



LAND INFORMATION *Bulletin*

from the National Consortium for Rural Geospatial Innovation
Chesapeake–Wilkes University, GeoEnvironmental Science and Engineering Department

Increasing the Payoff of Geospatial Technologies

A Pennsylvania Blueprint for Regional GIS Success

Local governments with GIS departments and programs today face a host of challenges: How do they deal with a growing mountain of data? How can they get data that are more accurate and up-to-date? Can they cut costs and still maintain quality?

Responding to questions like these is at the heart of a regional GIS initiative in central and northeastern Pennsylvania. Guided by the Pennsylvania GIS Consortium (PAGIS), and with support from the National Consortium for Rural Geospatial Innovations (RGIS), the regionally coordinated GIS initiative is helping local governments find partners with common goals to maximize quality of products, service, and efficiency, while reducing costs. This bulletin outlines the practical and political considerations when devising a comprehensive strategy for a regionally coordinated GIS program.

If you were a GIS manager in an agency or local government office, how would you define success? Chances are you would assess it “independently,” that is, you would evaluate how well your plan of action was meeting your department’s goals.

Often, a local GIS department has neither the desire nor the incentive to look beyond their own walls to explore GIS program options, much less expend resources. Funneling time and money into a regional GIS program would be counter-intuitive to many GIS managers. After all, it would require coordination and cooperation among many players who might normally feel they’re competitors, or at least have different ways of doing things. It’s human nature—and certainly business nature—to ask, *What’s in it for me? How will regional coordination help my county? or, How would I retain control over what I want to achieve?* But if managers can look beyond the “box”—their institutional boundaries—a world of benefits could open up to them.

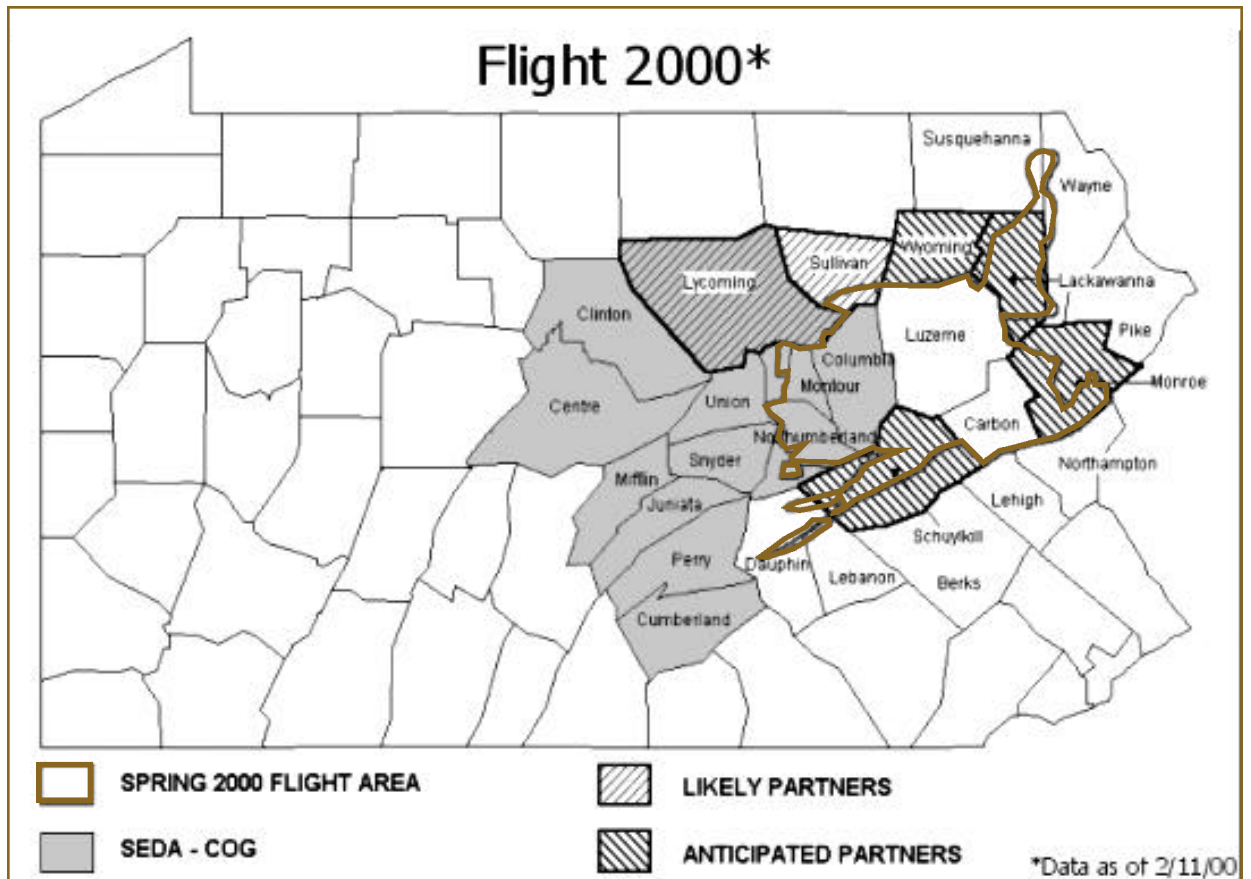


Above: Members of Congress and the press during a helicopter reconnaissance of regional mining sites in Pennsylvania

Right: Real-time monitoring of water quality on the Susquehanna River

“The aim of a regional perspective is to identify and amplify local strengths while minimizing deficiencies...”

Flight area for
2000-2001 aerial
data collection



The Pennsylvania GIS Consortium (PAGIS) has begun building a regionally coordinated program in northcentral Pennsylvania while working to bridge the perceptual gap between “them and us.” The process has not been easy and is far from complete, but valuable lessons have been gleaned along the way. Slowly but surely, the region’s GIS program is growing as local governments are becoming comfortable with regional coordination.

Current PAGIS staff, working in another area of the state for a council of governments, began exploring the impacts of regional coordination in 1994. They started with six counties, which shortly grew to ten. The working philosophy behind the effort became formally known as the *Locally Independent and Regionally Coordinated Deployment of Multiple-Purpose GIS*. The name is long, the logistics are complex, but their goal is straightforward: to maximize the quality of products, services, and efficiency while minimizing costs and related investments. Between 1994 and 1998, the participating county and municipal governments saw savings as high as 62 percent and leveraging ratios in excess of 10:1. This means that each federal dollar spent for data acquisition was matched by ten locally generated dollars.

PAGIS was created in 1998, in part to refine this GIS-deployment philosophy. Organizers, including the principal staff from the earlier efforts, have explored and experimented with strategies and dealt with numerous obstacles—political and

technological. They have abandoned ideas that don't work, and refined those that do—addressing such issues as standards, procedures, best practices, and productive relationships along the way.



Members of the Anthracite Region Technical Committee discuss environmental problems and geospatial requirements of the American Heritage River program for the Upper Susquehanna-Lackawanna Watershed. Congressman Paul Kanjorski and Alex Rogers (river navigator) are in the center of the photo.

Regional Coordination, Flexibility the Key

Regional coordination is the primary ingredient for a successful local GIS program. While many independent local GIS programs exist, they often fall prey to spiraling costs, turf battles, and degradation of quality data. By centrally coordinating their GIS activities, locally independent entities can generate substantial savings. Coordination can ensure high-quality products, and allow participating entities to preserve their independence in data storage, maintenance and distribution.

Thinking large can result in big savings, but reducing overhead costs, while important, is no panacea. Success stems from both opportunity and flexibility—the ability to educate yourself and be prepared to react objectively to take advantage of opportunities when they present themselves.

Savings opportunities vary, but the big four are:

Informed decision making. For example, learning that moving from a rectangular target area with dog legs toward a square target area running north/south and east/west will greatly reduce cost of the aerial data acquisition.

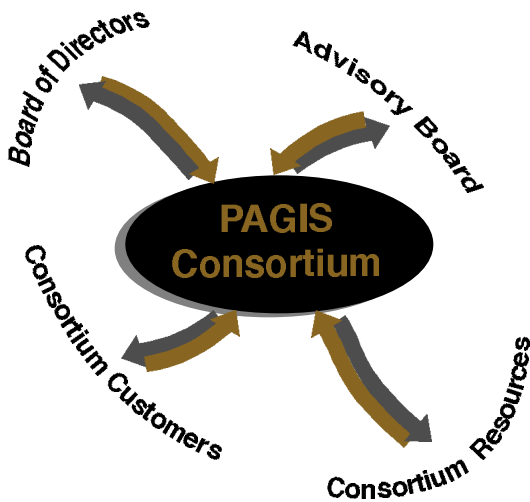
Mistake avoidance. With multiple organizations attempting to deploy their GIS independently, making some mistakes is inevitable. Creating an environment of trust and providing a forum for discussion allows these mistakes to be constructively identified, cataloged and discussed. Other participating organizations can learn from, and avoid, the mistakes others have made in similar GIS activities.

Duplication elimination. Typically, you might spend \$2 per parcel on data-conversion activities. But if you partner with another office needing the same work on the same parcels, you would pay half as much; with three partners, you only pay a third, and so on. Activity sharing can also produce savings in the more expensive and elusive arena of data maintenance.

Economies of scale. The more square miles included in the target area of an aerial photography mission, the lower the cost per square mile. Purchasing 50 copies of ESRI's ArcView will be cheaper per unit than buying two copies. Vendors are usually more than willing to cut prices when they find themselves dealing with one contract instead of ten.

Selling the Team Concept

A centralized coordinating structure, although essential to succeed, is tricky to manage. In the PAGIS consortium, it means coordinating multi-faceted GIS activities over 3,600 square miles, potentially involving parts or all of 15 counties and 196 local



PAGIS Partners

Education Sector

Wilkes University
King's College

Private Sector

Environmental Systems
Research Institute (ESRI)

Aerial Data Reduction (subsidiary of
Marconi Imaging Systems and British
Aerospace Enterprises)

CETROM

T3 Global Strategies

Public Sector

Federal

Former Vice President Gore's
Partnership for Reinventing Government

Federal Geographic Data Committee of
the U.S. Department of Interior

U.S. Army Corps of Engineers

U.S. Environmental Protection Agency

U.S. Department of Agriculture

U.S. Geological Survey

Department of Housing and Urban
Development

State

Pennsylvania Mapping and Geographic
Information Consortium

Department of Environmental Protection

Local

Luzerne County

Monroe County

Lackawanna County

Montour County.

Carbon County

The Town of Bloomsburg

Columbia County

Wilkes-Barre Chamber of Commerce

Wyoming Valley Sanitary Authority

Future partners

Other Counties

Municipalities

FEMA

PEMA

National Weather Service

U.S. Department of Energy

governments. And it is vitally important not to threaten the independence of local participants. The aim of a regional perspective is to identify and amplify local strengths while minimizing deficiencies—to make everyone feel that they're part of a team and that each is a mutually benefitting partner.

Aside from conflict management within, and between, agencies and departments, finding dollars for coordinated activities is a political challenge of another nature. Though regional coordination seems hard to sell, funding it offers the biggest return on investment resulting in as much as 10:1 ratio of local to federal leveraging, to say nothing of savings in excess of 60 percent. In data acquisition, for example, six contiguous counties acting in an unprecedented partnership in 1995 increased technical specifications by 100 percent (i.e., increased mapping scale from 1 inch equals 400 feet to 1 inch equals 200 feet) while reducing costs by 72 percent when compared to a single county that had flown a mapping mission the previous year.

The Whole Picture: A Four-part Strategy for Success

Neither geography, nor geographic data elements, respect political boundaries. Once the notion of "protecting your turf" is transcended, the synergistic power that comes from regional coordination can be unleashed, allowing for the greatest potential for success. Centralized planning, management, and education offers a broad view that looks beyond traditional boundaries established by towns, cities, boroughs, departments, and agencies.

Regional coordination can be handled by virtually any group that can remain neutral, unbiased and non-threatening to participating local entities. It can be a council of governments (local and regional), a for-profit entity, a coalition of universities, or a private non-profit organization. PAGIS is administered by an independent board of directors that ratifies policy proposed by private, public and educational partners. The chief executive officer and chief operations officer manage operations and directly supervise a small but highly qualified and dynamic group of partners.

This guiding entity's mission is to support, empower and enhance the work of local GIS champions and the user community. The regional body is comprised of representatives from each of the partners who decide how best to focus the regional resources. The emphasis is on sharing; regionally acquired resources are not divvied up into parts for individual use. For the best probability of success, PAGIS has found that the regional coordinating entity should fund and focus on a strategy consisting of at least the following items:

- **Identify Voids:** Find the un-met or unidentified human needs and technical problems
- **Provide education:** Solve and teach the essentials until the essence of the problem(s) has been mastered
- **Act:** Use a deliberate strategy instead of reacting to events
- **Evaluate:** Review your successes and failures and go back to No. 3 and/or No. 1 often

A Menu of Tasks

Once a regional coordinating body is in place, the first three-to-five years might be considered formative years for the regional GIS program. With the overall strategy in place, the program can make great gains by laying the groundwork during this time. Here is a suggested “menu” of tasks and the order in which they should be considered:

1. Establish and maintain the “champions’ group” of local, independent entities that drive the process
2. Provide training and education in:
 - Base mapping: procedures and accuracy standards
 - Hardware and software strategies and acquisition
 - Technology transfer
 - Data needs: inter-and intra-installations.
 - Data acquisition (for-fee versus for-free): accumulation, dissemination and maintenance
 - Data exchange requirements and procedures: data standards
 - State coordinate referencing-system selection
 - Data maintenance issues
3. Identify and respond to local resource voids as needed and as resources permit
4. Cultivate partnerships with additional entities within state and federal levels of government
5. Distribute free ArcView software to as many sites as possible
6. Begin data-acquisition and maintenance activities
7. Procure equipment, hardware and software for use at all levels
8. Acquire available small-scale regional database information and distribute locally as appropriate
9. Develop partnerships with, and among, local, independent and varied GISs
10. Establish and maintain a “Best Practices” GIS-implementation guide for reference

The first few years is a critical time for cultivating relationships and laying the groundwork for a sustainable regionwide GIS program. The sidebar above outlines a “menu” of tasks that can provide a solid start. One caveat, however: the coordinating entity should limit its role to making policy recommendations, and steer clear of managing production activities and enrolling goods and service providers. To not do so risks being perceived as biased, thereby alienating private-sector partners.

Partnering Up to Cut Costs: Practical and Political Considerations

A Matter of Practicality

If one word could sum up what is at the core of the locally independent, regionally coordinated GIS program, it would be: *partnership*. Imagine a hypothetical example: Several counties decide, on their own, to update their floodplain database, which requires that they each attain new aerial data.

If each county devises their own flight plan, they may get the data they want, but at what cost? Partnering with neighboring counties can lead to a strategic cost-cutting plan that takes into account three guiding axioms for efficient aerial-data gathering. Together, the three axioms illustrate how seemingly small changes in detailed requirements can significantly affect project cost.

Axiom 1: The greater the number of square miles, the lower per square mile cost

Axiom 2: The most efficient (i.e., lowest cost) flight plan targets an area that is exactly a square, with each side oriented exactly east/west and north/south

Axiom 3: The greater the level of detail, the greater the expense

Linear Vs. Square

To illustrate axiom 2, a 100-square-mile (10 miles by 10 miles) target area has a 40-mile perimeter. At 800 negative scale, the block can be covered by 9 flight lines with 225 exposures and two tie lines with 50 exposures.

Conversely, let's look at a 100-square-mile target area that is 100 miles long, one mile wide, and meanders along a river. It has a 202-mile perimeter (500 percent larger) which, at 800 negative scale, requires 32 flight lines (350 percent more) with 451 exposures (200 percent more) with 9 tie lines (450 percent more) and 113 exposures (200 percent more).

It's All in the Detail

As for axiom 3, it is reasonably intuitive that the level of detail is directly related to the altitude of the plane. The lower the airplane's flight line, the less viewable area per photo. More photos are needed, and, ultimately, the cost is higher. The table on page 7 shows a cost comparison of aerial photography for the same area at two different scales.

*Centralized planning,
management, and
education offers a broad
view that looks beyond
traditional boundaries
established by towns, cities,
boroughs, departments
and agencies.*

**Level of Detail Comparison:
800 scale vs. 1600 scale**

This table was compiled in 1998. While costs change with technology, the lesson that increased detail brings increases in cost is timeless.

Photography Scale	800 Negative Scale	1600 Negative Scale
Mapping scale supported	1 inch equals 100 feet	1 inch equals 200 feet
Target area minimum size	250 square miles	250 square miles
Maximum contours supported	2 foot	5 foot
EXPENSES (per square mile)		
Flight costs including contact prints and diapositives	\$150 with airborne GPS	\$47 with airborne GPS
Control	\$81	\$20
Analytics	\$186	\$51
Planimetrics	\$1,250	\$340
DEM for orthophotos only	\$419	\$144
Orthophotography	\$140	\$44
GIS processing for planimetrics	\$50	\$14
2-foot contour	\$2,433	NA
5-foot contour	NA	\$1,100

The Political Realities

To harness the productive power of the three axioms requires that decision makers and technicians work in concert to devise a plan. But this is usually easier said than done. Why? Because historically, locally independent decision makers, by nature, do not want to relinquish control of their project. Understandably, they focus only on the level of detail they need for their particular applications and for future projects. It’s difficult for many to break out of their institutional “box.”

How can decision makers, politicians and bureaucrats work together to view the bigger picture that ultimately will benefit everyone? First, they must begin understanding how regional alliances can save everyone money. Second, the decision makers must have a working knowledge of the basic technical issues and, therefore, be able to clearly see the win-win potential.

The Champion and the Decision Maker

To facilitate change and cooperation, locally independent projects must be coordinated in a non-threatening way. A regional champion(s) can facilitate simple communications among potential partners whose projects are being planned and budgeted. Chances are these independent entities will find that by combining projects and resources, they can reap instant savings and set the stage for future collaborations. The obvious ways to forge partnerships include 1) overlapping related projects, and 2) overlapping target areas. (See sidebar on p. 8)

Who are the champions and who are the decision makers? Are they the same? The **champion**, almost always, is not the decision maker. It is a person (usually a lower-level staff person) who has vision and recognizes the possibilities of taking a new approach. He or she probably has the vantage point of defining their needs for a specific project. They usually are not funded to champion this cause but usually do anyway because they see the power of what can be achieved.

*The champion,
almost always,
is not the
decision maker.*

Combining resources is a straightforward way to cut expenses. Here are two scenarios:

Project Overlap

Typical for many regions, a county and a municipality within that county manage their own parcel/land records. Acquiring the data for parcel updates would be costly, but by sharing the task, they can save approximately 50 percent of the cost with no threat to their local independence. In other cases of this nature, the two entities might not have a good working relationship, and in fact, sometimes they can even be combative. However, if there is not a threat or unequal advantage to either side, more than likely they will be willing to deal for the cash savings. And, just as important, they will become more aware of future opportunities to cooperate.

Target Area Overlap

A number of townships within a county are preparing to acquire data to support 400-scale mapping. At the same time, the county, itself, is planning a project requiring data to support 200-scale mapping. Despite the fact that several township leaders directly oppose the county commissioner, they cannot resist spending 25% less while acquiring 200-scale mapping data instead of the planned 400-scale data. To pull this off politically, the regional coordinating entity managed the contracts with the photogrammetric vendor and passed the savings back to the participants. The townships did not have to deal with the county or with each other. In this case, a locally independent, regionally coordinated deployment of GIS is born.

The **decision maker** usually is directly or indirectly the keeper of the checkbook. In the vast majority of cases, he or she was elected to their position by the voting public (generally not on a platform that had anything to do with GIS). And by the time you convince this person about the value and long-term potential of partnerships, they get unelected – and you get to start all over educating somebody new. Fortunately, there tends not to be such revolving doors with champions.

Benefits to PAGIS Partners

<u>University Partners</u>	<u>Private Sector Partners</u>	<u>Local Public Partners</u>
Enhanced visibility and marketability	Additional business	Mistake Avoidance
Expanded opportunities for curriculum development	Increased profit	Improved data management
Increased interaction and feedback from public and private sectors	More cost effective	Reduced start-up times and costs
Generate geospatial and Information Technology internship and job placement	Market-sector development	Cost-sharing activities
Local business and municipal support	Work- force development	Economies of scale
Job market development	Increased competitiveness	Higher quality at lower prices
Maintain educational leadership role in technology		
Direct ties/exposure to real-world production systems without competing with private sector		

*The challenge is
not in finding a
knowledgeable
decision maker...
it is in creating one.*

Case Study: A Pennsylvania Regional Master Plan at Work

The Upper Susquehanna-Lackawanna (US-L) Watershed blankets northeastern Pennsylvania—ten counties, 2,000 square miles, and 196 local governments. One-hundred-fifty years of coal mining left the ecological health of the watershed in shambles. Acid mine drainage leaches into the waterways, which eventually empty into Chesapeake Bay. While clean-up costs are immense—\$2 billion and counting—the entire region’s environmental and economic health are at stake.

Without regional coordination and a master plan for coordinating GIS activities throughout the region, the problem would be unapproachable. Instead, PAGIS has worked with local community and watershed groups—along with various federal, state and local agencies—to devise a plan. The result is an environmental master plan that has rendered a cohesive and coordinated GIS program to address the problem.

The first phase of the plan, identifying and gathering a variety of cultural and environmental data, is well under way. By taking a regional, bird’s-eye approach to the problem—with plenty of local input—an efficient and economical strategy for data acquisition, maintenance and distribution has become a reality.

(For more about this program, see *RGIS Land Information Bulletin*, “Tackling Environmental Clean-Up,” 2001)

Aerial photograph of the Susquehanna River and downtown Wilkes-Barre, PA. GIS data layers (river, building footprints, street center lines) are derived from digital photography for local government applications.



Field mapping of coal mining wastes with the global positioning system, another technology component of regionally coordinated GIS.



About RGIS

The National Consortium for Rural Geospatial Innovations (RGIS) brings geospatial technologies and the benefits of the Information Age to rural America where land is fundamental to rural economies and ways of life. By assisting state, tribal, regional and local governments—and non- and for-profit organizations—develop an information-technology infrastructure, RGIS is helping rural communities improve their quality of life, protect their health, and assure economic competitiveness in a growing nation.

Success Begets Success Begets Success

The experience of PAGIS has shown that the benefits for local partners in a regionally coordinated GIS program are immediate and can accrue over time. By participating in a regional plan, local entities benefit greatly from the exchange of ideas and sharing of concerns. They have benefited from the mistakes others have made, thereby avoiding them. In the process, they have improved data collection and management, reduced start-up times and costs, benefited from economies of scale, and ultimately have reduced costs from 10 to 75 cents on the dollar.

And success begets more success. People who have benefited from the regional coordination bring newcomers to the table. They begin examining other areas in which they can duplicate the success. Education and training increases. And the most remarkable testament to the program: when federal funding for regional coordination is lacking, local governments are opening up their wallets to keep the partnerships going and the savings generated from regional coordination alive and well.

Acknowledgements

This publication was produced by the National Consortium for Rural Geospatial Innovations, Chesapeake–Wilkes University, GeoEnvironmental Science and Engineering Department. For more information contact Tom Sweet or Dale Bruns, Pennsylvania GIS Consortium, 150-180 S. River St., Box 111, Wilkes-Barre, PA 18766; email: tsweet@odowd-itg.com; dbruns@wilkes.edu; phone: (570) 408-4610.



The Pennsylvania GIS Consortium
150-180 S. River St.
P.O. Box 111
Wilkes-Barre PA 18766