with various municipalities over the years, but it was recognized that such cooperation could become much more efficient and effective through a formalized collaborative agreement.

Figure 7 Ramsey County GIS Users' Group **Service Area**

- No major failures preceded the formation of the collaborative in 1995, although an early cost-sharing formula was determined to be prohibitive.
- No new positions or work units were created to support the collaborative, although portions of existing county positions now work to make the data needed available on a monthly basis.

Major Accomplishments

- Established a regular 3-year cycle of aerial photography and physical features data for all communities in Ramsey County
- Devised a fair and affordable cost-sharing formula
- Developed a system of disseminating CD-ROMs with monthly property record updates and other data updates as available to members
- Successfully recruited nearly all municipalities and other governmental organizations in Ramsey County to join the group
- Held well-attended monthly meetings throughout the year
- Provided the alternative of "paying affiliate" membership for nongovernmental organizations with a public purpose (which are not allowed full membership in a joint powers agreement in Minnesota)—notably, in Saint Paul, many community development corporations and neighborhood planning councils access GIS data via their membership in the Saint Paul Community GIS Consortium, a paying affiliate of the user group
- Established a leadership development program to cultivate fresh perspectives
- Created a strategic plan to guide the organization into the coming age of Internet GIS

Structure

- *Organization:*
  - Board (consisting of all regular members)
  - Board Officers: Chair, Vice Chair, Secretary, and Treasurer (by custom, the Treasurer is a permanent position; other positions rotate annually with the Secretary becoming the Vice Chair, the Vice Chair becoming the Chair, and a new person elected as Secretary)
- *Members/stakeholders:*
  - Municipalities
  - School districts
  - Special districts—especially watershed management districts, soil and water conservation districts
  - Nonprofit—community groups (paying affiliates)
- ***Legal authority:*** Authority is through a "joint powers agreement" as defined by Minnesota law. (See <http://www.ramseyconservation.org/gisgroup.html#Minutes> to view the document.)
  - Treasurer receives and spends funds; major expenditures are initially covered by the county and then billed to the collaborative.
  - Contracts are with Ramsey County, which bills the collaborative for its share.
  - Collaborative is a formal joint powers agreement organization.
- ***Financing:*** Funds are provided by annual payments based on the size and scope of each organization's service area.

Policies and Procedures

- *Decision making and conflict resolution:*
  - Formal decision making process is majority rule with motions and seconds; in practice, most decisions are by consensus.
  - No special rules or procedures aside from the distinction between regular members and affiliate (i.e., nonvoting) members.
- *Data:*
  - Data are produced by Ramsey County GIS staff.
  - Data are owned by Ramsey County and licensed to collaborative members.
  - With regard to liability, the database license specifies that the database is not a legally recorded map or survey and should be used for references only. The county is not liable for direct, indirect, special, incidental, or consequential damages arising out of the use of or inability to use the database. The county's sole responsibility is a prorated refund of any fee paid in the event of any substantial defect that impairs the licensee's use of the database.
  - The data formats are mostly ArcView shape files.
  - Data are distributed via CD-ROM and the FTP site.
- *Technology:*
  - The collaborative itself owns no hardware or software.
  - The collaborative owns no distribution mechanism; however, one of the member organizations hosts a Web page to make agendas, minutes, and other basic information regarding the collaborative available (<http://www.ramseyconservation.org/gisgroup.html>).
- *Human resources:* The User Group depends entirely on volunteers for support.

Keys to Success

- *Leadership:* Talented people were and are committed to the mission of the collaborative and were and are willing to work to make it succeed.
- *Vision:* A sense of future possibilities has kept the collaborative moving ahead after initial goals were achieved.
- *Incentives:* Initially, members were required to come to monthly meetings to get their monthly data updates; this decision prompted a culture of regular meeting attendance.

Costs and Expenses

- Aside from the annual cost-sharing escrow (about $35,000 annually), the only annual cost to the organization is approximately $1,200 for insurance. In 2001, $6,000 was budgeted for an intern to prepare a Ramsey County GIS Data Users Manual.
- One municipality donates its fire hall for our regular meeting place. There are "time costs" in the form of people donating time to the collaborative that would ordinarily be spent doing other work. Estimated "time costs" are as follows:
  - Chair: 8 hours/month
  - Other officers: 4 hours/month
  - Other representatives to collaborative: 2 hours/month

Benefits

- Greater ease in acquiring data that we all want and need
- "Collective bargaining" (i.e., our advice to the county is taken more seriously than the advice of any individual municipality by itself)
- Networking—relationships built in the collaborative are translating into additional, less formal ways of sharing data and expertise

Shortcomings (What Would You Have Done Differently?)

We have no regrets as a collaborative, although we have learned some lessons about dealing with vendors that will make us approach them differently.

Challenges Ahead in 2002 and Beyond

The major challenge is moving out of the world of back-office GIS with proprietary databases and into the new world of GIS in the center of an Internet/Intranet system with relational databases empowering such mainstream applications as asset management, customer relationship management, 911, and the like. The City of Saint Paul and Ramsey County are cooperating to build an Intranet/Internet GIS (Intranet rollout scheduled for September 10, 2001), and the collaborative is thinking about how smaller municipalities can best participate in that system.

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Pacific Salmon Information Network (PSIN)

States of Oregon and Washington

Gene Thorley
Science Advisor, Northwest Geographic Science Team—U.S. Geological Survey

Introduction—History, Purpose, and Functions

The Pacific Salmon Information Network (PSIN) was formed in September 1999 (Figure 8). Dr. Mark Schaefer, then Deputy Assistant Secretary for Water and Science in the U.S. Department of the Interior, met with a small group of local people in Seattle in June 1999 (with guidance from the White House Office of Science and Technology Policy, Committee on Environment and Natural Resources) to explore how information might be more effectively organized and used in addressing Endangered Species Act and salmon recovery issues. Out of that discussion, a larger meeting was planned. The first meeting of PSIN was chaired by Dr. Schaefer on September 14, 1999, and was attended by 40 people who explored current data coordination and inventory efforts and expressed an interest in future coordination.

The decline of Pacific salmon and related fish species is one of the most daunting environmental challenges facing the nation. The life cycle and geographic range of the fish are such that efforts to restore and recover them will touch many, if not all, of the ecological, social, and economic facets of the Pacific Northwest. Actions proposed to recover these fish are controversial, and there are different views on the many possible actions. Before the formation of PSIN, the U.S. Environmental Protection Agency provided a passive Web page that collected information on Pacific salmon, but it was closed down because of lack of participation and use.

Figure 8 Pacific Salmon Information Network (PSIN) **Service Area**

In April 1999, Neal Lane, the Assistant to the President for Science and Technology, and George Frampton, the Chair of the Council on Environmental Quality, asked the Committee on Environment and Natural Resources to lead an effort to strengthen the federal coordination and science underpinning the restoration of Pacific salmon. In turn, the Committee on Environment and Natural Resources charged the Subcommittee on Ecological Systems to undertake this task. As one of its activities, the subcommittee identified the need to enhance information sharing and the use of information technologies in support of the Pacific salmon recovery effort. This enhancement would aid communities to access information about their regions and to visualize the impacts of actions and help citizens and policymakers make informal collaborative decisions.

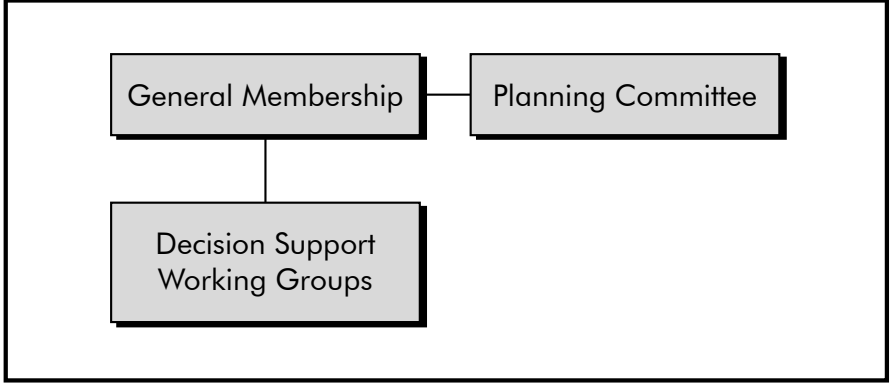
PSIN does not have a formally adopted mission or purpose statement, but it informally acknowledges that it meets to "improve information sharing and the use of information technologies in support of the Pacific salmon recovery effort."

There was no organizational change to support PSIN, but initial funding was necessary to provide for meeting facilitation and documentation by the Meridian Institute. Funding was provided for the first two PSIN meetings—to continue PSIN it was necessary to organize a multisector PSIN planning committee. Also, a PSIN federal participant is providing meeting facilitation and documentation support.

Major Accomplishments

- Provided an open, inclusive, neutral forum for information sharing in support of the Pacific Northwest salmon recovery effort
- Held nine, bimonthly, half-day PSIN meetings of the general membership since September 1999 covering a wide range of timely and important subjects; meetings have been documented, and minutes and most presentations are available
- Developed an "inventory of salmon information resources," which is available through the Washington Geographic Information Council clearinghouse
- Developed a prototype "pacific northwest salmon recovery atlas"
- Organized the PSIN Decision Support Working Group

Figure 9 Pacific Salmon Information Network (PSIN)
Organizational Structure



Structure

- *Organization:* Figure 9 shows the organizational structure of PSIN. The Pacific Salmon Information Network consists of the general membership, who participate in the bimonthly meetings and other PSIN activities; a seven-member intersector PSIN Planning Committee, which defines the agendas, venues, and dates for the bimonthly PSIN meetings; and a PSIN Decision Support Working Group, which discusses the application of decision support technologies in more detail and periodically reports its findings at the PSIN bimonthly meetings.
- *Members:* All interests are treated equally and referred to as members:
  - Academic/research
  - For profit
    - Natural resources and environment
    - Utilities, telecommunications, and transportation
    - GIS vendors, suppliers, and consultants
    - Other for profit (engineering)
  - General interest
    - Library
    - Citizen groups
  - Government
    - Tribe
    - Municipality
    - County
    - State
    - Federal
    - Regional/multijurisdictional
  - Nonprofit
    - Community
    - Public interest
- *Legal Authority:* PSIN has no legal authority, does not receive or expend funds, does not contract, and has no staff. PSIN is an informal gathering of interested participants. The number and makeup of the participants varies with the subjects of the PSIN general meetings.
- *Financing:* A PSIN federal member provides PSIN's meeting facilitation and documentation support. Activities are supported by PSIN members through in-kind and funding contributions.

PSIN does not have a formally adopted mission or purpose statement, but it informally acknowledges that it meets to "improve information sharing and the use of information technologies in support of the Pacific salmon recovery effort."

Policies and Procedures

- *Decision making and conflict resolution:* PSIN uses a consensus-based, decision-making process. PSIN has not adopted any rules or procedures for governance or conflict resolution.
- *Data:* PSIN is principally an information-sharing process and relies on existing clearinghouses for data discovery and acquisition.
- *Technology:* PSIN frequently has presentations of the application of hardware and software (e.g., GIS and decision support systems) but relies on members and private industry for development and implementation.
- *Human Resources:* PSIN's activities are supported by the in-kind and funding contributions of its members.

Keys to Success

- *A timely and important issue:* The decline of Pacific salmon and the listing of certain species as threatened or endangered provide an important context for PSIN. Initially, attendance at PSIN meetings was at the invitation of Dr. Schaefer. Continuation of the PSIN process has relied on the "enlightened self-interest" of the participants. In times of limited resources, PSIN participants must obtain value from the presentations and interactions, enabling them to be more effective in the collective effort to assist the recovery of Pacific salmon.
- *An open, inclusive, neutral process:* There are many forums for addressing issues associated with Pacific salmon recovery. In some cases, interested organizations are excluded from the process(es) or choose not to participate because they do not acknowledge the leadership of the convening organization. In establishing PSIN, Dr. Schaefer attempted to provide an open, inclusive, and neutral process, including the use of the Meridian Institute to facilitate and document the first two meetings.
- *An organization (or organizations) willing to facilitate the process:* All processes need a "champion" (or champions) willing to provide continuity and support. PSIN meetings are currently facilitated and documented by participants from the Northwest Geographic Science Team of the U.S. Geological Survey.
- *Short, interesting meetings:* Over time, PSIN has found that half-day meetings every 2 months seem to match the time and interest levels of the participants. The meetings are divided into information items and discussion topics. An intersector planning committee develops the agenda to ensure that the topics are timely and important. Meetings with a definite "theme" appear to be the most successful.
- *Procedures to enable maximum participation:* PSIN has initially focused on issues and activities associated with Pacific salmon recovery in the states of Washington and Oregon. Even so, the ability of interested participants to travel to a single meeting site is hampered by distance, time, and resources. Meetings have been held in Seattle, Olympia, and Portland to share the burden of travel. Video conferencing has also been used (with links to Seattle, Olympia, Ellensburg, and Vancouver, Washington) on a pilot basis to enable participation and to reduce the travel burden.

Costs and Expenses

Costs to establish PSIN included time of key personnel (e.g., Dr. Schaefer), travel costs ($5,000), and costs for the Meridian Institute to facilitate and document the first two PSIN general meetings ($25,000). Annual costs include personnel and travel costs to facilitate and document the PSIN meetings (donated) and personnel and operational costs to update and maintain the PSIN e-mail list (donated), an estimated value of $5,000 to 10,000.

Benefits

- Availability of an open, inclusive, neutral forum to share information and discuss and address issues related to Pacific salmon recovery
- Availability of an open, inclusive, neutral working group to learn about and pilot the use of decision support tools
- Ability to learn about Pacific salmon recovery activities being carried out in other organizations and regions

- Ability to pursue activities of interest to PSIN participants that fall outside of any single organizational jurisdiction or mandate

Shortcomings (What Would You Have Done Differently?)

PSIN is relatively "young" in its lifecycle. Few concerns have been raised about the way the organization is going about its business to date. Notwithstanding, PSIN is still searching for the right formula for meeting venue, frequency, and topics—so our less successful meetings could perhaps be considered "shortcomings" in planning.

Challenges Ahead in 2002 and Beyond

- *Linking information and decision support tools with management and policy decisions:* The Pacific salmon recovery issue is very complex, with competing demands from urban growth, energy, water use, salmon habitat improvement, and the like. Intuitively, it would seem that improved information, timeliness, and quality, coupled with the use of decision support tools, would lead to better and more understandable decisions. Unfortunately, there is a large gap between our current information and technology base and the use of this base in actual management and policy decision making. PSIN will be challenged to assist in narrowing that gap.
- *"Too many cooks…"?* As mentioned in a previous response, there are many forums for dealing with aspects of the recovery of Pacific salmon. Although the PSIN process is one of the few that is open, inclusive, and neutral, the demands on the time and resources of the participants are increasing. A continual challenge to PSIN will be to define and carry out those activities that "add value" to the Pacific salmon recovery effort, maintaining (and hopefully increasing) membership participation.
- *Availability of resources:* A common challenge faced by most informal, self-organized processes is the lack of dedicated resources. Processes such as PSIN (with no formal mandate and capability to accept funds and contract for services) are particularly reliant on in-kind support and funding through participant organizations. This reliance makes it more difficult to carry out PSIN activities related to solving problems (e.g., improving standards, piloting decision support tools).

For Further Information

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MetroGIS

Seven-County, Minneapolis–St. Paul Metropolitan Area
A Common Ground: Cooperation, Coordination, Sharing Geographic Data

Randall Johnson, AICP
MetroGIS Staff Coordinator

and

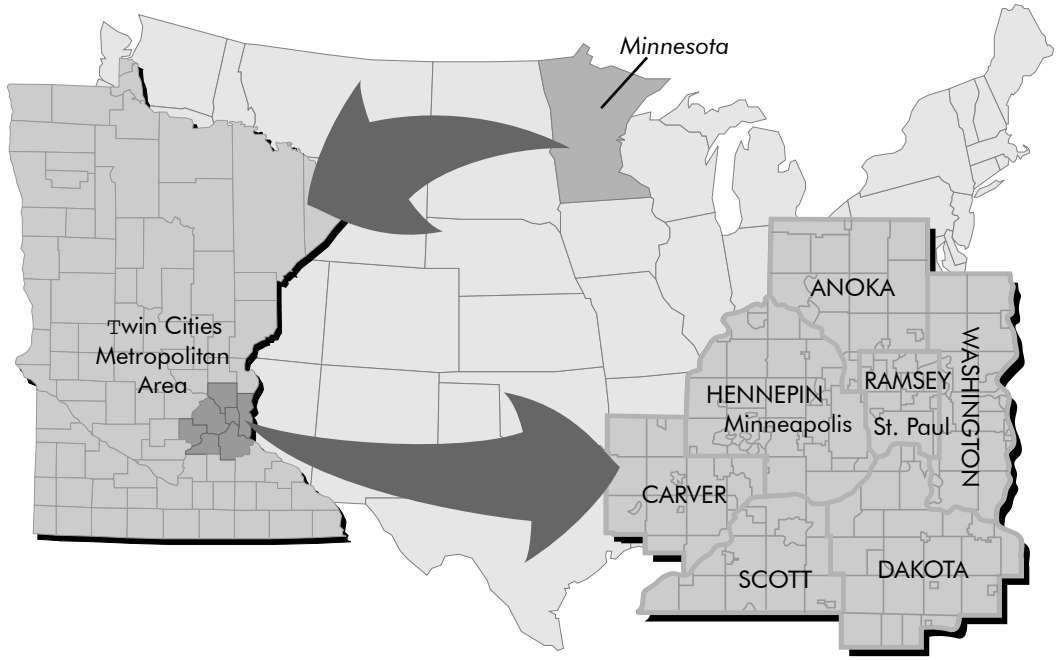
David Arbeit, Ph.D.[2]
Director, Minnesota Land Management Information Center
Member of MetroGIS Coordinating Committee

Introduction—History, Purpose, and Functions

MetroGIS is a multiparticipant, geodata collaborative that serves the seven-county, 3000-square mile, Twin City Metropolitan Area in Minnesota (Figure 10). It was conceived of and organized in 1995 and since that time has sustained a challenging effort to bring data producers and users together to generate significant benefits to both. Nonetheless, the long-term success of MetroGIS remains an open question as participants continue to strive toward a workable solution to sustain the effort to meet their common needs.

Minnesota organizations have a long tradition of cooperative development and use of GIS technology to address issues that significantly affect quality of life, dating back to the late 1960s. This legacy provided a rich

Figure 10 MetroGIS **Service Area**



Source: Craig Skone, GIS Technician · Metropolitan Council (Minneapolis-St. Paul Metropolitan Area)

environment for an ambitious regional geodata collaborative, primed to respond to a compelling need and a willing leader.

Both emerged in 1994, when the Metropolitan Council of Greater Minneapolis–St. Paul Area,[3] a regional government organization with taxing and regulatory authorities, recognized that it needed parcel-level data to accomplish its responsibilities, especially in the areas of planning and growth management. Moreover, to meet the need, the data had to be as accurate and current as data maintained by local governments to allow policy makers to focus on the quality of their decisions rather than the quality of the data. When Metropolitan Council staff recommended collaborating with the seven metro area counties rather than developing and maintaining the data for council use only, the council was prepared to provide the needed leadership. Collaboration promised not only to be the most effective solution, from both cost and functional perspectives but also to be consistent with the council's corporate goals.

Council recognition coincided with two significant conditions that made the region ripe for the MetroGIS initiative: (1) six of seven the counties, a few of the larger cities, some regional agencies, and state agencies had made large investments in GIS technology and (2) these initial investments were followed by significant additional investments by local and regional interests precipitated by the significant drop in GIS start-up costs during the early 1990s. The result was a plethora of conflicting data access policies, complex and inconsistent licensing requirements, and duplication of data development efforts. Where data documentation existed, it varied significantly in quality and format.

By 1995, GIS technology had become widely recognized by public agencies as a valuable tool to effectively perform their business functions, accompanied by a growing awareness of efficiencies potentially gained through sharing data, adopting standards, and improving data documentation (metadata) to facilitate sharing of data holdings. In October 1995, the Metropolitan Council and the Minnesota Land Management Information Center (LMIC) cohosted two informational forums to explore cooperation opportunities.[4] Participants demonstrated strong support for pursuing the concept of a regional GIS initiative. In December 1995, the Metropolitan Council hosted a strategic planning retreat to clarify expectations and to explore strategies for developing a regional GIS initiative.[5] Following the retreat, the participants began work on "next steps."

The first steps were to agree on a mission statement and an implementation strategy, which were accomplished through an intensive consensus-building process. The seemingly simple vision that emerged, with unanimous support of participants, has guided MetroGIS since that time:

> Provide an ongoing, stakeholder-governed, metro-wide mechanism through which participants easily and equitably share geographically referenced graphic and associated attribute data that are accurate, current, secure, of common benefit, and readily usable.

The "next steps" involved carrying out five strategic projects to define the form and function of the collaborative organization.[6] These were initiated in 1996 and completed by 2000. Their central focus was to develop and sustain effective solutions to the common geodata information needs of the nearly 300 local units of government and regional agencies that serve the Twin City Metropolitan Area (Table 2). The MetroGIS approach, to some

degree, reflected principles promoted by NSDI, which continue to underpin MetroGIS decision making. MetroGIS has put into practice a number of concepts introduced by NSDI, notably the "area integrator" as an organization responsible for assembling data from two or more primary producers into a solution that covers the extent of the collaborative community. MetroGIS maintains a data "clearinghouse" service, in collaboration with the Minnesota LMIC, that complies with NSDI standards for data documentation, indexing, and searching. MetroGIS also has adopted the NSDI-fostered practice, referred to as "skylines," of assembling data with difference spatial accuracies into a form usable as a whole without changing the spatial characteristics of the original data.

MetroGIS's business plan, adopted April 2000,[7] identifies 5 "mission critical" functions and 13 additional priority functions to support through 2003. The top priority is "promote and endorse voluntary policies, which foster coordination among the region's organizations." These 18 functions combined address all 6 of the collaborative purposes listed in Table 1. The MetroGIS approach is based on the premise that collaborations must depend not simply on good will but on good sense—the investments required to assemble and manage aggregated data are real and cannot be justified on good will alone. The public officials who make up the MetroGIS Policy Board provide the ultimate reality check!

Table 2
MetroGIS Priority Information Needs
Endorsed by the MetroGIS Policy Board
May 28, 1997

Rank	Information Need Statement	I need to know...
1	The boundaries and characteristics of a specified jurisdiction (e.g., city, school district, county, police and fire districts)	Jurisdictional boundaries
2	The street addresses for specified locations	Street addresses
3	About land-use or development plans that have been officially adopted by public bodies	Land-use plans
4	Who has rights to a property, including ownership, leases, easements, and right-of-way	Rights to property
5	The boundaries and location of a specified parcel	Parcel boundaries
6	The locations and characteristics of water features (e.g., lakes, wetlands, floodplains, aquifers, watersheds)	Lakes, wetlands, and so forth
7	How a piece of land is being used, including whether it is vacant	Land-use, existing
8	The boundaries and characteristics of census areas (e.g., census blocks, block groups, tracts)	Census boundaries
9	Where people live and how to contact them	Where people live
10	The regulations that affect the use of a piece of land (e.g., zoning)	Land regulations
11	The locations and characteristics of roads and highways	Highway and road networks
12	The socioeconomic characteristics of an area's population (e.g., census tract, count, city)	Socioeconomic characteristics of areas
13	A unique identifying attribute of a land parcel, such as parcel ID	Parcel identifiers

Major Accomplishments

MetroGIS has made significant progress toward fulfilling its vision, thanks to substantial financial and resource commitments made by the Metropolitan Council, several hundred volunteers representing dozens of cooperating organizations, and grants received from NSDI-related initiatives. MetroGIS accomplishments include the following:

- Implemented, or made substantial progress to implement, regional solutions for 9 of the MetroGIS community's initial 13 priority information needs: jurisdictional boundaries; street addresses; where people live; parcels and parcel identifiers; highway and road networks; census boundaries; lakes, wetlands, and water courses; land cover; and planned (future) land use
- Implemented MetroGIS DataFinder (<http://www.datafinder.org>) as a registered node of NSDI. More than 100 separate entities use DataFinder daily, and usage is steadily increasing—424 datasets were downloaded in July 2001
- Endorsed standards for metadata (FGDC compliant), a regional projection and coordinate system, coding components for the jurisdictional boundary datasets, spatial accuracy testing, and reporting (FGDC compliant), in addition to data content standards associated with each regional information need solution
- Executed agreements that provide access by all government interests serving the seven-county area, without fee and subject to identical access requirements, to parcel and other geospatial data produced by all seven metro area counties and the Metropolitan Council
- Awarded the Minnesota Governor's Commendation for two "Exemplary GIS Projects" (Regional Street Centerline and Regional Land Cover data solutions)
- Testified before a U.S. House of Representatives Subcommittee in conjunction with the 1999 National GeoData Forum
- Awarded ESRI's 2001 Geography Network Challenge Grand Prize for its transportation Web mapping service (<http://www.datafinder.org/maps.asp>)
- Maintained active involvement by key stakeholder representatives at the policy, management, and technical levels—many since MetroGIS's inception, nearly 6 years ago

Structure:

- *Organization:* The MetroGIS organizational structure (Figure 11) reflects the strong commitments that have been made. Governing bodies of organizations critical to MetroGIS's success have adopted resolutions[8] supporting MetroGIS principles and also have appointed elected officials to serve on the MetroGIS Policy Board.[9] The board is advised by a Coordinating Committee made up of more than 20 GIS professionals and managers representing participating organizations, while dozens of other GIS professionals serve on MetroGIS teams and special purpose workgroups devoted to identifying workable solutions to data access, data content, data standards, and policy needs critical to achieving the vision of MetroGIS.

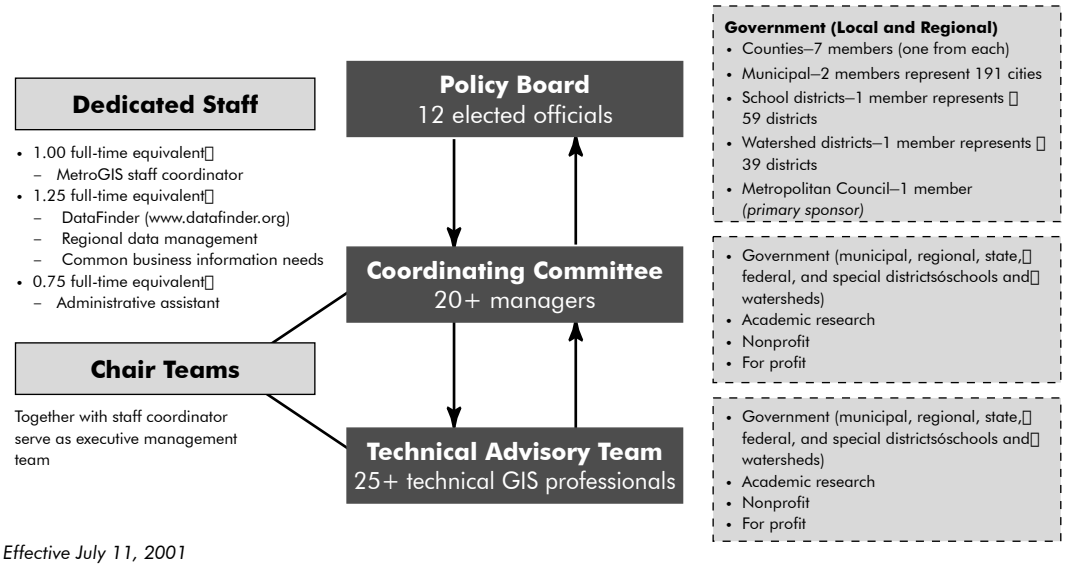
  Operating Guidelines (<www.metrogis.org/organization/m-guidelines.htm>) have been adopted by the Policy Board to provide a basic structure for governance. The Policy Board and Coordinating Committee meet quarterly. The

Technical Advisory Team and special purpose work groups meet as needed to complete their work, which is generally assigned by the Coordinating Committee. The teams report back to the Coordinating Committee, which recommends actions to the Policy Board.

- *Members:* MetroGIS does not have formal rules for membership, but it does recognize three classes of stakeholders in its operational guidelines: essential participant, system enhancer, and secondary beneficiary. All are welcome to participate in MetroGIS, which implements its policies on behalf of all of the more than 300 local and regional government interests represented by the Policy Board members, regardless of whether a particular organization is active. Generally, any organization involved in geospatial activities within the Twin Cities area is encouraged to participate in MetroGIS through ad hoc work groups and the Technical Advisory Team. Membership on the Coordinating Committee and Policy Board are governed by the MetroGIS operating guidelines, which are designed to ensure a balance between data users and data producers, as well as across the stakeholder classes.

- *Legal authority and funding:* Relying on an informal, voluntary structure, without legal standing, MetroGIS provides a trusted forum through which representatives of nearly 300 local government units and regional, state, and federal government agencies, academia, and assorted nonprofit and private sector interests collaboratively define and implement regional solutions to common geodata needs. The option of adopting a legally recognized organizational structure has been investigated on two occasions, the most recent occurring this past spring. The Policy Board concluded on both occasions that all of MetroGIS's functions were being effectively achieved without a legally recognized structure, and until the benefits of changing can be clearly demonstrated, MetroGIS should remain an informal organization. Because MetroGIS is not a legal entity, it must rely on stakeholders for administrative support, technical expertise, technology, contracting and legal services, and official standing to receive and spend funds obtained from grants and other sources. Nonetheless,

Figure 11 MetroGIS
Organizational Structure



Effective July 11, 2001

MetroGIS has succeeded in resolving technical and institutional obstacles and recommending solutions to higher authorities, as needed, to achieve the mission of the collaborative. The Metropolitan Council has provided administrative support and most of the funding to date. The council and several other organizations also have assumed data integration and distribution responsibilities on behalf of MetroGIS, which cannot own data.

Policies and Procedures

- ***Decision making and conflict resolution:*** The MetroGIS operating guidelines provide a minimal set of rules to govern its decision making. These rules do not include provisions specific to conflict resolution. Rather, MetroGIS relies on a defined process, grounded in underlining principles, for its decision making. The guidelines embody three principles:
  - Encourage a consensus-based process involving all Policy Board members for matters fundamental to the long-term success of MetroGIS.
  - Seek the powers and resources needed to develop and sustain MetroGIS through a voluntary, collaborative, and cooperative process.
  - Require a super majority of 75 percent of Coordinating Committee members for recommendations to the Policy Board and, if not a unanimous recommendation, forward dissenting opinions with the recommendation.
- ***Data:*** Because MetroGIS has no legal standing as an independent organization, it cannot own data. Further, it has no technical staff to develop data. Rather, MetroGIS offers a forum in which geodata users collectively define their common business information needs, agree to desired technical specifications and institutional roles and responsibilities to address these needs, and then pursue commonly agreed on strategies to meet them.

The first step to meet common MetroGIS data needs, which began in 1996, was to define the community's common business information needs. Thirteen were identified (see Table 2).[10] Solutions to nine are currently operational.[11] For details regarding both the institutional and data components of each see <http://www.metrogis.org/supported/workgroups/ workgroup.htm>. The method, referred to as MetroGIS's Business Information Needs Process (<http://www.metrogis.org/supported/binproc.pdf>), brings the data user and producer communities together to collectively define (1) appropriate sources of data to address each of the priority common information needs and (2) roles and responsibilities necessary to assemble, maintain, document, monitor user satisfaction, and distribute regionally significant data in accordance with the needs of the community. The community collectively recommends an organization(s) with a related business need and appropriate expertise as primary[12] and regional custodians. The Policy Board then adopts and promotes a three-part policy for each regional solution made up of (1) regional data specifications, (2) custodian roles and responsibilities, and (3) a willing organization(s) to carry out the roles and responsibilities. The MetroGIS Business Information Needs Process embodies concepts promoted in the *NSDI Framework Handbook*.[13]

Participation by the designated primary and regional custodians is voluntary. Only a letter of intent, to ensure a clear understanding of expectations of the affected custodian organization(s), is requested of the custodian candidate(s) prior to Policy Board action. To date, no organization has refused to accept the roles and responsibilities requested of it by the MetroGIS Policy Board.

Principles that underlie custodian roles and responsibilities are as follows:

- MetroGIS components are expected to be decentralized, but data services should appear to the user community as a one-stop-shop.[14] Metadata should either be posted directly on MetroGIS DataFinder or on a compatible, Internet-searchable node that can be searched simultaneously with DataFinder searches. Likewise, the actual source data and associated web mapping services can be located wherever the custodian wishes to serve them, provided the functionality complies with MetroGIS policy. MetroGIS is not the owner or custodian of any of the components, including DataFinder.
- No organization is expected to carry out a function for the collaborative that it does not have an internal business need to support unless it is appropriately compensated. MetroGIS is seeking to institutionalize collaborative roles, preferably by incorporating them into the day-to-day routines of member organizations.
- Data submitted to a regional custodian by a primary producer cannot be modified by the regional custodian, except for projections needed to assemble with other like primary data. The user community is expected to identify data anomalies and report them to the primary producer so that the next version is corrected for all users.
- Intellectual property rights and responsibilities remain with the primary producers, which decide access rules within the context of the MetroGIS process for each regional solution.[15]
- Each designated regional data custodian has responsibility for creating and maintaining metadata for the respective regional solutions compliant with FGDC clearinghouse requirements and submitting this metadata to the MetroGIS DataFinder.[16] The Metropolitan Council is the regional custodian for DataFinder.

▮ *Technology:* MetroGIS does not attempt to establish hardware or software standards. The policy is to rely on the hardware and software used by its stakeholders. Where a stakeholder elects to undertake a custodial role on behalf of MetroGIS, the end product must be readily usable via all major GIS platforms in use in the seven-county area.

▮ *Human resources:* Administrative and technical staff members dedicated to support MetroGIS are employees of the Metropolitan Council. The council's rules govern salary, benefits, and professional development.[17] (See the Costs and Expenses section below for a summary of MetroGIS staffing allocations.)

Keys to Success

MetroGIS makes a practical assumption that organizations cooperate out of self-interest. Very early, participants agreed to support the "data-sharing" ideal only if it met their own business needs. In other words, MetroGIS must serve a diverse collection of functional ends, not data sharing for its own sake. For MetroGIS, the principal stakeholders are the Metropolitan Council, other regional agencies, and local units of government—counties, cities, school districts, and watershed districts—few of which need geodata for the same purpose or use it in the same form. The principal challenge for MetroGIS is to meet the common geodata needs of these organizations without costing them more in resources or time than would otherwise be the case if they developed or assembled the data they need from others on their own.

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Based on this "self-interest" assumption, MetroGIS is guided by several fundamental principles that we believe can also serve as practical tips for others to consider:

...MetroGIS has found that widespread commitment to a common vision can play a significant role in reaching collective agreement.

- *Secure champions:* Broadly supported "proven practices" will not just happen. Sustained collaboration requires leadership from organizations with related business needs and a willingness to participate; leadership from knowledgeable and respected individuals with a passion for the possible; and a lot of hard work and significant resources. Providing lead support for the functions MetroGIS supports cannot be a job responsibility in addition to "regular duties." Overseeing the affairs of the collaborative must be job one for a person or persons with the appropriate skill sets and undaunted enthusiasm necessary to maintain sufficient momentum to keep key parties actively engaged. The organizational structure must nurture leadership from within as well as draw others to the community who have been involved in rich the tradition of GIS experimentation. It takes time to build the required support, and it takes advocates at all levels in all key organizations to institutionalize the agreed on practices—the ultimate goal if the efforts of the collaborative are to be sustained. No single organization or minority faction can be perceived as "driving the bus," if the collaboration is to be sustained.
- *Achieve broad support of vision and expectations:* Early on, collective agreement was reached on the desired purpose of the collaborative, and MetroGIS continually monitors the correctness of the stated purpose. Three activities were extremely beneficial to developing and maintaining a common understanding of purpose and desired outcomes for MetroGIS: the initial strategic planning retreat, the identification of common business needs, and the identification of priority functions. These activities involved intensive consensus-building processes.[18] They were successful because knowledgeable and dedicated individuals committed to participating in the projects, and highly trained professionals conducted the processes. Finally, intellectual property rights are the source of the single most complex and difficult obstacle to standardizing data access policies, yet MetroGIS has found that widespread commitment to a common vision can play a significant role in reaching collective agreement.
- *Active involvement of policy makers:* Elected officials were empowered early on and throughout the initiative to maintain policy focus on the broader public good, broaden understanding of the issues and benefits, provide direction on strategic initiatives, provide a reality check for proposed courses of action, identify appropriate areas for collaboration, advocate with higher authorities when needed and, of course, set policy. The MetroGIS Policy Board was created before any initiatives were undertaken, other than to craft a high-level vision that the policy makers were asked to mold into a reality that could be supported by all key stakeholders.
- *Maintain focus on common business information needs:* MetroGIS identified common business information needs of key stakeholder organizations via a broadly collaborative process and embarked on a regional geodata strategy focused on meeting these common needs. The collaborative has elected to focus entirely on common geodata needs and an effective means to search and retrieve the associated data. Application development is not a function supported by MetroGIS.
- *Promote understanding:* To help Policy Board members better understand the value of geospatial data and the use of GIS technology, a demonstration is made at each board meeting to illustrate the benefits of using

the technology and the benefits gained through data sharing and collaboration. Activities of the collaborative are regularly communicated through a variety of means with the policy maker, manager, and technical communities to foster informal professional networks and champions for the initiative at all levels and within all critical organizations. County-based GIS user groups are fostered and encouraged to "bubble-up" issues to the regional level that are beyond their ability to effectively address. Fostering a clear understanding of the issues, opportunities, and collective objectives by the entire community (i.e., being prepared when opportunity presents itself) may well broaden the reach of "good luck," which also clearly has its place for some of our successes.

- *Seek consensus on policy decisions:* Consensus among Policy Board members is sought for action on issues and opportunities fundamental to MetroGIS's success. Solutions must be institutionalized to sustain the collaborative's objectives. Organizations that have related business needs must actively participate to institutionalize the roles and responsibilities desired by the MetroGIS community.
- *Represent diverse perspectives:* MetroGIS's decision making derives from work performed by broadly representative committees and workgroups, composed of committed managers and technical staff with appropriate expertise who identify common needs, develop work programs, and formulate solutions to these needs. Data producers and users are involved in all aspects of the collaborative's decision making. No single organization or faction dominates.
- *Document stakeholder benefits:* Identifying and documenting stakeholder benefits in a manner readily understandable by the various stakeholder communities is fundamental to strengthening commitments to MetroGIS, whether or not the benefits can be precisely measured. MetroGIS encourages testimonials from its stakeholders and seeks out opportunities to collaborate with the academic community to identify and document the benefits of collaboration.
- *Acknowledge fair-share contribution options:* Contributions to the sustained operation of the regional collaborative from any one stakeholder may be in the form of funding, data, or people and equipment.
- *Align with internal business needs:* No stakeholder organization will be asked to perform a function for the collaborative that exceeds its internal business needs. Stated another way, all solutions must have their roots in actions consistent with day-to-day business functions.
- *Maintain an institutional memory:* Champions at all levels of the collaborative have left and will continue to leave MetroGIS, and stakeholders may not be able to keep abreast of all of the breadth of activities MetroGIS is engaged in. Creditable documentation of meetings, policy decisions, studies, and so forth is critical to maintaining a course consistent with previously agreed on policy and direction.

Costs and Expenses

The Metropolitan Council concluded early on that it would be difficult, not to mention extremely time-consuming, to obtain significant financial contributions from other stakeholders until they acknowledged the benefits of a regional GIS to their respective organizations. By agreeing to fund MetroGIS during the start-up period, the council cleared the way for all essential stakeholders, regardless of their philosophy and financial resources, to actively participate in the strategic decisions that have shaped MetroGIS.

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Serving in its role as primary sponsor, the Metropolitan Council has invested more than $3.2 million in project and staff expenses to support MetroGIS from 1996 to 2001 and has agreed in principle to provide an additional $800,000 to support MetroGIS through 2003. This investment included support for a new full-time staff position in August 1995 to facilitate creation of the experimental regional GIS initiative, now known as MetroGIS. In addition, several of the council's GIS technical and administrative staff members have been assigned to MetroGIS, the equivalent of approximately three additional full-time MetroGIS support positions. The council also has provided most of the funding for outreach and coordination activities, pilot projects, and several strategic projects[19] necessary to acquire the institutional and technical knowledge needed to implement a regional data-sharing mechanism.

Other sources of project financing include a $380,000 cosponsor contribution from the Minnesota Department of Transportation for a data license and maintenance agreement for a regional addressable street network dataset, a $100,000 NSDI Framework Demonstration grant awarded for MetroGIS's Fair-Share Financial Model and Organizational Structure Project, and an $18,000 NSDI Web Mapping Services Project grant.

Notwithstanding the significant financial support provided by the Metropolitan Council, MetroGIS could not have achieved the success it has had without the willingness of several hundred GIS technicians, managers, and elected officials who represent the stakeholder community and who collectively volunteer hundreds of hours of time to craft solutions that are acceptable to all relevant and affected parties.

The concept of a subscription fee to spread the costs of collaboration among the major beneficiaries was investigated in 2000 as part of MetroGIS's business planning initiative. Although the proposed "fair-share" for regional government stakeholders, of which the Metropolitan Council is the largest beneficiary, was assumed to be about 60 percent, cost sharing received little firm support. The concept was judged to be premature for the business planning period through December 2003. The "fair-share" funding concept for collaboration expenses will be reevaluated in 2002 in preparation for the 2004 budget cycle.

Notwithstanding the significant financial support provided by the Metropolitan Council, MetroGIS could not have achieved the success it has had without the willingness of several hundred GIS technicians, managers, and elected officials who represent the stakeholder community and who collectively volunteer hundreds of hours of time to craft solutions that are acceptable to all relevant and affected parties. These volunteer commitments have included attending numerous meetings to investigate options and recommend policy, providing technical prototyping of GIS techniques needed to assemble geospatial data from multiple sources, drafting agreements and licenses, designing and administering surveys, and speaking at functions to promote MetroGIS's vision and policies.

Benefits

MetroGIS has invested in several studies to document its benefits, including a study funded by an FGDC grant. The following are among the documented benefits of MetroGIS thus far:

- Decision support has improved because of more accessible data that meets user needs.
- Data-sharing activity has expanded.
- Efforts to use data from multiple sources have been reduced.
- Time expended to locate existing data has been reduced.
- Commitments to data content standards have been strengthened.
- Commitments to metadata have been strengthened.

- Benefits of data sharing are more widely understood.
- Benefits of collaboration are more widely understood.
- Informal professional working relationships have been enhanced.
- GIS is becoming recognized as a basic business tool throughout the metro area.

Shortcomings (What Would You Have Done Differently?)

Although it is a relatively successful effort that has clearly produced benefits for its stakeholders and continues to maintain a solid base of support, MetroGIS also has made its share of mistakes and miscalculations that are important to document.

- *The business information needs timetable was too ambitious:* The timetable initially set for attaining solutions for each of the MetroGIS regional priority business information needs was too ambitious. A collaborative process requires time to work through the issues in a manner satisfactory to all relevant and affected parties. Several of the work groups attracted a core of the same stakeholder representatives, distracting them from their basic duties. As a result, the commitment required had to be scaled back to ensure continued participation by the breadth of the stakeholder community. The option of having Metropolitan Council staff "just do it" was avoided to ensure the solutions were truly a product of collaboration.
- *Team staffing support was mismatched:* Very talented technical GIS staff members were initially asked to support advisory teams and ad hoc groups working to develop recommendations on data content, standards, and access-related issues, in a manner similar to the support provided for the policy-related bodies. The administrative burden was overwhelming, as they were asked to prepare draft work plans, to initiate agenda-setting meetings with the team leadership, to mail agenda packets a week before the meeting, and to prepare written staff reports for each agenda item. The reports were expected to frame the issues, provide relative background information to team members, explain the pros and cons of options, and present a recommendation for the team's consideration. They were also asked to prepare meeting summaries and to follow up on direction received. These expectations were unrealistic for GIS technical staff. Eventually a person with the appropriate skill sets was hired. The expectations for team support were not changed because of the need in a collaborative environment to thoroughly document the process and demonstrate that all view points had been given due consideration.
- *Web site architecture modifications were not well thought out:* MetroGIS contracted with a Web designer to convert its initial modest organizational information site, built by a self-taught staff member, to conform to more robust HTML protocol. No documentation for the new site architecture was provided. A high-functioning administrative assistant was assigned to maintain the site. That person left the unit, and three other individuals have maintained the site over a 5-year period; none had formal Web training. Although the site (<http://www.metrogis.org>) is serving its intended purpose, updates are complicated by patchwork architecture. MetroGIS is now faced with rebuilding the site. In retrospect, thorough documentation of the architecture and update procedures and more supervision of the subsequent modifications would have avoided many of the design issues that now require attention.

Challenges Ahead in 2002 and Beyond

The MetroGIS vision that emerged out of public forums and strategic planning events held in late 1995 and early 1996 continues to drive the active involvement of organizations within the Twin Cities metropolitan region. In some respects, notwithstanding the benefits that have been realized to date, MetroGIS remains an experiment in progress. The following are some of the more evident challenges and issues that must be overcome, presented in no particular order:

- *Securing adequate and stable long-term funding:* The Metropolitan Council has pledged to support MetroGIS through 2003, consistent with MetroGIS's current business plan. The average annual cost for maintaining the current level of support for MetroGIS's collaboration functions is in the $350,000 to $450,000 range, depending upon the level of staff support for committees and the pace of development for some technical needs related to regional data solutions, Web site maintenance, and data distribution. These costs are for collaboration activities only; they are above and beyond what the stakeholder organizations are currently spending to support their own internal GIS programs. To prepare for the 2004 work planning and budget discussions, the concept of equitably distributing the costs of collaboration among the major beneficiaries will be evaluated for a second time. Issues of funding equity have yet to be fully addressed. Stable long-term financing cannot be achieved until these equity issues are resolved, which leads to the next challenge, documenting benefits.
- *Documenting benefits:* The need to demonstrate tangible benefits continues to be priority. Issues of funding equity are directly tied to perceived benefit. MetroGIS is benefiting its stakeholders who depend on other organizations for data, especially organizations that depend on data from more than one data producer. These costs savings need to be more clearly documented and more broadly conveyed to the leadership of these organizations. School districts and watershed districts are good examples, especially when their jurisdictions cross county lines. Regional, state, and federal agencies have also acknowledged the benefit of not having to internalize the cost to assemble and merge data from multiple sources (i.e., parcel data from seven counties) on their own but have difficulty justifying budget proposals for collaboration costs, as opposed to data development costs. Additionally, counties are among the primary geodata producers within Minnesota and depend only marginally on other organizations for most of the data they need. The case for county participation—essential for MetroGIS success—can be greatly strengthened if the benefits to them of data from other sources can be more convincingly documented.
- *Developing practical common data specifications:* MetroGIS has identified its highest priority information needs, based on public forums and formal surveys, and is working to develop clear data specifications and partnerships with organizations that have the needed expertise to appropriately address those basic needs. Some of the data needs parallel the NSDI Framework Data elements, but others reflect local priorities. General specifications have been developed for most of the highest priority data, such as municipal boundaries, and de facto specifications have evolved for some others, such as an addressable transportation network. In all cases, adopted specifications must be supported by strong consensus. Developing data specifications that both work and receive consensus support require a significant investment in time, resources, and personnel. This is a challenge with no obvious solution.

- *Enhancing data distribution capabilities:* Agreement on solutions to common data needs is of little value unless the data user can efficiently access that data. MetroGIS's top priority for 2001 to 2002 is to design and implement an Internet-based data distribution mechanism[20] that allows users to self-define their geographic area of interest area and to choose among the geodata available for that area. The desired mechanism also involves design and implementation of a state-of-the-art security module and the ability to integrate distribution of source data with Web mapping services. An associated priority is to facilitate the creation of more compliant metadata for additional datasets and post the metadata on MetroGIS DataFinder or a comparable Internet searchable site.

- *Respecting costs of collaboration:* MetroGIS participants, whether active on its Policy Board, its Coordinating Committee, or its working committees, have made a huge time investment to help carry MetroGIS as far as its come. MetroGIS must continue to be respectful of the amount of time required of its stakeholders' volunteers to participate in MetroGIS's activities and remain informed about the activities of the collaborative. The objective is to maintain a balance that minimizes the amount of time needed to achieve effective collaboration and sustain a trusted process without transforming MetroGIS into another level of bureaucracy.

- *Adapting to state data practice laws:* Minnesota laws governing data access, privacy, intellectual property, and cost recovery were reviewed by a state Information Policy Task Force that made some very significant recommendations in a 1999 legislative report. Controversial recommendations were considered by the legislature but not approved and likely will continue to be reintroduced. Several of these directly affect the current ability of government to charge data development cost recovery fees, fees that have been temporarily waived for government and academia access as result of incentives provided through MetroGIS's initiatives. Many local governments oppose the task force's recommended changes, especially those that require payment of a data development recovery fee for access. The challenge is double edged: While eliminating most data fees potentially removes a major barrier to data access, it also may curtail funding for geodata development and constrain MetroGIS from using subscriptions and fees as revenue sources to support for its work.

- *Replacing "Data-Sharing" incentives:* MetroGIS participants have enjoyed an open data-sharing environment for the past several years, largely because of agreements between the Metropolitan Council and each of the seven MetroGIS counties. In exchange for a negotiated amount of funding to be used for data maintenance and other technical work that both meets the needs of the contracting county and addresses a MetroGIS issue, each county agreed to make its geodata available to any public organization, and recently to academic institutions, doing business within the metropolitan region. Several metropolitan counties had previously charged fees for their data but essentially have waived them for MetroGIS participants in return for a negotiated project funding. Continued data-sharing incentives may be needed to maintain an open data-sharing environment for the MetroGIS community.

- *Strengthening local users groups:* Local GIS users groups are operational in each of the seven Metro Area counties, in part, due to incentives provided through MetroGIS. The findings of Dr. William Craig's 1999 Benefits Study[21] clearly demonstrated that gathering people with an interest in geodata together in discussions about sharing data leads to increased awareness of each other's situation, friendship, and trust. Increases in these characteristics, in turn, translate into increased data

sharing. These local user groups also nurture the champions necessary to continue to make progress at the regional levels and higher.

- *Maintaining focus:* Keeping focused on the basic MetroGIS vision remains a challenge, especially as the real and perceived successes of MetroGIS become increasingly apparent to organizations elsewhere promoting the NSDI vision. MetroGIS was created to meet regional and local needs. MetroGIS staff members have participated actively in Minnesota organizations seeking improved coordination of geographic information technology, with NSDI events sponsored by FGDC, and with creation of GDA. For the most part, all parties benefit, but maintaining focus on MetroGIS needs is, at times, a balancing act that requires constant attention.

For Further Information

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PaMAGIC

Pennsylvania Mapping and Geographic Information Consortium

Eric Jespersen, Past President

Introduction—History, Purpose, and Functions

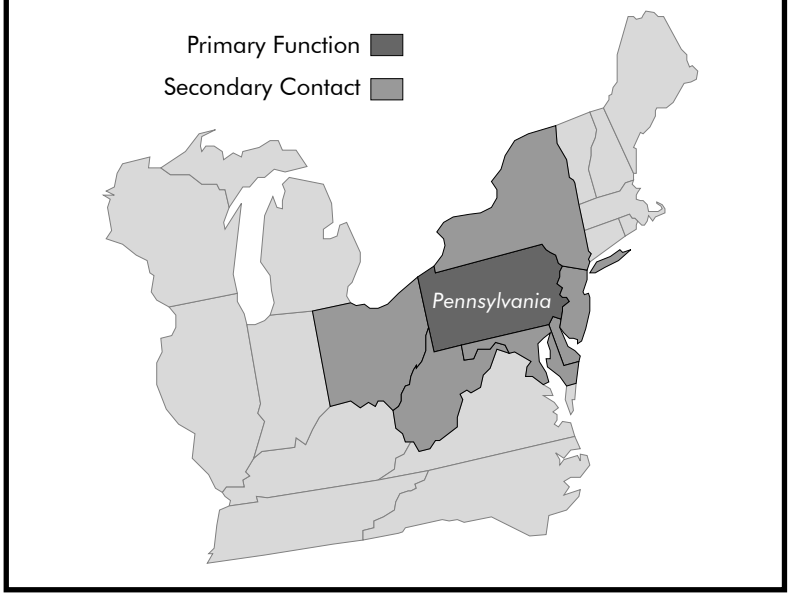
In May 1996, a small group of GIS professionals put forward the concept of a public–private–academic organization to eliminate duplication of effort and increase coordination in data creation and information exchange within the commonwealth. The idea was readily accepted, and a follow-up meeting was planned for the coming month.

Approximately 250 people convened, and they elaborated the goals and objectives of the proposed group. Later in the summer, a subgroup of about 60 individuals met to define the organization further, to name it, and to select an interim board of directors. The mission selected at that time was as follows: "To provide leadership, coordination, and guidance to enhance the development, use, and access to spatial information and related services in Pennsylvania." At the same time, we created a set of goals and initiatives to focus the group's efforts.

The entire formation process was flavored by at least two previous statewide coordination attempts, by a distrust of certain state agencies, and by the fact that county-generated data of very high quality was becoming commonplace. The PaMAGIC service area is shown in Figure 12. Major points of agreement in the formative meetings included the following:

- A noncoercive body offering equal voice to all participants should be formed.
- The design should allow "one person, one vote" decision making.

Figure 12 PaMAGIC **Service Area**



- Dues should be established at $15 per year to encourage broad participation.
- Board representatives should be selected on a regional basis to accommodate economic and cultural differences across the state and to avoid undue influence by wealthier metropolitan areas or specific agencies.
- Easy information exchange (and use of emerging technologies to facilitate that exchange) should allow the advanced counties to progress together, while simultaneously allowing late entrants to GIS to take advantage of the common experience to avoid mistakes. PaMAGIC was envisioned from the start as a virtual organization.

The organization remains voluntary and noncoercive and has evolved to be the advocate of local government within the state. Early boards focused on particular events and opportunities to focus activities. Each president has taken advantage of his or her parent organization's strengths to help advance the whole. For instance, the first president built PaMAGIC into his own regional task force's activities, so that PaMAGIC appeared to sponsor numerous events in its first year. The second president had the ability to publish data sets, so PaMAGIC data compact disks containing statewide data sets were widely distributed.

After 2 years of solid activity, the coordination climate changed. State agencies formed their own coordinating body (the Pennsylvania Geospatial Information Council or PAGIC) and became much less involved in PaMAGIC. Beginning in 1998, activities focused on formalizing the administrative function and gaining a voice in PAGIC; both efforts were reasonably successful. Sadly, the existence of two coordinating bodies created confusion among all participants. Our membership remained stable at about 250 members; however, and PaMAGIC maintained the more diverse set of GIS professionals and interests.

Still guided by the original goals and objectives, PaMAGIC's fourth president and board of directors focused on standards development and acceptance. They developed a workshop model that consisted of regular meetings in a central location such that the volunteer participants could limit their time commitment to 1 day per month and produce written results quickly and efficiently. Both PaMAGIC and PAGIC cosponsored a series of town meetings to explain the process and benefits of the standards development workshops.

Major Accomplishments

- PaMAGIC performed and published three reviews of GIS coordination status within the commonwealth, including county-by-county data holdings surveys. Each review was more comprehensive than the previous one, and the latest was performed in conjunction with the state police.
- We developed and published draft standards for data interoperability and created a process for their continued development.
- We participated in national organizations (National States Geographic Information Council and FGDC) on a regular basis to provide context and balance to our local activities and to provide a voice to the commonwealth in national actions.
- We advocated the value and importance of local data, both to the professional community in general and to the state agencies through our seat on PAGIC.

- PaMAGIC survived as a volunteer organization for 5 years and developed a reputation for consistency and broad perspective. The board continues to represent public, private, and academic entities in approximate proportion to our membership, without any particular formula requiring such representation.

Structure

- PaMAGIC is a 501(c)(3) nonprofit organization whose activities are guided by an 11-person board of directors. Originally, the board contained 13 directors representing 9 regions with 4 at-large board members. The agenda and level of activity are directly related to the president's vision, as tempered by the board. As in any volunteer organization, most of the work is performed by a small number of active members.
- Our only member category is "individual," and annual dues are now $25. We have annually considered corporate sponsorships and repeatedly tabled the issue for lack of a good way around the impression of undue influence. We have, however, always enjoyed a very strong benefit from public and private organizations in their support of time and travel investments for their staff as they participate in events; in-kind support is probably 5 or 10 times as much of our funding as member dues. Interestingly, no large organization has ever tried to gain influence by signing up large numbers of members. PaMAGIC is probably successful because it is not beholden to any one constituency and obviously not built to take control.
- Our constituency remains GIS professionals at both managerial and technical levels. We do not lobby, and our regular information exchange is within the technical community.

Policies and Procedures

- *Decision making and conflict resolution:* The original intent was to establish a virtual organization with frequent and open exchange of ideas and information. Given that intent and the lack of a mechanism to acquire power, the only decisions to be made are where to focus the group's energy in the coming months and years. The board is expected to anticipate problems, envision solutions, and then fit them to the political and technical climate. Generally board meetings consist of a 2-hour roundtable discussion of current activities to provide context for decision making, followed by direct discussion and voting on specific activities.
- *Data:* PaMAGIC holds no data. We have always advocated the use of metadata. In 1999 we partnered in an FGDC Cooperative Agreement Program grant for metadata promotion.
- *Technology:* One of our regional data consortia provides Web hosting and administrative capacity for PaMAGIC, on a fee basis.
- *Human resources:* PaMAGIC remains a virtual organization, with no professional or technical staff of its own. Board members may charge expenses for extraordinary travel and lodging, but generally do not—their parent organizations support their activities.

Keys to Success

- PaMAGIC has focused on a limited number of issues and has steadily educated members and the broader community on the details of those issues. Our positions are not always popular or common and are often taken well in advance of actual problems. This leads to the perception of

an organization pointed to the future and allows us to frame the discussion; the fact that our position is based on the experiences of public, private, and academic sectors adds significant weight to our arguments. Additionally, there is a concerted effort to maintain contacts nationally and to bring the broader context to our advanced positions.

- The organization seeks no power and is not coercive. Although this leaves an apparent vacuum into which others wish to move, the GIS community in Pennsylvania strongly resists centralized power (successfully to this point). The ideal that we move slowly toward is decision-making power in balance with the economic investment made by each sector; progress is limited because the greatest investment is now made by the lowest levels of government and because they are so numerous and varied.
- A steady core of individuals guides the organization and provides a consistent focus. At the same time, new individuals join the board and slowly change the organization. The board of directors enjoys much freedom of action and does most of the work. Annual elections of about half the board ensure reasonable change.
- PaMAGIC does not employ a formula for representation of the various sectors but has always achieved balance between membership and board representation. Elections are held annually at the Pennsylvania GIS conference, and PaMAGIC maintains a high profile throughout the meeting, mainly with technical presentations, plenary session, and social events.

Costs and Expenses

The Pennsylvania Department of Environmental Protection provided about $25,000 for the initial meetings in 1996 at which the vision, mission, and goals of the group emerged.

Ongoing operating funds are an unusual mix of dues, in-kind support, and the time of members to meet and work. A reasonable estimate of that blend (annually) is as follows:

- $3,000–$4,000—member dues
- $5,000–$6,000—in-kind services such as printing, CD publication, mailing, secretarial
- $20,000–$30,000—value of board and other members' time and travel

Occasional grants from commercial firms have funded surveys, special meetings and publications, and social events. About $10,000 in FGDC grants has funded specific initiatives on metadata and standards.

Benefits

- Pennsylvania has a draft set of standards built around the high-caliber data produced by local government and developed by a broad cross-section of the technical community.
- The technical community for GIS in the commonwealth is more closely associated than would otherwise be the case and has a common voice.
- We maintain solid relationships with neighboring states and a realistic perspective on national trends because of our involvement on a national level.

Shortcomings (What Would You Have Done Differently?)

- PaMAGIC has been unsuccessful in broadening our base of membership beyond the GIS technical community to other related professional organizations. Our membership should be growing as the use of GIS grows.
- The organization has no technical or managerial staff, which limits the frequency and number of activities we can mange. There have been points in time at which the funds to secure permanent staff were available; the strong mandate to remain noncoercive limited the board's ability and desire to accept those opportunities.
- When the state agencies created their own coordinating body, we lost most of their personnel's involvement in our organization. Although PaMAGIC is a partner in PAGIC, the commonwealth suffered a 2-year setback in progress due to the confusion of multiple coordination efforts on a statewide level.

Challenges Ahead in 2002 and Beyond

PaMAGIC needs to evolve into an alliance that once again contains all interested parties. As nationally, the change from top-down or bottom-up organizations to something structured around shared responsibility is hampered by existing perceptions and practice.

The breadth of our information exchange must increase to include the more than 2,500 municipalities in Pennsylvania, primary education, and the general public. It is unclear how a strictly volunteer organization can manage that task. One scenario for our evolution is to create an alliance of existing organizations that already reach those elements of our society. The difficulty is to do that in a way that does not explicitly threaten the status quo.

Identifying leaders from among our technical community to maintain our progress is always difficult. Thankfully, we have strong-minded young people in this field, and our prospects are good if we continually provide examples and opportunities.

It is unclear that historic relationships among levels of government will change rapidly enough to take advantage of the pace of technical change. It is likely that social and not technical difficulties will most impede our progress.

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National Cooperative Soils Survey (NCSS)

United States and Trust Territories

A nationwide partnership of federal, regional, state, and local agencies and the private sector working together to inventory, interpret, publish, and distribute soils information for public use.

Horace Smith, Chair, National Cooperative Soil Survey (NCSS)
and Director Soil Survey Division, U.S. Department of Agriculture (USDA)–
Natural Resources Conservation Service (NRCS)

Introduction—History, Purpose, and Functions

The Division of Soils within the U.S. Department of Agriculture (USDA) was begun in 1899. Leadership for conducting soil surveys before that date was divided between the states and other federal departments such as the Geological Survey and the Weather Bureau. The first soil surveys were conducted to find areas for the expansion of agriculture. Emphasis was on areas to increase tobacco production in the East; in the West, dry areas were explored to determine suitability for food crops. Under the guidance of the division, those first soil surveys were conducted in close cooperation with local institutions, state experiment stations, geological surveys, and other boards of agriculture. The cooperative nature of producing soil surveys brought the strength of different minds together to produce information with broad applications, and it has been maintained to this day. In 1953 the Soil Conservation Service (SCS) was formally given the charge of leadership of the National Cooperative Soil Survey (NCSS). NCSS is now a formal organization with a set of bylaws. At the same time, it remains a process by which soil surveys are produced. The primary purpose of NCSS is to provide a forum through which cooperators can aid in the continuing development and improvement of standards and procedures for carrying out all phases of soil survey work. SCS became the Natural Resources Conservation Service (NRCS) in 1995.

In addition to the formally chartered organization, NCSS consists of a nationwide partnership of federal, regional, state, and local agencies; institutions; and the private sector. This partnership works together to cooperatively investigate, inventory, document, classify, and interpret soils and to disseminate, publish, and promote the use of information about the soils of the United States and its trust territories. The activities of NCSS are carried out on national, regional, and state levels. NRCS is responsible for the leadership of soil survey activities of USDA, for the leadership and coordination of NCSS activities, and for the extension of soil survey technology to global applications.

Working agreements are the basis of understanding for cooperative work with other agencies and organizations. These agreements are in the form of memoranda of understanding (MOUs), contribution agreements, and trust fund agreements. NRCS or any public agency may initiate working agreements relating to soil survey activities. If another federal agency initiates a working agreement, the name of the document and the format may be different from those used by NRCS. Cooperators operate within their own sphere of authority; their guidelines are in subpart 104I-73.101 of the NRCS Property Management Regulations. An MOU is not a contract, nor are the plans and specifications agreed on and contained

therein legally binding for the signing agencies. It may provide for other working agreements such as contribution agreements or trust fund agreements for transfer of funds, services, space, or equipment.

As a result of the desire to maximize agricultural production and to reduce the negative effects of human activities on the land, SCS and NCSS thrived. Federal, regional, state, and local partners came together under a set of unifying data collection standards to share data and information about the collection process, to resolve technical barriers, and to capture the chemical and physical soil properties affecting agriculturally production. Over the years, organizations involved in NCSS have modified their internal structure, staffing, funding methods, and process to better address the needs of the partnership and to accommodate program shifts and changing technology. The areas where soil data have been generated by NCSS are illustrated in the map found at < http://www.ftw.nrcs.usda.gov/jpg/ssa_small.jpg>.

Major Accomplishments

The long-term collaboration among the contributing partners of NCSS has resulted in accomplishments that would not be attainable by any one partner individually. Examples of benefits are as follows:

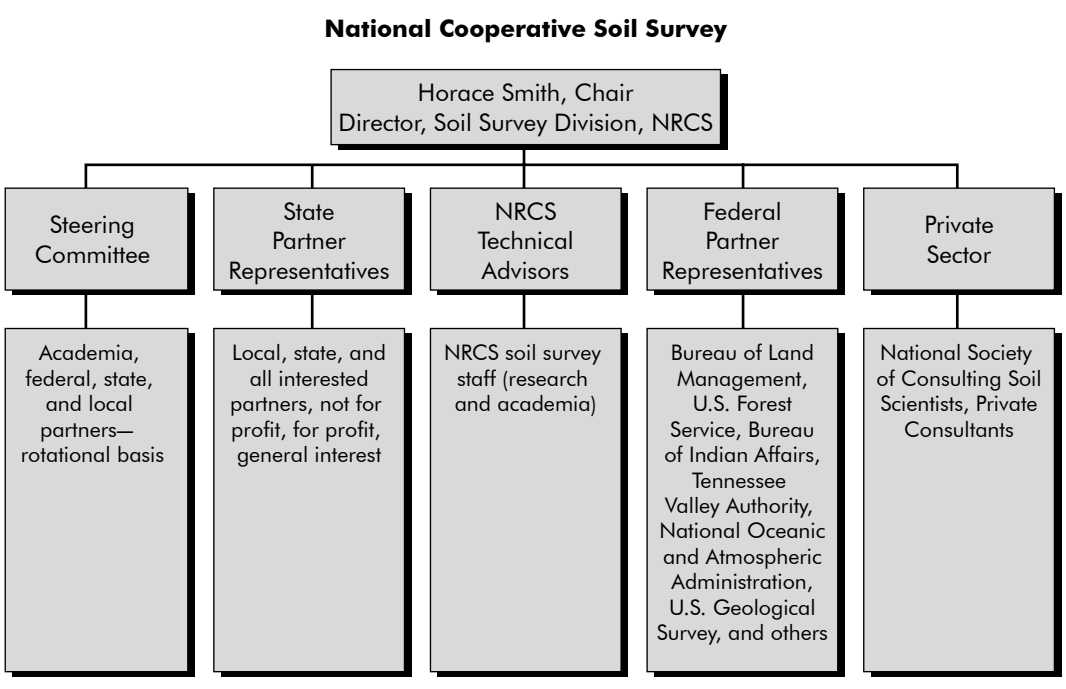
- The collaboration has allowed NCSS to complete soil surveys for more than 96 percent of the private land in the United States and 81 percent of the public lands.
- By partnering with universities and land-grant institutions, NCSS assists in the development, maintenance, and delivery of soil-related curricula at universities and in turn develops tomorrow's soil scientists. As technology has evolved, this has been key to the development of young staff members with knowledge in soil science and other disciplines related to agriculture, including digital data development and GIS analysis.
- As a result of the cooperation with local and state governments, the soil survey data are used for local planning and smart growth efforts. Consequently, local governments are willing to contribute to the collection of the data, publication of the final report, and development of the digital data.
- Cooperation with local consultants conducting very detailed local mapping has enabled NCSS to see more of the potential uses of the soil data and to begin planning to support these "nonagriculture" applications.
- By cooperating with agronomists, environmentalists, engineers, community planners, and others, NCSS has supported a multitude of planning applications focusing on the wise use of data and technology to minimize the negative effects on the land.
- A National Soil Information System and Soil Survey Geographic Database (SSURGO) geospatial data standard was developed to move the program to the digital arena.

Structure

The permanent Chair of NCSS is the Director of the NRCS Soil Survey Division (Figure 13). Partners of NCSS vary in the nature of their contributions, geographic extent of involvement, expected outcomes, and application needs. Since the technical organizational structure is well defined, flexibility can be supported at the local level to ensure that partner needs are met within the bounds of the NCSS requirements. NCSS partners include the following:

- *Academic and research:* Through the land-grant university system, Cooperative Extension, Agriculture Research Service, and the academic geospatial community, NCSS works to incorporate the latest technology and tools to enhance the quality of analog and digital soil surveys and to expedite the data collection and dissemination process. In some areas, academic institutions train staff, assist in digitizing soils, conduct chemical and physical soil analysis, or partner to fund additional staff.
- *For profit:* Soil information is in demand where urban development has caused increased environmental regulation and where land prices and community interest in smart growth issues are common. The established mapping standards of NCSS are cited in the legislation of many states, and, consequently, the private sector requires training and assistance in applying these standards. NCSS members train "for profit" entities and often assist in the development of standards for the mapping of "detailed soil surveys" for more site-specific uses.
- *General interest:* Homeowners, landscapers, gardeners, students, and others may contribute to the NCSS process, and their historical effect can be seen in the types of interpretations provided with all completed soil surveys. For example, suitability ratings for basements, golf courses, ponds, and playgrounds are intended to increase the usefulness of the survey data to the public. The general public has full access to published soil surveys through the county and state library system, which archives surveys of local interest. Soil survey data are commonly used by the land trust community to help identify sensitive environmental areas.
- *Government:* The soil survey data are used for a range of applications within the government arena, including federal, state, and local. They are also the primary financial supporters of the soil survey, and their continued

Figure 13 National Cooperative Soils Survey
Organizational Structure



support is critical to the maintenance, update, and collection of the data. Applications range from pesticide leaching potential to electrical power siting efforts. The soil survey is a critical element in land-use planning and often serves as foundational data to support local, state, and regional planning. Consequently, local governments often have funds to support the update of soil data, but NCSS may lack staff to conduct the inventory in a timeframe that meets their needs.

- *Nonprofit:* The nonprofit community has participated technically and financially in the completion and application of soil data. NCSS relies on these entities to use and apply the data for a variety of purposes and to highlight the usefulness of the data. Examples include "smart growth" initiatives and environmental monitoring organizations.

NCSS is a cooperative undertaking of USDA and a representative state agency—commonly the state agricultural experiment station of a state's land-grant university. Other agencies—local, state, or federal—cooperate under special agreements. In recent years, the private sector, represented mainly by the National Society of Consulting Soil Scientists, has become a part of this cooperative partnership.

As stated earlier, NCSS is a cooperative undertaking of USDA and a representative state agency—commonly the state agricultural experiment station of a state's land-grant university. Other agencies—local, state, or federal—cooperate under special agreements. In recent years, the private sector, represented mainly by the National Society of Consulting Soil Scientists, has become a part of this cooperative partnership. The original federal authority for the soil survey of the United States is contained in the record of the 53rd Congress, chapter 169, Agricultural Appropriations Act of 1896. The authority was elaborated in Public Law 74-46, the Soil Conservation Act of April 27, 1936, and again in Public Law 89-560, Soil Surveys for Resource Planning and Development, September 7, 1966. The *NRCS General Manual* is the primary references on principles and technical detail for local, state, and federal contributions to soil surveys authorized under these acts.

Before any soil investigation work begins, an MOU on behalf of NCSS partnership is developed. All parties to be active participants in the survey are reflected in the document, and roles are clearly defined. The MOU outlines issues such as fieldwork, laboratory analyses, special studies, and plans for entering into cooperative or trust agreements. Those making any contribution to the effort are further sited in the MOU for recognition in the final publication. Collaborative arrangements are based on the contents of the MOU and supporting documents. It is assumed that all signing parties will do everything within their power to fulfill their stated responsibilities. Although the documents are formal, they are nonbinding statements of intent.

Financing is provided by those interested in seeing the soil survey work completed, and hence their level of contribution is captured in the MOU. Partners contribute to a trust, which is used to fund the effort. Other contributions in the form of staffing and equipment are also captured in the MOU.

Policies and Procedures

NCSS decisions are regularly made in a collaborative atmosphere. In the absence of standards and common data collection practices and methodology, this would be very difficult; however, NCSS uses well-established protocols, and all participants agree to follow these standards for the duration of the data collection process. Additional information is available from the following locations: <http://www.statlab.iastate.edu/soils/nssc/>, <http://www.statlab.iastate.edu/soils/nssh/>, <http://dlnt20.fsa.usda.gov/scdm/>, and <http://www.statlab.iastate.edu/soils/ssm/gen_cont.html>.

Conflict resolution is addressed through a defined organizational structure. The first level of the structure is the field soil scientist. Subsequent technical

and managerial levels address conflict or differing technical views while taking into consideration the use and intent of the soil survey. Each state and trust territory has a lead soil scientist who normally resolves conflict within his or her area of responsibility. This is done through regular informal partner meetings and a yearly formal meeting. Where regional conflict may exist among states or where a neutral party is needed, 18 regional soil scientists are assigned areas based on geography. Consequently, there is a very well-defined hierarchy to which issues are directed and resolved.

NRCS as part of NCSS has worked extensively in the areas of data production, acquisition, maintenance, assembly, and integration. As the lead for NCSS, NRCS facilitates the development of standards of soil data generation, distribution, and archiving. Additional standards exist for generating, applying, archiving, and conducting quality control of digital geospatial data. Additional information is available from <http://dlnt20.fsa.usda.gov/scdm/> and <http://www.ftw.nrcs.usda.gov/ssur_data.html>. Soils information developed by the NCSS partnership is public domain. FGDC-compliant metadata summarize data limitations and strongly recommend users unfamiliar with the information to consult a professional soil scientist. Contact information is provided. Due to the changing landscapes, age of some of the data, and general limitations of scale, the metadata further caution the user to be aware of these issues.

The map extent for the NCSS digital soil survey data set (<http://www.ftw.nrcs.usda.gov/jpg/ssa_small.jpg>) is a soil survey area, which may consist of a county, multiple counties, or parts of multiple counties. A SSURGO data set is the digital data of the soil survey area and consists of map data, attribute data, and metadata. SSURGO map data are available in modified digital line graph (DLG-3) optional and Arc interchange file formats. Attribute data are distributed in ASCII format with DLG-3 map files and in Arc interchange format with Arc interchange map files. Metadata are in ASCII format. Hardcopy products are available as well. Data distribution occurs in many formats. At the field level, data may be distributed for specific areas of interest, while from central repositories, users download a SSURGO dataset and tailor the data to meet their needs. Data are also distributed on CD-ROM, FTP, and map services. A variety of hardware and software platforms are used to generate, store, deliver, and collect digital soils data. Operating systems include NT, UNIX, LINUX, and Windows. Large data repositories are running UNIX. Telecommunications capabilities may limit some users from accessing the large soil datasets. In these cases, users may access data at their local USDA Service Center office in hardcopy or digital format or request data on several media formats including CD-ROM. The status of digital soil development can be viewed at <http://www.ftw.nrcs.usda.gov/status_data.html>.

NCSS partners interested in supporting a particular soil survey contribute to the effort in any manner possible. The preferred method is funding for staff and resources; however, it is very common for the local county soil and water conservation districts to contribute trained soil scientist staff and other expertise. As mentioned earlier, other contributions may include a district manager and equipment.

NRCS is viewed as the training source for soil science in the United States with the exception of the university system. NRCS conducts regular formal

training in a variety of soil survey and analysis functions. These sessions are attended by staff from federal agencies, state and local governments, and universities. On occasion, individuals from the private sector also participate. NCSS staff costs are provided by the supporting agency. However, in some cases, staff salaries are shared by several organizations if a single entity is unable to support the staff. Resource issues are managed locally and incorporated into the MOU.

Keys to Success

The cooperative partnership has addressed many difficult technical and organizational issues over the years but has maintained a strong foundation and continues to generate quality products. Primary to this success are three key factors: the generation of a useful product, a well-defined organization/partnership structure, and well-defined data standards. Each is addressed below.

- *Useful, quality product:* NCSS has been successful over the years primarily because the cooperative partnership generates a product that is of value to a wide range of users. Not only does the soil survey provide extensive resource information, but NCSS also has worked extensively with local users to encourage proper use and accurate interpretation.
- *Well-defined structure:* The structure of NCSS has evolved over the years and changed with the advancement of technology, shifts in agriculture, and resource-related issues. However, the basic structure and lines of communication remain today as they have for more than half a century. Additionally, authority for technical decisions and conflict resolution remains as close to the data collection point as possible. Staff members are empowered to resolve issues at the field and state level where possible. NCSS partners are aware that the state soil scientist leads the program in the particular state and are free to raise issues when needed.
- *Well-defined standards:* NCSS is extremely decentralized. At any one time, hundreds of soil scientists are mapping soil resources across the nation. However, the techniques for data collection, classification schema, mapping techniques, and landscape interpretation methods are standard. Naturally, human variability will always be a factor; however, standards for outlining every phase of the soil survey are published and available to all interested in collecting and interpreting the data. As a result, data from the entire nation can be aggregated and eventually centralized to generate national views.

Costs and Expenses

Soil surveys in general are conducted on a county basis. Each partnership varies due to the partners involved, anticipated products, and resources available. General overhead costs are estimated for each survey when initiated but vary considerably.

NCSS is a standard part of NRCS and is viewed as a critical function. NCSS coordination is standard operating procedure and incorporated into the job description of most soil scientists. However, this is not the case for all partners of NCSS, and in some cases, significant efforts are made to coordinate and initiate a soil survey and partnership on behalf of NCSS. For example, state and local governments may lobby legislative staff for funds to assist NCSS in conducting a soil survey.

Benefits

Participants of the partnership benefit in many ways. Because of the variation with which soil data can be and are used, capturing all of the benefits is difficult; however, some of the more obvious are listed below:

- Availability of soils information to assist in local planning needs—specifically issues related to prime farmland, erosion, and hydric soils;
- On-site analysis for new buildings, development, and land management issues;
- On-farm planning of conservation practices to minimize soil erosion, maintain water quality, and so forth; and
- The ability to use soil data as model inputs for pesticide leaching on national level—and hence develop strategies to minimize leaching concerns.

Shortcomings (What Would You Have Done Differently?)

NCSS has faced many challenges. Among the most significant is the incorporation of advanced technology and subsequent development of digital data. A few of the lessons learned are provided below:

- Ensure that coordination and collaboration is rewarded and valued throughout the partnership. Although this is often assumed in NCSS, continued emphasis is helpful.
- Develop, document, and share standards early in the process.
- In the case of digital data development, establish units that focus solely on this aspect of data production. This is a specialized area and requires dedicated hardware, software, skill, and resources. It is not an effort that can be "added" to existing duties.
- Define a process for specific cooperation with the academic sector and infusion of the new technology into existing processes.

Challenges Ahead in 2002 and Beyond

NCSS is challenged with addressing the needs of the conservation community, environmental planners, users related to the agriculture sector, and urban communities. The needs vary as do their interest for digital products. All users prefer faster delivery of products and greater level of application assistance and data support. Historically, NCSS funds and the MOUs have documented the collection of data and the generation of a report both on hardcopy and electronically but have not specifically defined long-term support and application products—this has often been assumed. There may be a need to further define these relationships in the long term.

Generating digital geospatial data has increased the resource needs of NCSS significantly. Hardware, software, telecommunications, specialized staff, and data delivery infrastructures have splintered the traditional soil data collection effort. The horizontal and vertical integration of data to support our field staff, partners, and cooperators is a significant undertaking. Evolving technologies may assist this effort in the coming years, but in the short-term, data will continue to be individually integrated and delivered to the field office. One method of data distribution to support NCSS can be viewed at <http://www.lighthouse.nrcs.usda.gov/lighthouse>.

With 2,800 USDA Service Center offices and NRCS staff in each, the delivery of soil data is a significant undertaking. Each of these offices

anticipates digital soils, digital orthoimagery, and farm field boundary data with which to conduct conservation analysis. Future effort will focus on the continued collection, maintenance, and distribution of data to support program missions and NCSS partners. Parallel efforts will address the continuing need for simplified analysis tools to interpret the complex nature of soil information as well as multiscale, multitemporal data integration issues.

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Endnotes

[1] <http://www.geoall.net/draftingteam.htm>

[2] David Arbeit, as Director of the Minnesota LMIC, serves as senior staff to the Minnesota Governor's Council on Geographic Information. David served as the first chair of the MetroGIS Coordinating Committee from March 1997 to March 1999. He also coauthored with the MetroGIS Staff Coordinator Metro GIS's successful NSDI Framework Demonstration Grant Application in 1998.

[3] The Metropolitan Council's responsibilities include running the regional bus system, collecting and treating waste water and managing water resources preservation, overseeing growth management policy, planning regional parks, and administering funds that provide housing opportunities for low- and moderate-income families. See <http://www.metrocouncil.org> for more information.

[4] <http://www.lmic.state.mn.us/>

[5] Twenty representatives of public, academic, nonprofit, and private sector organizations serving the metro area with geodata expertise, including Michael Domaratz of the FGDC staff, attended. By March 1996, a common vision had been adopted, and the Metropolitan Council had agreed to provide significant financing to define the form and function of the regional GIS initiative. By fall 1996, MetroGIS's principles had been endorsed by governing bodies for all key stakeholders, and a Policy Board had been created, which first met in January 1997.

[6] <http://www.metrogis.org/organization/form-index.htm>

[7] <http://www.metrogis.org/about/business_planning/business_plan.pdf>

[8] A template for the resolution is at <http://www.metrogis.org/about/history/resolution.pdf >.

[9] Elected officials from 11 organizations, representing all forms of local and regional government serving the Twin Cities Metropolitan Area, make up the MetroGIS Policy Board. Each stakeholder organization adopted a resolution acknowledging and supporting the principles of MetroGIS and agreed to appoint one of their board members to sit on the initial MetroGIS Policy Board. These individuals represent 191 cities, 59 school districts, 39 watershed districts, 7 counties, and metropolitan agencies. See Figure 9 for a MetroGIS's Organizational Chart and <http://www.metrogis.org/teams/pb/index.shtml#team_members> for a list of the MetroGIS Policy Board members and their respective organizational affiliations.

[10] See <http://www.metrogis.org/about/history/chronicle_phase1.shtml> for information about the methods used to define priority information needs of the MetroGIS community.

[11] See <http://www.metrogis.org/data/index.shtml > for the status of work on each of MetroGIS's priority information needs.

[12] Primary producers/custodians are organizations whose jurisdictions are smaller than the extent of the collaborative's area of interest/jurisdiction but whose data are assembled with other primary producer's data to create a regional solution.

[13] <http://fgdc.gov/framework/frameworkintroguide/>

[14] See Exhibit 2 in the Scope of Work document at <http://www.metrogis.org/data/datafinder/data_distribution_rfp_scope.pdf> for an illustration of the metadata/data search and distribution components, which MetroGIS is attempting to fully operationalize.

[15] With the exception of parcels and addressable street centerlines, of the nine regional solutions implemented to date, all are available without license or fee.

[16] DataFinder is MetroGIS's FGDC-compliant clearinghouse node. It was designed to serve as the primary portal through which the MetroGIS community searches for and gains access to geospatial data. The goal is to provide for a virtual one-stop-shop. The data may, in fact, be located on a different server than DataFinder but the technology masks this fact. Internet map services and source data are obtained via the same portal.

[17] <http://www.metrocouncil.org> for more information.

[18] Dr. John Bryson and his colleague Charles Finn facilitated MetroGIS's initial strategic planning retreat held in December 1995. Both were on the faculty of the Humphrey Institute at the University of Minnesota. The technique they used is referred to as "cognitive mapping." It is explained in Dr. Bryson's book *Strategic Planning for Public and Non-Profit Organizations, Revised Edition* (San Francisco: Jossey-Bass, 1995). Consensus was reached on the community's common priority business information needs through a multifaceted, 6-month process that involved business object modeling and a rigorous survey methodology. Consensus was reached on functional priorities for MetroGIS using matrix analysis techniques. David Arbeit, Director of the Minnesota LMIC, and William Craig, Associate Director of the Center for Urban and Regional Affairs, University of Minnesota, designed the surveys and matrices and supervised the analysis of the two latter referenced projects.

[19] In addition to the initial strategic planning retreat, five strategic initiatives, identified through an intensive consensus-building process, framed the decision making that defined the form and function of MetroGIS over approximately 3 years. See <http://www.metrogis.org/organization/form-index.htm>) for an explanation of each initiative.

[20] See <http://www.metrogis.org/data/datafinder/index.shtml#data_distribution> for more information about this project and to view the scope of work for the request for proposal that closes September 4, 2001.

[21] See Section 1.3—Benefits of Collaboration.

3 Organizing and Sustaining Geospatial Collaboratives: Fundamentals of Success Summarized

Findings from the Collaboratives Featured in this Guide

The geodata collaboratives whose chronicles are included in this *Lessons from Practice* guide collectively identified 17 key practices involved in successfully creating and sustaining their respective geodata collaboratives. Those practices commonly cited by the featured collaboratives are identified below. All 17, and the collaborative(s) that cited each of them, are listed in Appendix 1. Several of these key practices relate to a particular collaborative function (e.g., "timely and important issue" was stated for a collaborative focused primarily on information sharing whereas "align with internal business needs" was stated for a collaborative engaged in area integration functions); others, such as, "proactive, open, and inclusive process" and "maintain an institutional memory" apply to collaborative efforts with varying purposes.

Of the 17 "keys practices to success" identified, 6 were cited by all of the featured collaboratives (no order of significance is intended):

- Broad support for vision and expectations;
- Champion individuals/community support;
- Knowledgeable, respected participants;
- Frequent contact with national (higher order) organizations;
- Proactive, open, and inclusive process/procedures to enable maximum participation/diverse perspectives; and
- Improved understanding/outreach.

Five additional key practices were cited by four of the six participants as important to their respective successes (no order of significance is intended):

- Champion organization(s),
- Documented stakeholder benefits/business argument,
- Focus on common business information needs,
- Institutional memory, and
- Business plan support/well-defined issues.

The featured collaboratives were created for several different purposes: as a forum to share information, as a forum to share exiting geospatial data, as a forum to perform area integration functions for like-data from multiple sources, and combinations of these and others. However, they have six characteristics in common—characteristics fundamental to their abilities to achieve their respective visions.

It was also clear from the information provided by the featured collaboratives that, depending on the purposes or functions supported, neither the form of

the organizational structure, legally reorganized or informal, nor the existence or complexity of operating rules is essential.

Dedicated staff are associated with the more ambitious collaboratives, which is to be expected, and these staff members are generally provided by the lead or champion organization, as opposed to working directly for the collaborative.

Significant sector diversity is common among the participating interests for all but one of the featured collaboratives. Even the exception has significant diversity among its local government and neighborhood participants. All have diverse government sector participants. Five of the six collaboratives have nonprofit participants. In addition, four of the six have for-profit participants.

The challenges faced by each of the featured collaboratives are wide ranging. However, all of these organizations have in common a continuing need to demonstrate the benefits of the collaborative to their stakeholders and to maintain momentum by achieving tangible short-term and longer-term objectives. Put another way, unless the work of the collaborative is perceived by the stakeholders as helping them more effectively achieve their day-to-day business functions, participation will diminish, and the likelihood of garnering needed resources will wane.

Finally, all acknowledged that luck or otherwise unexplained good fortune has played a role in each of their successes. To quote Bruce Oswald, with the New York State GIS Data-Sharing Cooperative, "Hard work, clearly defined issues and goals, great planning, commitment, expertise, and good business arguments are essential for the success of this kind of initiative, but luck is also an important factor. There is no substitute for being in the right place at the right time with the right folks."

Findings from Prior Research: The "Dos" and "Don'ts" of Collaboration

The project team believed it was important to relate the key practices for the success identified by the geodata collaboratives featured in this document with the findings from recent studies conducted by the academic community. Dr. Zorica Nedovic-Budic, a member of the project team, summarized the recent research findings that follow and compiled Appendix 3, a list of references to numerous academic studies and writings that pertain to the topic of collaboration among stakeholders in the geodata community. The research summarized in the following section was conducted by Dr. Zorica Nedovic-Budic of the project team in collaboration with Jeffrey K. Pinto, Ph.D., Professor, Behrend College of Business, Pennsylvania State University–Erie.

Technological developments and solutions are increasingly enabling data sharing. These developments are important, but the nontechnical coordination process, issues, and concerns are still the keys to success. This section focuses on research findings that provide insight into specific actions helpful in building geodata collaborations. Some actions to avoid are also cited. The key practices for success, collectively identified by the collaboratives featured in this document, are generally stated in less-specific terms than the findings reported from the academic case studies. Notwithstanding these differences, there is a strong correlation between the findings from the two approaches. Leadership, broad support for collective vision, equity, trust, and openness are concepts embedded and fundamental to the findings of both initiatives.

The Playing Field

According to a International City/County Management Association survey (Huffman and Hall 1998), by 1997, almost one-third (27.1 percent) of all cities and about one-half (43.3 percent) of all counties in the United States were using GIS technology. The 200 respondents to the *American Forests Survey*, a representative sample of the nation's larger cities and counties, indicated growth in GIS use from 40 percent in 1992 to 77 percent by 1996 (Richie et al. 1998; Warnecke et al. 1998). Technology adoption rates, however, vary substantially among states and regions.

The rapid increase in organizations adopting GIS technology highlights the fact that between and within organizations, there has been a general inability and sometimes unwillingness to share data and information across boundaries, with concomitantly low levels of coordination (Warnecke et al. 1998). A 1997–1998 national framework survey sponsored by FGDC revealed that about 40 percent of responding city and county agencies participate in a data coordinating council and that well over 80 percent of those participating in a data coordination council share data with other organizations. The majority of the respondents involved in sharing GIS data tend to participate in groups of two to five agencies. However, this high percentage does not necessarily imply full coordination and integration of geographic information. In fact, it most likely refers to ad hoc and irregular acts of exchange. Similarly, participation in councils is not equal to actual coordination. Also, regardless of seemingly intensive data-sharing activities, very few (less than 10 percent) make information about their database or the database itself accessible (FGDC Web page <http://www.fgdc.gov/framework/survey_results/readme.html>; Harvey 2000; Somers 1999; Tulloch 2000).

Based on the same survey, on average one-third to one-half of the respondents had developed data distribution policies. About one-third of these policies permit access with no restrictions, and about one-half make data available under certain conditions. In another survey, Onsrud et al. (1996) found that spatial data distribution restrictions are commonly in the form of contracts, licenses, or copyright agreements. Onsrud et al. discovered an even split among agencies with open access and those with cost recovery policies; many agencies practiced hybrid approaches. Unlike the diverse landscape in data availability and access at the local and regional level, there are few distribution restrictions for federal and state datasets. Those datasets, however, tend to have generalized content and low resolution and therefore are of very limited utility for local applications.

Lessons Learned in Practice

The waste caused by duplication of effort, due largely to a lack of information exchange among local, state, and federal government and private sector organizations, remains a significant impediment to building spatial data infrastructures (SDIs) at the national, state, regional, and local levels and prevents more effective and efficient use of GIS throughout society. To facilitate SDI development, research by Nedovic-Budic and Pinto (1999a, b) provides insights into the mechanisms and behavioral aspects of interorganizational GIS activities. Following are the lessons derived from their recent case studies and a national survey:

- *Keep it simple:*
  - The extent of the interaction between organizations usually goes beyond data-related activities (e.g., data purchase; data exchange; project-driven joint data efforts; joint data acquisition; joint database development, maintenance, or both) to include joint system development, personnel (often in the role of coordinators and technical support), space, and applications. The latter group is more often practiced in intraorganizational settings.
  - Moving from data to applications, the interactions increase not only in their sophistication and complexity but also in the difficulty of making them functional.
  - Shared or jointly supported application developments are the most challenging.
  - Think big but start small and build gradually around data-centered approaches.
- *Formalize structure:*
  - Mutual trust is the key to successful cooperation (as pointed out by Harvey 2000, in press), but supporting interaction with formal documentation, such as intergovernmental agreements, MOUs, data licenses, contracts, and so forth, is wise. Documentation is typically more practiced (and probably more needed) in relationships with other organizations than within an organization.
  - These documents may enable a continued data exchange even in cases where the other forms of interaction are discontinued.
  - The nature of sharing structures also needs to be established early in the process. Simply allowing the GIS and database interactions to evolve over time without set rules and procedures often attracts increasingly suspicious partners and may lead to problems down the road. The key, therefore, is to establish a stable and simple relationship structure.
- *Ensure that contributions are fair, equitable, and continuous:*
  - First, determine the contributions in advance and in specific terms. Data are the major contributions to coordinated activities. Financial and staff contributions are also substantial, the latter being more evident in intraorganizational settings.
  - Take into account the concerns most organizations would have about how commensurate their contributions would be relative to their size, resources, and use of data or other joint products.
  - Apply the principle of equity in accepting contributions and distributing the common resources.
  - Extensive negotiations may be necessary to decide on contributions and returns.
  - Loss of full independence and investment of energy and resources are deliberate and tangible contributions toward developing and maintaining relationships with other organizations.
  - Some level of contribution from each participant tends to increase the commitment to the joint goals and raises the stakes in success.
  - Secure long-term commitments for contributions. Their variations on annual basis may jeopardize the project and prevent implementation of strategic or more elaborate multiyear developments.

- *Determine and communicate control and ownership:*
  - As with any multiparty venture, participants need to feel empowered to plan, make decisions, and bring them to realization.
  - Participants in interorganizational activities expect a fair decision-making process to ensure their adequate control over the joint activities and resources.
  - Voting rights and decision authority must be carefully determined and clearly defined.
  - Extensive negotiations may be necessary here as well.
  - Expect that depending on their resources, power, and role in the partnership, organizations differ in their definitions of fairness and equity.
- *Manage perceptions about data ownership:*
  - Openness with regard to data access, minimal proprietary interest in data, and no major financial gains expected from data distribution, are all conducive to less conflict and tension regarding the ownership of data.
  - All parties must perceive the coordinating unit or coordinator and their location as neutral (i.e., having no vested interest or commitment to any one agency or organization).
- *Control the "What's in it for me?" syndrome:*
  - It is only natural and should be taken seriously.
  - Understanding and respecting the reasons that motivate organizational participation is part of the success.
  - Saving resources and taking on a common mission and goals are the most frequently declared reasons for interorganizational interaction.
- *Manage the process:*
  - Ongoing communication and negotiation are inherent parts of coordination efforts.
  - Identifying semantic differences and commonalties between concepts held by participants and creating a common working language are prerequisites for effective communication.
  - Communication happens both formally and informally.
  - Persistence and willingness to compromise are the keys to success, particularly through difficult times (which are experienced by even the most successful collaboratives).
  - Coalition building and bargaining may be exercised as well.
  - Differential commitment levels are possible. The true commitment, however, helps overcome many of the obstacles in the process of joint database or system activities and maintains the focus on the matters pertinent to the joint activities. Participants committed "for the wrong reasons" are usually disruptive to the joint effort.
  - Process takes time and patience.
  - The spirit of cooperation is crucial for keeping participants active and interested. It is based on teamwork, shared understanding, trust, and mutual credibility.
- *Provide project leadership:*
  - Leadership is the key success factor.
  - It provides vision, support, and backing with resources.
  - Project leadership exercises the authority to promptly act on common plans and decentralizes power to allow for implementation of the agency-specific parts.

- Stability characterizes effective project leadership structures.
- Project leadership ensures "enforcement" of common standards and commitments (e.g., database or other contributions).

- *Define roles and responsibilities:*
  - The roles and responsibilities of each participant have to be well defined—another key success factor.
  - Database development and maintenance responsibility is the life cord of interorganizational activities.
  - It is necessary to identify and secure support of the original data providers early in the coordination initiative so that data provision and update will be kept close to the source or in organizations with compatible functions.
  - Additional resources and support infrastructure need to be provided to the units with accepted new roles and responsibilities (e.g., charged with maintaining the data), which incur additional workloads and expenses.
  - The units perceiving inequities in data maintenance commitments are prone to downgrade their own support of the system. In the absence of staffing, funding, equipment, or training provisions, the agencies assigned database maintenance responsibilities are likely to fall behind in the timing and quality of database update. They also tend to depart from prescribed standards and procedures as another consequence of the inadequate support for database maintenance duties.
  - Assignment of roles and responsibilities is highly susceptible to fairness issues and concerns.
- *Manage change:*
  - In a highly technical field, such as GIS, it is necessary to adapt local solutions to take advantage of technological change and innovations.
  - The problems of mismatch between new database tasks and procedures and existing organizational structures are common in the newly initiated interorganizational efforts.
  - Technological change requires change in administrative and organizational structure and processes. Integrated and distributed data processing tend to generate leaner, more flexible, and more responsive organizations with fewer management levels and more direct information exchange between the top and bottom layers.
  - The sense of upcoming change and the uncertainty brought with it tend to be unsettling to many agencies and their personnel. It is crucial to confront the concerns about the implications of the technological change and joint database activities for subsequent organizational and staff realignment.
  - The status of the joint project needs to be frequently demonstrated and communicated to all participants and leaders. Project expectations should be managed at administrative, management, and operational levels.
  - The culture of both sharing and change must be nurtured.

4 Next Step: Who's Who of Geodata Collaboratives

GeoData Alliance (GDA) was formed to "foster trusted and inclusive processes to enable the creation, effective and equitable flow, and beneficial use of geographic information." Fostering collaboration among relevant and affected organizations is essential to attaining this goal. Fostering and nurturing relationships that move the concepts of NSDI toward reality in all parts of the county is also fundamental to achieving GDA's goal.

To effectively foster and nurture the sought-after collaboration and transfer of knowledge, a mechanism similar to the National Geospatial Data Clearinghouse for data is needed to connect organizations, people, and eventually relevant knowledge. A profile or metadata record of sorts for each entity would be searchable via the Internet in the same way that data are currently searchable via the National Geospatial Data Clearinghouse. The need to pursue an "organizational clearinghouse" was identified by the GDA Drafting Team, as part of its deliberations to create a vision and principles for GDA.[1]

This vision begins with developing a "standardized profile" that would be completed by those wishing to participate, hopefully, beginning with the collaboratives featured in this guide and growing from there. As an interim measure, those interested are encouraged to use the on-line profile registration form at <http://www.geoall.net/nomination_form.html>, developed to expedite this project, to communicate interest in becoming part of a "Who's Who" in geodata collaborative initiatives.

Welcome to the next generation of geodata collaboration!

The Project Team

Endnotes

[1]The drafting team identified this need and developed a rudimentary design for future consideration. The team concluded such an "organizational clearinghouse" should be among the priority projects pursued by GDA.

APPENDIX 1
CHARACTERISTICS OF SUCCESSFUL GEODATA COLLABORATIVES

Key Practices to Success	New York (p. 9)	Ramsey County (p. 19)	PSIN (p. 23)	MetroGIS (p. 29)	PaMAGIC (p. 43)	NCSS (p. 49)
Broad support for vision and expectations	X	X	X	X	X	X
Champion individuals/community support	X	X	X	X	X	X
Knowledgeable, respected participants	X	X	X	X	X	X
Frequent contact with national (higher order) organizations	X	X	X	X	X	X
Proactive, open, and inclusive process/ procedures to enable maximum participation/diverse perspectives	X	X	X	X	X	X
Improved understanding/outreach	X	X	X	X	X	X
Champion organization(s)	X		X	X		X
Documented stakeholder benefits/business argument	X		X	X		X
Maintain institutional memory			X	X	X	X
Focus on common business information needs		X	X	X		X
Business plan and well-defined issues	X			X	X	X
Seek consensus on policy decisions			X	X		X
Timely and important issue			X		X	X
Active involvement of elected officials				X		X
Align with internal business needs (i.e., functions for collaborative)				X		X
Incentives		X		X		
Short, interesting meetings			X		X	

Characteristics of Successful Geodata Collaboratives

APPENDIX 2
METHODOLOGY EXHIBITS

Exhibit A: Letters of Invitation

Exhibit B: On-Line Nomination Form

Exhibit C: Collaborative Diversity Criteria

Exhibit D: Template for Collaborative Chronicles

Methodology Exhibits

Exhibit A

Letters of Invitation

June 20 and
July 19, 2001

Dear Colleagues:

Do you have experience organizing and/or sustaining a successful geodata collaborative; two or more organizations that are or were working together to successfully address common geospatial data-related issues and opportunities? Have you been affiliated with a collaborative effort that didn't fare so well? If the answer to either question is yes, we invite you to share your story with the broader geodata community. In so doing, you can also significantly reduce your fee for membership in the emerging GeoData Alliance (GDA).

Earlier this year, the GDA was launched (<http://www.geoall.net>). The call is now out to individuals and institutions to consider joining this unprecedented initiative. GDA's core objectives include fostering enhanced communication between existing geodata collaboratives and establishment of numerous additional collaboratives to collectively address geospatial related issues and opportunities that are larger than any single organization and fundamental to achieving the vision of the National Spatial Data Infrastructure (NSDI).

The first undertaking of the emerging GDA is to document the experience of several successful, and possibly not so successful collaboratives, in the form of a "field guide" that prospective collaborators can use to apply the lessons learned by others. Geodata collaboratives have many forms and are established for a wide variety of purposes. Our goal is to document a variety of these experiences in a uniform manner that provides insight into the philosophy and actions that are critical to successfully organizing and sustaining a geodata collaborative.

A short nomination form is at <http://www.geoall.net/nomination_form.html>. The deadline for nomination is Wednesday, July 25. The project team will review the nominations and select several for full articles to be included in the proposed "field guide." Those who are selected will be notified by July 27 and will have until August 7 to submit an article. A template for the article will be provided. Membership in the GDA is not required to participate. However, those authors whose articles are included in the "field manual" will receive a 50 percent reduction in their GDA annual membership fee for three years, institutional or individual. Those who submit a nomination, but are not selected to submit the follow-up article, will receive a 50 percent credit applicable to their 2001 or 2002 membership fee.

Randall Johnson, who will be on leave from his responsibilities as MetroGIS Staff Coordinator—<http://www.metrogis.org>), is the Project Manager. Zorica Nedovic-Budic, Professor of Urban Planning and GIS, University of Illinois, Champaign-Urbana is also a member of the Project Team. If you have any questions, please call Randall at 703/648-5549.

Respectfully,

Kathy Covert
Secretary,
GeoData Alliance

Randall Johnson, AICP
GDA Field Guide Project Manager,
GeoData Alliance

Exhibit B

On-Line Nomination Form

The GeoData Alliance
Nomination Form—Geodata Collaborative Case Study Candidates

Your willingness to participate in this first initiative of the emerging national GeoData Alliance (GDA) is very much appreciated. The information collected through this nomination process will be used to identify several geodata collaboratives, which collectively possess a wide variety of objectives, to tell their stories in the form of case studies. Those nominees selected for a case study will be contacted by July 26, 2001, and will be provided with a template for their case study article. Our goal is to document a variety of collaborative experiences in a uniform manner that provides insight into the philosophy and actions critical to successfully organizing and sustaining a geodata collaborative.

Again, thank you for your participation in this nomination process. The deadline to submit a nomination is July 16, 2001. If you have any questions, please contact Kathy Covert at 703/648-4144 or by e-mail at klcovert@usgs.gov or Randall Johnson at 651/602-1638 or by e-mail at rajohnson1@fgdc.gov.

1. What is the name of nominated geodata collaborative organization:

2. Contact person:
   - First:
   - Last:
   - Street Address Line #1:
   - Street Address Line #2:
   - City:
   - State: Select State ...
   - Zip:
   - Phone:
   - E-mail:

3. When Formed: (month/year).

4. Describe the geographic extent of the collaborative's jurisdiction or area of operation:
   - All or a portion of state(s)
   - All or a portion of county(s)
   - Other:

5. Does collaborative have a formally adopted Mission Statement/Statement of Purpose?
   ☐ yes ☐ no
   If yes, please E-mail to: rajohnson1@fgdc.gov

6. Does collaborative have formally adopted operating guidelines/bylaws?
   ☐ yes ☐ no
   If yes, please E-mail to: rajohnson1@fgdc.gov

7. What is the purpose(s) of collaborative: (check all that apply)
   ○ Share existing data
   ○ Forum for networking/information transfer
   ○ Forum to share geodata program resources (e.g., data acquisition, equipment, application development)
   ○ Forum to resolve technical obstacles to achieving purpose
   ○ Forum to resolve institutional obstacles to achieving purpose
   ○ Forum to endorse proven practicies important to achieve purpose (e.g., standards, procedures
   ○ Others: Please list

8. Who are the collaborative's stakeholders (check all that apply):
   ○ Academic/Research
   ○ For Profit
   ○ General Interest
   ○ Government
   ○ Nonprofit

9. Major accomplishments:

10. Does the collaboratie have a legally recognized organizational structure (incorporated)?
    ☐ yes ☐ no
    If yes, what type and why selected.

11. Was the collaborative established by legislative mandate or other official directive:
    ☐ yes ☐ no
    If yes, please cite.

12. Why do youthink the story of this collaborative would be beneficial to others?
Comments:

13. If selected to submit a full article, can you comply with the submittal deadline?
yes no
Comments:

Submit Reset

Exhibit C

Collaborative Diversity Criteria

The project team developed the criteria listed in the left-hand column below to define the characteristics sought in the geodata collaboratives that would be featured in this guide.

Nine self-nominated collaboratives were initially selected by the team, and each agreed to submit an article. These nine candidates addressed the breadth of the selection criteria, thorough different approaches, and included public and nonpublic initiatives. The diversity represented by those nine collaboratives was as follows:

Desired Characteristic	**Possessed by Selected Self-Nominees*†**
1. Represent several parts of the county	Modest (*no organizations from* the Southeast *or South Central United States*)
2. Represent different jurisdictional extends	Yes (*county, multicounty, state, multistate, national*)
3. Formal structures vs. informal organizational structures	Yes (*a, b, i vs. c, d, e, f, g*)
4. Proactive role for elected officials	Yes (*e*)
5. Horizontal participation only (i.e., just local)	Yes (*b*)
6. Vertical collaboratives (i.e., local, state, federal)	Yes (*a, c, d, e, f, g, h, i*)
7. Functions:	
Networking/information transfer only	Yes (*f*)
Data sharing (existing) only	Yes (*c, d*)
Data acquisition/joint data development and maintenance only	No (*But, one of the stated functions of b—orthoimagery*)
Address institutional obstacles to data sharing	Yes (*a, b, e, g. h, i*)
Address technical obstacles to data sharing	Yes (*a, b, e, g, h, i*)
Endorse and promote proven practices	Yes (*a, b, e, g, h, i*)
8. Unsuccessful collaboration efforts	No (*did not expect any*)
9. Have a relevant story to tell, not a proposed initiative	Yes (*a, c, d, e, f, g, h, i*)

*Each of the nine selected, self-identified collaboratives is identified by the letters a–i.
†The identity of the nine selected collaboratives has been withheld to conceal the identity of those who later elected not to participate.

Exhibit D

Template for Collaborative Chronicles

(Collaborative Name)

(Geographic extent—Title Format)

(Optional: descriptive name conveying the essence of the collaborative)

(Author' Name)

(Author's Title)

(Date—mmddyy)

1. Background—history, purpose, and functions:
   - When was your collaborative formed and for what purpose(s)? Please relate your collaborative's purposes to categories listed for Question 7 on the nomination form at www.geoall.net/nomination_form.html.
   - Has your collaborative formally adopted a mission and/or purpose statement? If so, please state in the text of your article or as an appendix.
   - What was the culture/context that laid the foundation for your collaboratives' formation?
   - Were there any failed previous collaborative attempts with the same general purpose related to geographic data? If so, in the "Errors" section below, explain what was done different and why to overcome in the latest attempt.
   - Was there any organizational change to one or more of the partnering organizations to support the collaborative, such as, creation of a position(s) or work unit?
   - Please embed a digital map into your article depicting your collaborative's area of interest/jurisdiction/influence.

2. Major Accomplishments:
   - List, in bullet form, several major accomplishments of collaborative. (Please do not list benefits here).

3. Structure:
   - Provide an organizational chart that depicts the components of the collaborative's organizational structure and include supplemental text as needed.
   - Identify the member/stakeholder organizations by the type and subtypes listed in the table presented at the bottom of the Instruction Page and their explain respective roles and responsibilities, and level of involvement. Please include this information in the organizational chart if possible. If your collaborative uses terms such as member, subscriber, cooperator, etc. please explain how these terms apply.
   - What is the legal authority and scope of the collaborative? How is each of the following authority elements dealt with, if relevant to the collaborative: receiving and spending funds, contracting, and staffing.

- Is the collaborative formal (legally incorporated, statutory, written contract, etc.) or is it an informal organization (nonbinding statement of intent, mutual understanding, common practice, etc.)?
- How are the collaborative's activities financed?

4. Policies and Procedures:

Decision Making and Conflict Resolution:

- Explain your decision making process.
- Are there any collaborative-adopted rules or procedures that govern the process? If so, please cite a Web site or provide as an appendix.
- Are there any special collaborative-adopted rules or procedures specific to conflict resolution? If so, please cite a Web site or provide as an appendix.

Data:

- Production, acquisition, maintenance, and assembly and/or integration for the collaborative's area of interest
- Ownership
- Liability
- Format(s) (source data and web mapping services)
- Distribution

Technology:

- Hardware and software
- Distribution mechanism(s)

Human Resources

- How is the collaborative's work supported?
- Please explain how training and compensation is dealt with.

5. Keys to Success

- List in bullet form, the top 3-5 keys to your collaborative's success and provide a brief explanation of the importance.

6. Costs/Expenses

- Briefly describe the start-up and annual costs to support the collaborative.
- Briefly describe "costs" that are not necessarily or easily quantifiable, such as, time away from primary work tasks to participate in the activities of the collaborative, changes in internal organization priorities to address the needs of the collaborative, etc.

7. Benefits:

- List in bullet form, several substantive benefits that have accrued to the participants and others as a result of the activities of the collaborative.

8. Errors (What would you have done differently?):

- List in bullet form, any error(s) made by your collaborative that prospective geodata collaborators could learn from and avoid.

9. Challenges Ahead in 2002 and Beyond

- Briefly describe any major issues (and/or opportunities) the collaborative will face in the next year.

For Further Information

Name:

Phone:

E-mail:

Web site:

Instructions:

Please—

1. Use the same headings as provided in the template.
2. At a minimum, address each of the questions listed in the template.
3. Use 12 point, Times New Roman font for the main body of your article.
4. Use the styles provided for the heading and subheadings.
5. Use 1-inch margins on all sides.
6. Embed page numbers in the center of the footer and include a number of the first page.
7. Submit in MSWord 97 or RTF compatible format.
8. Embed a scalable map in your article for your area of influence that is readable by either ArcView or MS PowerPoint software. Color is permissible, provided it is also readable in black and white. (At this time, we are not sure what colors, if any, the document will be printed in.
9. Try to hold to 10 pages. **Approximately two-thirds of the text should relate to the last five sections, with an emphasis on practical tips and advice and to the prospective collaborator**. Answer the questions in narrative form, combining answers as appropriate, except where bullets are requested.
10. You are encouraged to cite Web references in your article to documents with important mandates, rules, agreements, etc. 1 to 2 page documents may be added as appendices when germane to a central point in the article.
11. Use endnotes, not footnotes if you choose to add additional documentation in this manner.
12. Submit your articles, by e-mail, on or before August 7th to Randall Johnson at rajohnson1@fgdc.gov.

Structure Section Supplement—Please identify the type and subtypes of your collaboratives membership from the options listed below.

Academic/ Research	For Profit	General Interest	Government	Nonprofit	TYPES
❑ Academic ❑ Research	❑ Natural Resources and Environment ❑ Utilities, Telecommunications, and Transportation ❑ Real Estate and Financial ❑ GIS Vendors, Suppliers, and Consultants ❑ Manufacturing, Wholesale, and Retail ❑ Social and Human Services ❑ Other For Profit	❑ Library ❑ Media ❑ Individual ❑ Citizen Group	❑ Tribe ❑ Municipality ❑ County ❑ State ❑ Federal ❑ Regional or Multijurisdictional Government ❑ Quasigovernmental or Special District ❑ Other Government	❑ Professional, Trade, or Labor Association ❑ Advocacy ❑ Community or Public Interest ❑ Other Nonprofit	SUBTYPES

Methodology Exhibits

APPENDIX 3
Bibliography

Albrecht, Johan. 1999. Towards interoperable geo-information standards: A comparison of reference models for geo-spatial information. *The Annals of Regional Science* 33:151–169.

Alfelor, Roemer M. 1995. GIS and the Integrated Highway Information System. In *Sharing Geographic Information*, pp. 397–412. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

Azad, Bijan. 1998. *Management of Enterprise-wide GIS Implementation: Lessons from Exploration of Five Case Studies*. Cambridge: Massachusetts Institute of Technology.

————, and Lyna L. Wiggins. 1995. Dynamics of Inter-Organizational Geographic Data Sharing: A Conceptual Framework for Research. In *Sharing Geographic Information*, pp. 22–43. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

Bishr, Yaser. 1998. Overcoming the semantic and other barriers to GIS interoperability. *International Journal of Geographical Information Science* 12(4):299–314.

Brown, Mary M., and Jeffrey L. Brudney. 1993. Modes of geographical information system adoption in public organizations: Examining the effects of different implementation structures. *Annual Meeting of the American Society for Public Administration*. Copy available from M. M. Brown, Department of Political Science, University of North Carolina at Charlotte, 445G Fretwell Hall, Charlotte, NC 28223.

————, Laurence J. O'Toole Jr., and Jeffrey L. Brudney. 1998. Implementing information technology in government: An empirical assessment of the role of local partnerships. *Journal of Public Administration Research and Theory* 8:499–525.

Calkins, Hugh W., and Richard Weatherbe. 1995. Taxonomy of Spatial Data Sharing. In *Sharing Geographic Information*, pp. 65–75. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

Campbell, Heather J., and Ian Masser. 1991. The impact of GIS on local government in Great Britain. *Proceedings of the Association for Geographic Information Conference*, London: Association for Geographical Information.

Cash, James I., Jr., Robert G. Eccles, Nitin Nohria, and Richard L. Nolan, eds. 1994. *Building the Information-Age Organization: Structure, Control, and Information Technologies,* 3rd ed., pp. 338–396. Burr Ridge, Illinois: Irwin McGraw-Hill.

Citera, Maryalice, Michael D. McNeese, Clifford E. Brown, Jonathan A. Selvaraj, Brian S. Zaff, and Randall D. Whitaker. 1995. Fitting information systems to collaborating design teams. *Journal of the American Society for Information Science* 46(7):551–559.

Clemons, E., and M. Kenz. 1988. Competition and cooperation in information systems innovation. *Information and Management* 14(1):25–35.

————, and M. Row. 1992. Information technology and industrial cooperation: The changing economics of coordination and ownership. *Journal of Management Information Systems* 9(2):9–28.

Cook, Karen S. 1977. Exchange and power in networks of interorganizational relations. *Sociological Quarterly* 18:62–82.

Croswell, Peter L. 1991. Obstacles to GIS implementation and guidelines to increase the opportunities for success. *Journal of the Urban and Regional Information Systems Association* 3(1):43–56.

Dangermond, Jack. 1989. The organizational impact of GIS technology. *ARC News* 11, (3).

Evans, John D., and Joseph Ferreira Jr. 1995. Sharing spatial information in an imperfect world: Interactions between technical and organizational issues. In *Sharing Geographic Information*, pp. 448–460. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

Frank, A.U. 1992. Telecommunication and GIS: Opportunities and challenges. In *Networking Spatial Information Systems*, pp. 235–250. Eds. P. W. Newton, P. R. Zwart, and M. E. Cavill. London: Belhaven.

Frank, Steven M., Michael F. Goodchild, Harlan J. Onsrud , and Jeffrey K. Pinto. 1996. User requirements for framework geospatial data. *Journal of the Urban and Regional Information Systems Association* 8(2):38–50.

Haithcoat, Timothy, Lisa Warnecke, and Zorica Nedovic-Budic. 2001. Geographic information technology in local government: Experience and issues. In *The Municipal Year Book 2001*, pp. 47–57. Washington, D.C.: International City/County Management Association.

Harvey, Francis. 1997. Improving multi-purpose GIS design: Participative design. In *Spatial Information Theory*. Eds. S.C. Hirtle and A.U. Frank. Berlin: Springer-Verlag.

————. 2000. *Potentials and Pitfalls for Vertical Integration for the NSDI. Final Report of a Survey of Local Government Perspectives*. <http://www.uky.edu/AS/Geography/ppnsdi/reports/reports.htm>.

————. In press. Constructing GIS: Actor networks of collaboration. In review for *Urban and Regional Information Systems Association Journal*.

————, Werner Kuhn, Hardy Pundt, Yaser Bishr, and Catharina Riedemann. 1999. Semantic interoperability: A central issue for sharing geographic information. *The Annals of Regional Science* 33:213–232.

Heikkila, Eric. 1998. GIS is dead; Long live GIS! *Journal of the American Planning Association* 64(3):350–360.

Huffman, Lisa A., and Gwen Hall.1998. Use of innovative technology applications in local government. *Special Data Issue*, no. 1. Washington, D.C.: International City/County Management Association.

Interorganizational National GIS Survey Data Summaries—<http://www.urban.uiuc.edu/faculty/budic/W-NSF-2.html> (user name: znbguest; password: views).

Jain, Hemant, K. Ramamurthy, Hwa-Suk Ryu, and Masoud Yasai-Ardekani. 1998. Success of data resource management in distributed environments: An empirical investigation. *MIS Quarterly* 22(1):1–29.

Johnson, Jeffrey P. 1995. Information Policy for Local Government Geographic Information Systems: Adoption, Implementation and Results. Master's Thesis. Orono: University of Maine.

Kaplan, B., and D. Duchon. 1988. Combining qualitative and quantitative methods in information systems research. *MIS Quarterly* 12(4):571–86.

Kevany, Michael J. 1995. A proposed structure for observing data sharing. In *Sharing Geographic Information*, pp. 76–100. Eds. Harlan J. Onsrud and Gerard Rushton,. New Brunswick, New Jersey: Center for Urban Policy Research.

Kumar, K., and H.G. van Dissel. 1996. Sustainable collaboration: Managing conflict and cooperation in interorganizational systems. *MIS Quarterly* 20(3):279–300.

Laurini, Robert. 1998. Spatial multi-database topological continuity and indexing: A step towards seamless GIS data interoperability. *International Journal of Geographical Information Science* 12(4):373–402.

Lopez, Xavier R. 1996. Stimulating GIS innovation through distribution of geographic information. *Journal of the Urban and Regional Information Systems Association* 8(2): 24–37.

March, J.G., and H.A. Simon. 1958. *Organizations*. New York: John Wiley and Sons.

Masser, Ian. 1998. *Governments and Geographic Information*. London: Taylor & Francis.

————, and Heather J. Campbell. 1995. Information sharing: The effects of GIS on British local government. In *Sharing Geographic Information*, pp. 230–249. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

————, and Harlan Onsrud. 1993, *Diffusion and use of geographic information technologies.* Dordrecht: Kluwer Academic Publishers.

McCann, Joseph E. 1983. Design guidelines for social problem-solving interventions. *Journal of Applied Behavioral Science* 19(2):177–192.

Meredith, Paul H. 1995. Distributed GIS: If its time is now, why is it resisted? In *Sharing Geographic Information*, pp. 7–21. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

National Academy of Public Administration. 1998. Geographic information for the 21st century—Building a strategy for the nation. Washington, D.C.: National Academy of Public Administration.

National Center for Geographic Information and Analysis. Web site <http://www.ncgia.ucsb.edu>.

National Research Council. 1993. *Toward a coordinated spatial data infrastructure*. Washington, D.C.: National Academy Press.

Nedovic-Budic, Zorica, and Jeffrey K. Pinto. 1999a. Interorganizational GIS: Issues and prospects. *Annals of Regional Science* 33:183–195 (Special issue on geospatial information sharing and standardization).

————. 1999b. Understanding interorganizational GIS activities: A conceptual framework. *Journal of the Urban and Regional Information Systems Association* 11(1):53–64.

————. 2000. Information sharing in an interorganizational GIS environment. *Environment and Planning B* 27(3):455–474.

Obermeyer, Nancy J. 1995. Reducing inter-organizational conflict to facilitate sharing geographic information. In *Sharing Geographic Information*, pp. 138–148. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

Onsrud, Harlan J., and Gerard Rushton, eds. 1995. *Sharing Geographic Information*. New Brunswick, New Jersey: Center for Urban Policy Research.

————, Jeffrey P. Johnson, and Judy Winnecki. 1996. GIS dissemination policy: Two surveys and a suggested approach. *Journal of the Urban and Regional Information Systems Association* 8(2):8–23.

————, Jeffrey K. Pinto, and Bijan Azad. 1992. Case study research methods for geographic information systems. *Urban and Regional Information Systems Association Journal* 4 (1):32–44.

Orthner, Helmuth F., Jean-Raoul Scherrer, and Roger Dahlen. 1994. Sharing and communicating health care information: Summary and recommendations. *International Journal of Bio-Medical Computing* 34:303–318.

Reich, B.H., and S.L. Huff. 1991. Customer oriented strategic systems. *Journal of Strategic Information Systems* 1(1):29–37.

Richie, Liesel, Stephen A. Barlow, and John T. Forbes. 1998. *1998 National County Spatial Information Technology Survey Results*. Mississippi State: Social Science Research Center, Mississippi State University.

Roche, Stephane, and Jean-Baptiste Humeau. 1999. GIS development and planning collaboration: A few examples from France. *Journal of Urban and Regional Information Systems Association* 11(1):5–14.

Somers, Rebecca. 1999. Framework Data Survey—Preliminary report. *GeoInfo Systems* 9(9):1–35.

Sperling, Jonathan. 1995. Development and maintenance of the TIGER database: Experiences in spatial data sharing at the U.S. Bureau of the Census. In *Sharing Geographic Information*, pp. 377–396. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

Taupier, Richard P. 1995. Comments on the economics of geographic information and data access in the Commonwealth of Massachusetts. In *Sharing Geographic Information*, pp. 277–291. Eds. Harlan J. Onsrud and Gerard Rushton. New Brunswick, New Jersey: Center for Urban Policy Research.

Thompson, J. 1967. *Organizations in Action*. New York: McGraw-Hill.

Tulloch, David. 2000. Looking back and looking ahead: The state of framework data. In *Urban and Regional Information Systems Association 2000 Conference Proceedings,* pp. 427–436. Park Ridge, Illinois: Urban and Regional Information Systems Association.

Van de Ven, A.H. 1976. On the nature, formation, and maintenance of relations among organizations. *Academy of Management Review* 1(4):23–44.

Warnecke, Lisa, Jeff Beattie, Kollin Cheryl, Winifred Lyday, and Steven French. 1998. *Geographic information technology in cities and counties: A nationwide assessment*. Washington, D.C.: American Forests.

Wigand, Rolf T. 1988. Integrated telecommunications, networking, and distributed data processing. In *Handbook of Information Resource Management*, pp. 293–321. Eds. Jack Rabin and Edward M. Jackowski. New York: Dekker.

APPENDIX 4
Other Information Resources

Bryson, John. 1995. *Strategic planning for public and non-profit organizations,* Rev. ed. San Francisco: Jossey-Bass.

Buehler, K., and McKee L., eds. 1998. *The OpenGIS Guide*, 3rd ed. Wayland, Massachusetts: The Open GIS Consortium. URL: <http://www.opengis.org/techno/guide.htm>.

Federal Geographic Data Committee. Web site: <http://www.fgdc.gov>.

————. 1994. Development of a national digital geospatial data framework. *Status Report from the Framework Working Group*.[*Please provide location of publication and publisher.]

————. 1999. *Federal Geographic Data Committee Newsletter* 3(2)(Special Forum Edition).

GeoData Alliance. Web site: <http://www.geoall.net/>.

National Spatial Data Infrastructure (NSDI) Framework Handbook and Guide. Web site: <http://www.fgdc.gov/framework/frameworkintroguide/>.

The intent is to make this list a "living resource" for the community. Please notify the GeoData Alliance (see Appendix 6) to add other resources you believe are helpful to prospective geodata collaborators.

Other Information Resources

Appendix 5
About the Project Team

Project Manager: Project Design, Methodology, and Principal Author

Randall (Randy) Johnson, AICP
MetroGIS Staff Coordinator,
Metropolitan Council (Minneapolis–St. Paul Metropolitan Area)

Randy Johnson is Regional GIS Liaison for the Metropolitan Council. He has had a principal role in defining and implementing MetroGIS, a geodata collaborative that serves the seven-county, Twin Cities Metropolitan Area in Minnesota. He is a geographer and city planner by training, with more than 20 years of experience as a city and regional planner before turning his interest to matters concerning geodata collaboration. While coordinating community development activities for the city of Shoreview, Minnesota, he successfully facilitated establishment of a GIS coordination mechanism for the government organizations that serve Ramsey County. In August 1995, he filled a newly created position with the Metropolitan Council and was tasked with facilitating collaboration on a regional scale. Randy participated in the Denver, Baltimore, Seattle, and Annapolis NSDI Framework Workshops and on the drafting team that crafted the vision and principles for the emerging GDA. He coordinates staff support for MetroGIS and efforts to secure political support, participation, broadly supported solutions to the community's common geodata information needs, and workable data-sharing policies and agreements among key MetroGIS stakeholders. MetroGIS has received two Minnesota Governor's Commendations for Exceptional GIS Projects and a national award for its Web mapping services. Mr. Johnson holds a master's degree in planning and urban policy development.

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Methodology and Summary of Previous Research

Zorica Nedovic-Budic, Ph.D.
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Zorica Nedovic-Budic is Associate Professor of urban planning and GIS. Her doctoral dissertation work, completed in 1993 at the University of North Carolina at Chapel Hill, explored the human and organizational factors of the implementation of GIS in local governments. Her subsequent research and teaching built on that initial research focus and continues to evolve around the issues of GIS diffusion, technology transfer, and the effect of GIS in urban planning. Another of her research areas is a comparative study of urban development and planning practice. Both GIS-related and planning research interests have extended to include developing countries and countries in transition from communist to democratic and market-based regimes. In the summer of 1994, Dr. Nedovic-Budic was a visiting scholar to the National Center for Geographic Information and Analysis. In 1995–1996, she was involved as a co-principal investigator in FGDC's grant for establishing a prototype local node on NSDI. In 1996 she helped with GIS-based recreational inventory development for the state of Illinois Department of Natural Resources; she also examined motivations and mechanisms for interorganizational GIS (with funding support from the National Science Foundation). Finally, during her recent visit at the University of Melbourne Department of Geomatics, she initiated comparative research, which examined the evolving SDIs in the states of Victoria and Illinois and assessed the utility of those SDIs for local planning. Dr. Nedovic-Budic has published extensively in urban planning and information systems journals and contributed through service to the Urban and Regional Information Systems Association, the University Consortium of Geographic Information Science, and the American Planning Association.

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Concept and Logistics

Kathy L. Covert
Partnerships Coordinator
Federal Geographic Data Committee

Kathy Covert is on the staff of FGDC where she has focused on creating the institutional mechanisms needed to sustain enduring spatial data infrastructures. Ms. Covert began her career in 1976 with the U.S. Geological Survey as a student in the University of Colorado Cooperative Education program. She has more than 20 years experience in all phases of large scale topographic mapping—including 10 field mapping assignments in the Rocky Mountain West and 2 tours of duty in Antarctica. On August 2, 1993, she heard Nancy Tosta articulate her vision for a National Spatial Data Infrastructure. The vision was so compelling that in 1995 Kathy moved from Denver to Reston to join the staff of the FGDC as Partnerships Coordinator. She served as Project Manager for the highly successful 1999 National GeoData Forum and for the follow-on initiative to create the GeoData Alliance, where she now serves as Secretary and Interim Trustee. Ms. Covert holds degrees in Geography from the University of Colorado and Syracuse University and in October 2001 will complete a 3-year term on the Urban and Regional Information Systems Association board of directors.

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About the Project Team

APPENDIX 6
GeoData Alliance at a Glance

Purpose Statement

To foster trusted and inclusive processes to enable the creation, effective and equitable flow, and beneficial use of geographic information

Organizational Vision

GeoData Alliance (GDA) will comprise a complex, dynamic web of activities and relationships, evolving through the self-directing efforts of its participants—individuals and institutions with diverse geodata interests and needs, all of whom agree to share a common commitment to GDA's purpose and principles. Equally important, while GDA is creating mutual benefit, improved trust, and improved working relations through collaborative activities, it is also simultaneously thriving on and protecting its participants' autonomy and capacity for independent, innovative action.

Benefits of Joining GDA

The idealism that inspired GDA's founding, based on the knowledge that geospatial information can play a leadership role in bringing solutions to complex problems in an interconnected world, has already been reason enough for many to join. GDA will help individuals, organizations, and communities work together more effectively to address geodata-related issues and opportunities of common interest. In addition, membership in GDA also provides a host of practical benefits:

- An Internet-based marketplace for exchanging ideas,
- An Internet-based tool to enable connection of people and organizations that share similar geospatial needs and interests, modeled after the NSDI Clearing house for geospatial data,
- Practical marketing assistance, including boilerplate agreements, MOUs, and seminars,
- Assistance in forming data-sharing collaboratives, and
- A quarterly newsletter.

Organizational Structure and Governance

The 501(c)(3) nonprofit organization is characterized by voluntary membership, open organization, a highly democratic decision-making process, and a clear purpose and set of operating principles. GDA is an adaptive, self-regulating, nonlinear organization that will facilitate the development,

accessibility, and usability of geospatial data. Members govern themselves and the parts of the network in which they participate. A council of trustees, elected by members, is responsible only for those few deliberations and decisions that concern the whole of GDA.

More information about GDA's organizational principles, structure, and membership fees is available at <http://www.geoall.net>.

For Further Information

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