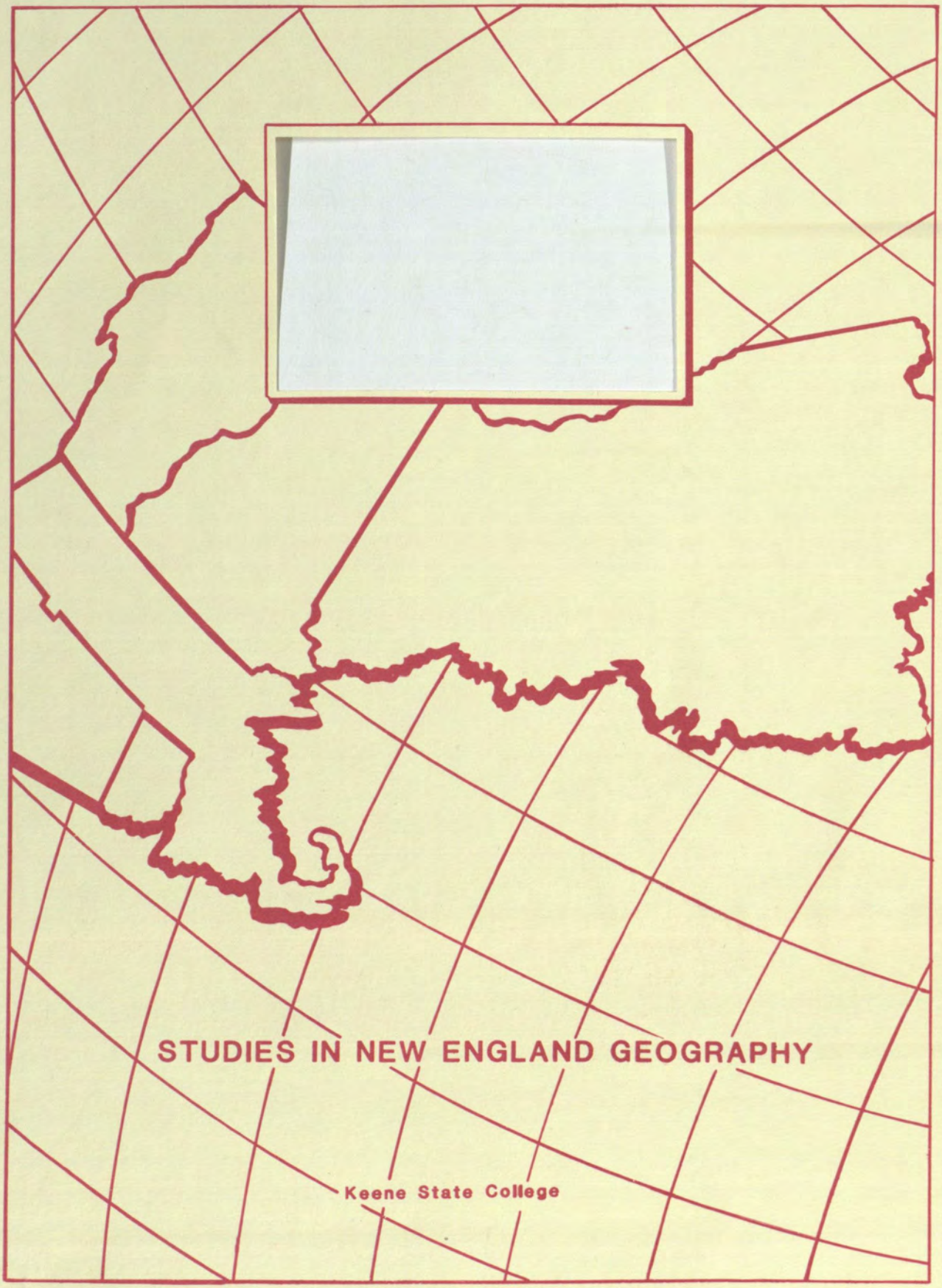

STUDIES IN NEW ENGLAND GEOGRAPHY

Keene State College

GIS IN NEW HAMPSHIRE: RETROSPECT AND PROSPECT

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Introduction

Though seemingly ubiquitous in application, the use of geographic information systems (GIS), varies substantively among cities and counties in the United States. Numerous communities have yet to successfully integrate GIS technology with municipal decision making, despite proclamations that "geographic information systems have finally arrived in state and local governments and, with them, an extraordinary opportunity for planning" (Innes and Simpson 1993, 230). Powerful information systems and readily available data facilitate community efforts to accommodate daily needs and address broader issues such as sustainable development and managed growth. As yet, however, the use of GIS by smaller municipalities and rural counties in many parts of the country remains less common than not.

As noted by Maguire (1991), no singular definition of GIS is definitive, and at least 11 different meanings have been documented. Central to each of these interpretations, however, is consensus that GIS adds value to spatial data and therefore facilitates decision making. Consequently, municipal benefits of GIS are widespread and have heretofore been documented under the rubrics of housing, emergency management, recycling, and growth management, among others (Mitchell 1997). Additional support for the benefits of GIS are provided through case study analyses. For example, in a study of local governments in four southeastern states, GIS was found to improve operational effectiveness and facilitate management decisions (Budic 1994). In many cities, including New York City and Long Beach, GIS is used as a facilitator of interagency coordination and cooperation. The wide applications and resulting wide range in use of geographic information systems has led to its dramatic spread among US municipalities (Antenucci, et al. 1991).

In light of such studies, GIS technology has purportedly diffused amidst widespread celebration and rapid acceptance (Harris and Weiner 1998). Recognition and acclaim allocated to cases of successful GIS utilization has augmented perceptions of GIS pervasiveness. However, as noted by Ventura (1995), only a small number of studies focusing on the acquisition of geographic information systems by local governments have actually been conducted. The purpose of this paper, then, is threefold. First, the spatial variation of municipal and regional use of GIS in the state of New Hampshire is exposed. Next, current obstacles and the future potential of GIS implementation in the state are highlighted. Finally, a case study of Milford, New Hampshire demonstrates the problems and prospects of GIS acquisition by a relatively small municipality with only limited resources.

To determine the geographic extent of geographic information systems in New Hampshire, a closed-response questionnaire was mailed to the GIS representatives of the state's nine Regional Planning Commissions (RPCs). The survey provides a method for understanding present and future use of geographic information systems in New Hampshire. Divisible into four sections, the survey instrument captures information regarding: GIS use by the regional planning commissions; the type and extent of municipal GIS service provided by RPCs; obstacles to municipal acquisition of geographic information systems; and projected regional GIS use in New Hampshire. Due to the small number of potential respondents, the need for participation was emphasized and a 100 percent survey response was attained.

Data for the case study of Milford was generated through a synthesis of primary and secondary survey research. The frequency of map and database use by Milford town officials, as well as the primary GIS objective of each department, was ascertained through a closed-response

survey questionnaire. Primary data was also gathered through a round-table discussion with representatives from the departments of planning, tax assessing, public works, and wastewater management. By interviewing these 'information-rich' individuals for study, this approach follows a format of targeting those cases with potentially substantial knowledge regarding issues of central importance to this study (Patton 1990, 169). Perspectives of municipal decision-makers are likely to induce, or at least influence, relevant policies and programs. Therefore, this approach offers invaluable insight into the attitudes and efforts towards acquisition of a municipal GIS for the town of Milford, New Hampshire.

Background to Case Study Region

The uneven distribution of geographic information systems is eminently apparent in New England. In southern New England, larger communities of the Megalopolis region typically possess sufficient capital and labor necessary for the implementation of geographic information systems. Conversely, smaller towns and villages that have less access to, and understanding of, such systems typify northern New England. Yet, the need for GIS in northern New England is growing ever more acute due to expansion of the Megalopolis. In order to address the issue of urban sprawl and its associated economic and environmental repercussions, communities in northern New England are increasingly recognizing the benefits of GIS.

Emblematic of development in New England are recent trends found within the state of New Hampshire. The Merrimack Valley of southern New Hampshire contains the state's largest cities and numerous bedroom communities to the Boston metropolitan area. Central New Hampshire, a vacation destination for many inhabitants of the expanding Megalopolis region,

has also experienced significant buildup. Northern New Hampshire remains largely undeveloped, though it too is experiencing an increase in population. Overall, New Hampshire's population growth rate was highest among the New England states between 1990 and 1997 (Economic and Labor Market Information Bureau 1999). Concerns over the state's current and projected growth are readily evident. In a recent survey conducted by the *New Hampshire Land and Community Heritage Commission*, 82 percent of respondents indicated concern for the 'loss of open space, or historic or cultural resources' in New Hampshire (Simonetta 1998). Such concerns serve to promote the use of GIS as a growth management and resource preservation tool.

Like many of their counterparts across the United States, most towns in New Hampshire have refrained from GIS implementation because, "making that decision represents a major commitment for most organizations and requires support at all levels of the organization" (Antenucci, et al. 1991, 213). As a result, the Office of State Planning (OSP), and the state's nine Regional Planning Commissions primarily support GIS use in New Hampshire. Such a design has much merit, as evidenced by the state of Vermont, which has successfully utilized its planning commissions for an ambitious approach to GIS service and delivery to the state's cities and towns (Millette 1990).

New Hampshire's state planning office, in conjunction with the Complex Systems Research Center (CSRC) at the University of New Hampshire, coordinates the development of a statewide geographic information system known as the New Hampshire Geographically Referenced Analysis and Information Transfer (NH GRANIT) system. Readily accessible, the statewide digital coverage at 1:24,000 scale serves as the foundation of the system. Additionally,

the role of the OSP, as charged by the New Hampshire Legislature, includes the provision of technical GIS support to local municipalities (Office of State Planning 1994).

Contributions by the state notwithstanding, the most critical efforts in the support and promotion of GIS in New Hampshire are provided by the nine regional planning commissions. More than just repositories of digital data, the RPCs also serve as GIS mentors for member municipalities and coordinators of local efforts. Since the agencies received funding for GIS pc-based workstations in 1989, the RPCs have worked to realize three principal objectives:

- To promote the use of GIS as a planning tool at the local and regional levels;
- To extend the utility and availability of the NH GRANIT System to the local level; and,
- To develop knowledge and understanding of GIS at the RPC level to be passed along to municipalities when they begin to develop their own GIS applications (New Hampshire Office of State Planning 1994, 52).

Having acted in this capacity for more than a decade, each RPC has become attuned to the problems and prospects facing the diffusion of GIS within their region.

Survey Analysis

In their role as nexus between municipalities and the state, the regional planning commissions are uniquely qualified to address the current trends and future projections of GIS use in New Hampshire. Intimately aware of the municipal needs in their respective regions, a synthesis of RPC survey responses reveals geographic variation in the use of GIS throughout New Hampshire. Though constituting only a minority in each of the regions' total communities, municipalities that perform their own GIS work are located predominantly in southeastern New Hampshire (Figure 1). Such results are to be expected, as this region is characterized by the

state's largest and most affluent cities. Throughout the rest of the state, GIS technology is still limited to a small number of municipalities in the Southwest or North Country. Such cities include Keene and Littleton, and typically represent the largest cities in their respective regions. Thus, the correlation between municipal population size and use of GIS appears valid.

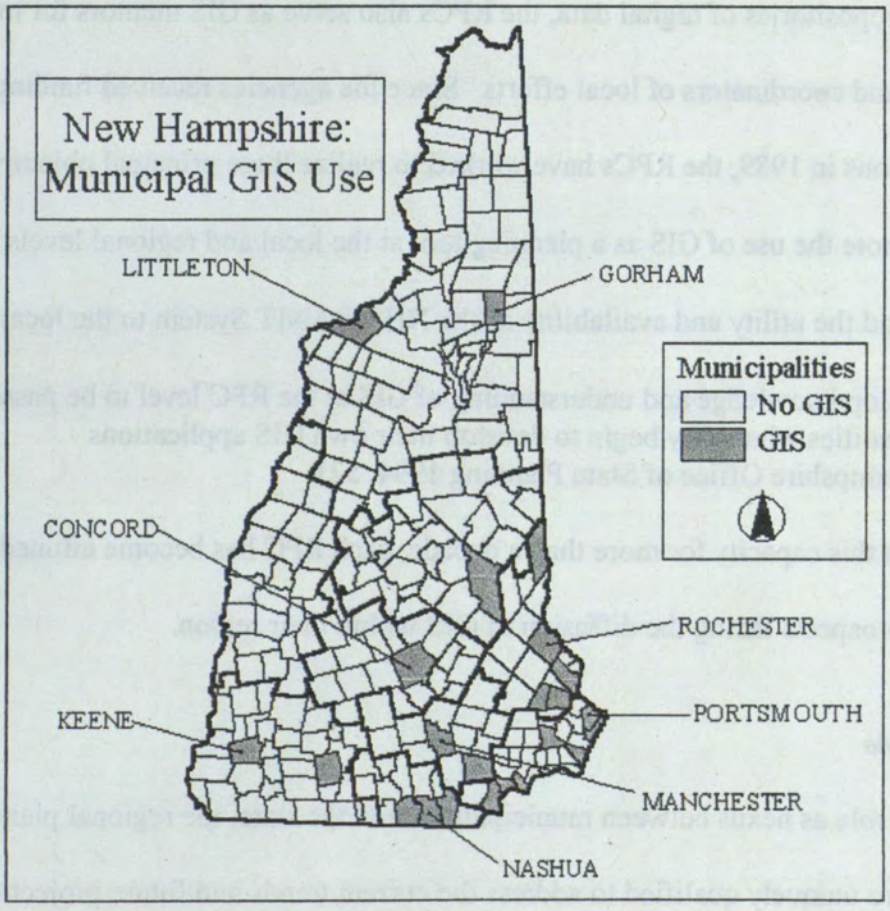

Figure 1: *New Hampshire Municipalities with GIS Technology*

The inability of New Hampshire municipalities to acquire and implement geographic information systems is the result of two congruent obstacles. Not surprisingly, in a state notorious for its fiscal conservatism, both relate to cost concerns. Although numerous cost/benefit analyses, including those by Huxhold (1991), and Smith and Tomlinson (1992),

have reported long term benefits to outweigh short-term costs, initial expenses have proven a prohibitive factor in New Hampshire. Most problematic is that investment needs of a GIS extend beyond hardware, software, and data creation, as costs for training and the need for skilled personnel also serve to deter GIS implementation. Such limiting factors hampering the diffusion of geographic information systems in the state are readily apparent to existing GIS personnel:

> Most town halls are not staffed with people dedicated to GIS applications and cannot afford to have their existing staff learn GIS because of their workload and pressing priorities. Start up costs are the second obstacle to overcome (GIS Representative, Central Regional Planning Commission 1999).

As a result, in all but a single region, a majority of communities contract with their representative planning commission to fulfill their GIS needs (Figure 2).

With the exception of the North Country region, within which only two municipalities perform any GIS work at all, New Hampshire's planning commissions are accountable to a preponderance of their constituents. Far from ubiquitous though, municipal requests for GIS work are confined to the heavily populated and urbanized areas in southern New Hampshire. Moderate GIS use is demonstrated in the Central region, while a virtual absence of geographic information systems persists in northern New Hampshire. Such results reveal that the GIS contracts between municipality and regional planning commission in New Hampshire remain largely confined to the larger, more affluent communities with the most available resources.

Relationships between planning commissions and their communities are measurable not only by the number of GIS contracts, but by the type of contract as well. By this variable, however, there is little variation. Regional Planning Commissions throughout New

Hampshire typically receive solicitations for only a select few of the potential applications of GIS. The frequency of GIS use by RPCs in order to accommodate the needs of their member communities is readily demonstrated through application of a *Map Utilization Cross-Reference* chart.

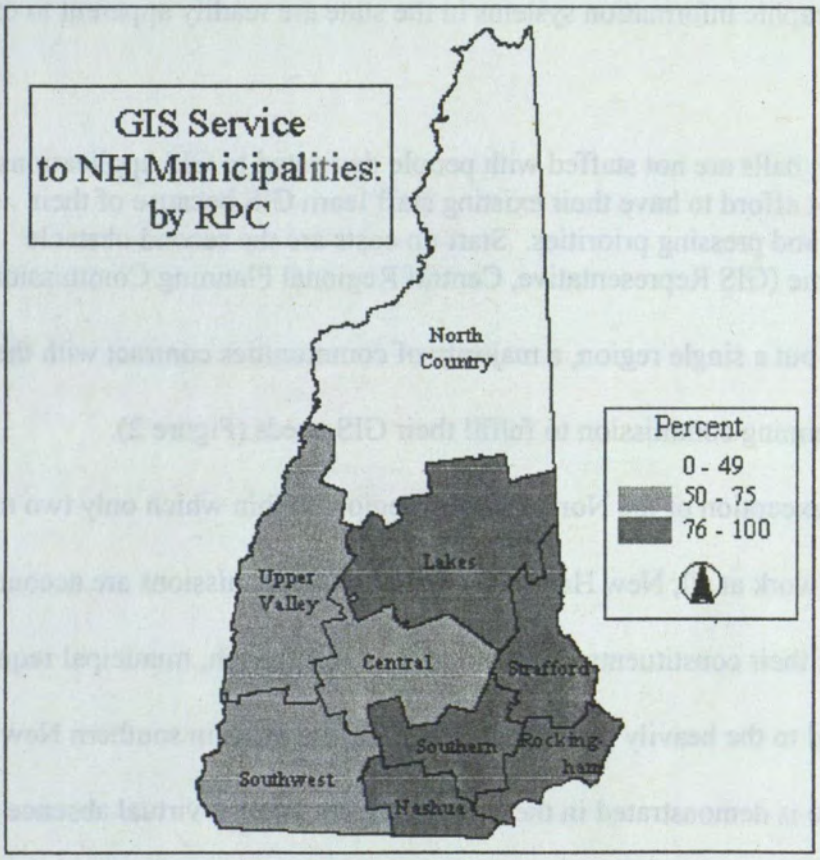

Figure 2: *Percent of Municipalities contracting for RPC GIS service: by RPC district.*

As noted by Huxhold (1991, 239), this type of chart is a "good method for communicating the extent and amount of map utilization." Though not a comprehensive list of all applications, the table provides an opportunity to assess the demand for many potential uses of GIS. Results reveal that, more often than not, planning commissions are never contracted to provide information for a majority of functions (Table 1).

Table 1 *Frequency of GIS service provided to New Hampshire municipalities by the nine Regional Planning Commissions*

Application	3+ times / week	1-2 times / week	1-2 times / month	1-2 times / year	Never
Accident Data	-	-	2	5	2
Choropleth Maps	1	-	2	4	2
Construction / Paving Plans	-	-	-	2	7
Crime Statistics	-	-	-	-	9
Election District Maps	-	-	-	1	8
House Number Maps	-	-	-	3	6
Land Use Maps	-	3	4	2	-
Parking Maps	-	-	1	2	6
Resource Maps	1	5	3	-	-
Fire Dispatch	-	-	-	3	6
Police Dispatch	-	-	-	2	7
Sewer Line Maps	-	-	1	7	1
Storm Sewer Maps	-	-	1	2	6
Street / Road Maps	5	1	3	-	-
Tax Parcel Maps	1	1	6	1	-
Traffic Control Maps	-	1	-	2	6
Traffic Signal Records	-	-	-	1	8
Topographic (USGS) Maps	1	2	5	-	1
Underground Conduits	-	-	1	1	7
Violation Inspections / Maps	-	-	-	1	8
Water Distribution Maps	-	-	-	3	6
Zoning Maps	1	2	4	2	-

As indicated by the cross-reference chart, most GIS applications lie dormant for extended periods of time. For example, not a single RPC reports any contract to map municipal Crime Statistics. Similarly, seven of the nine planning commissions report never having received requests for Police Dispatch maps. In fact, a preponderance of potential GIS applications are either never applied or are put to use only one or two times per year. A smaller number of maps, such as Land Use, Natural Resource, and Tax Parcel maps are requested with some frequency.

However, only a single map type, Street/Road Maps, is accessed by multiple planning commissions three or more times per week.

Municipal requests to the state's Regional Planning Commissions for GIS service remain modest. However, such results are not overly surprising, as initial GIS use by local government tends to be limited to simple query and display applications (Ventura 1995). Over time, the number and types of applications of geographic information systems generally increase.

In New Hampshire, such increases are anticipated among towns in seven of the nine RPCs. Only in the North Country and in the Central region is GIS use expected to remain the same. For the North Country, such results reinforce the inverse relationship between areas of limited population size and the utilization of GIS. Forecasts for no additional spread of GIS throughout the Central region are perhaps more troubling. Benefits of geographic information systems, known to Concord, must spread to other municipalities in the region.

As all but two planning commissions anticipate the use of GIS to increase in their region, demands for RPC service will also likely increase at or near the same rate. Such trends must be taken into account by the planning commissions as they plan for the future. Though they serve as the state's envoys of GIS, they too are limited in resources and personnel. In fact, two RPCs lack any full-time GIS employees, while six others have only a single full-time position dedicated to geographic information systems.

In New Hampshire, individual towns are less likely to acquire GIS technology and hire new personnel to operate the systems than they are to turn to their Regional Planning Commission for service. As a result, the existing demands on RPC systems' operators are certain to increase, and perhaps to an unreasonable level. Already, New Hampshire's GIS professionals

are at times expected to perform programming and networking tasks. Additional tasks, certain to be added as a larger number of municipalities seek the benefits of geographic technology, will further exacerbate the situation.

Summary of GIS Use in New Hampshire

It may be true that, "the potential users of GIS are nearly limitless, and the types and numbers of users are growing at a logarithmic pace" (DeMers 1997, 7). However, the application of geographic information systems in New Hampshire remains, as yet, primarily confined to only the larger municipalities. Awareness and appreciation of GIS is noted throughout New Hampshire, however cost concerns tends to stunt most municipal GIS initiatives. Not surprisingly, the highest concern relates to the need for skills training and staff support. Municipalities in fiscally conservative New Hampshire tend to fit the norm whereby solving technical problems is less difficult than the "integration of GIS into the work and culture of an organization" (Heywood et al. 1998, 172).

In light of such expenses, the number of municipalities that obtain GIS services from their Regional Planning Commission far exceeds those that go it alone. Presently, there is little variation in the types of maps the planning commissions are contracted to produce with any great frequency. However, demands placed on the planning commissions are expected to increase as municipalities increasingly contract for more complex projects. The planning commissions themselves have only a limited number of skilled GIS personnel, and future demands may well test their ability to provide comprehensive service to their member municipalities.

Although the majority of municipalities in New Hampshire lack any form of geographic information systems, a combination of occurrences may well induce municipal GIS acquisition. Indeed, increased municipal GIS use in New Hampshire is likely to occur due to:

- limitations in the ability of the Regional Planning Commissions to meet future geo-technological demands of their member municipalities,
- steadily decreasing costs of the hardware, software, and data associated with geographic information systems,
- and, increasing awareness by public, private, and community leaders as to the myriad of potential benefits of geographic information systems.

New Hampshire municipalities with GIS capabilities remain more limited than not. Despite this technology-lag, many communities in the state do recognize the role of GIS and subsequently are working to join in the widespread adoption of geographic information systems.

Municipal GIS Implementation: Milford, New Hampshire

One such municipality recognizing the need for an "in-house" GIS system is Milford, New Hampshire. Located in Hillsborough County, Milford is serviced by the Nashua Regional Planning Commission (NRPC). Although town administrators are serviced by the NRPC for large-scale GIS projects, such as build-out analyses, neither the administrators nor the Nashua planning commission have the time or resources to attend to all of Milford's municipal needs. Consequently, this community of 13,000 residents is exploring the option of implementing a desktop GIS into town offices so as to enhance the daily operations of town administrators. As upwards of 80 percent of all municipal applications have geographic components, the need for local geographic information systems is acute (Huxhold 1991).

Similar to many small towns, Milford's Town Hall houses several departments, such as public works, planning and building, tax assessor, and town administrator. These departments are generally comprised of only a single director and one or two supporting staff members. Data sharing is performed through the manual delivery of paper documents and there is no mapping software in the offices. As a result, staff members spend a good portion of the day delivering documents around the building, taping parcel maps together, and creating visual displays with colored pencils. Since the Milford offices are not as large as many others in New Hampshire, these time-consuming tasks become even more costly because they detract the attention of the limited personnel. Consequently, many of Milford's department heads recognized the need for a GIS within the offices of the Town Hall and a GIS Committee was formed in 1999. Comprised of the directors of the departments of Planning and Building, Public Works, Tax Assessing, Wastewater Management, and the Ambulance Corps, this committee is open to all municipal employees. Since its formation, Milford's GIS Committee has taken significant strides towards the implementation of a town-wide GIS while following an orderly and comprehensive approach (Figure 3).

Planning Phase

Milford's GIS implementation process began in July 1999, when a *User Needs Assessment* was distributed to all municipal departments. The questionnaire sought to assess the current database and mapping functions of each department, and whether the current software was meeting those needs. Response to the survey indicates that though the departments can function within the current system, too many personnel-hours are being spent on activities that

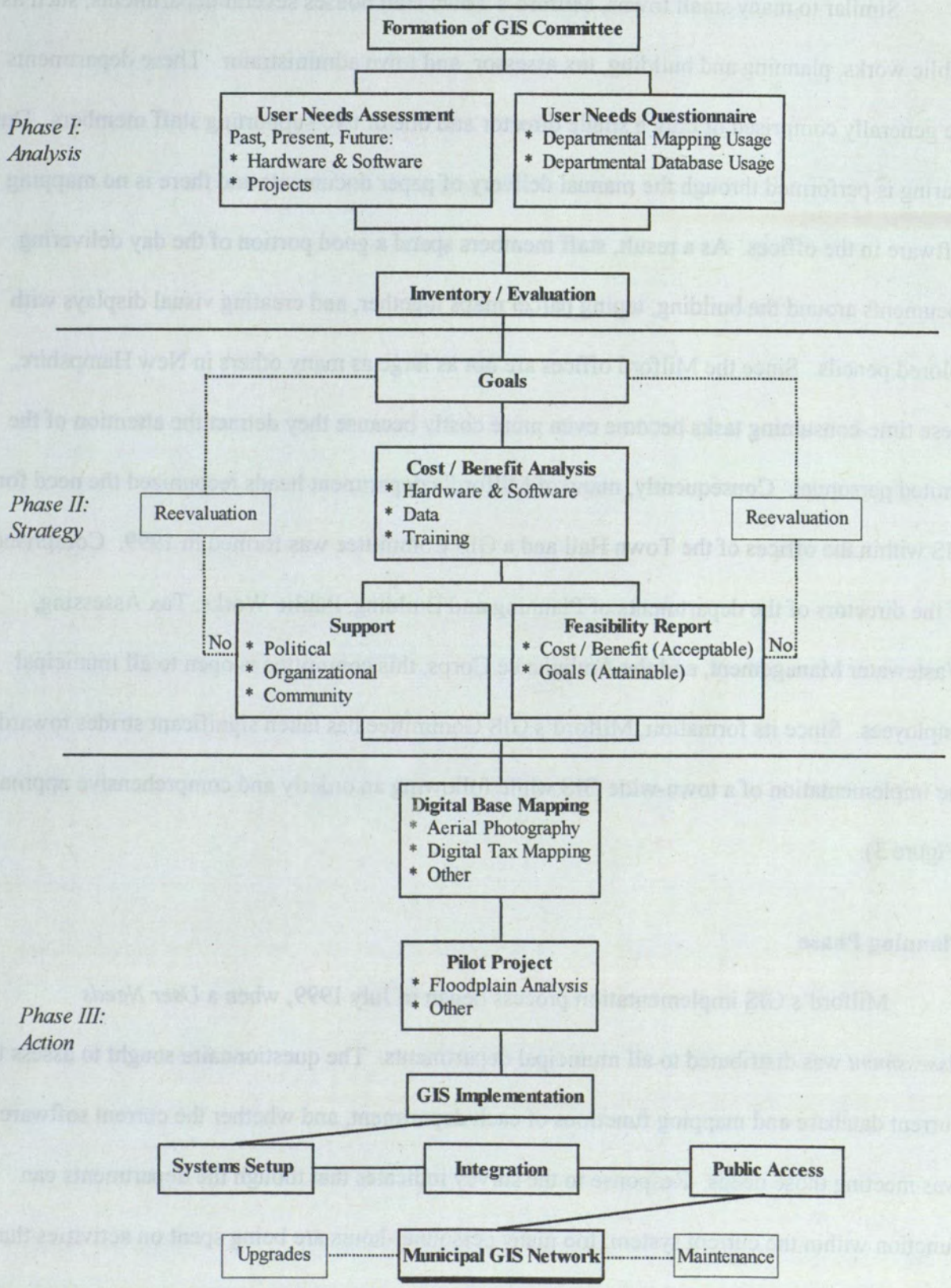

Figure 3: *GIS Implementation Process.*

could be performed far more efficiently. For example, personnel in the Fire Department must physically measure the distance between fire hydrants and residential units (for insurance purposes) approximately twice a week. By way of contrast, with a geographic information system, any requests for this information could be fulfilled within a few minutes from a single computer within the firehouse. Additionally, staff from the Tax Assessor's office recently spent numerous hours manually flipping through tax cards for information on sales as part of an analysis project conducted by the department. The laborious nature of the project was readily noted and recognized to be "a huge drain on manhours which could be put to better use... If the data was electronic it could be called up, queried and manipulated right from a PC in a fraction of the time. A huge potential cost savings in labor time alone" (Representative, Milford Tax Assessor's Office 1999).

In addition to database management, the *User Needs Assessment* revealed the perceived need for improved mapping technology. One representative who currently displays data by repeatedly photocopying existing maps and 'whiting-out' old information purports such sentiment. This mapping deficiency directly affects the public as well. Without a GIS, many government maps are unavailable at the Town Library where they are most accessible to the public. Once GIS is implemented, the library hopes to provide its patrons with demographic mapping and information on town-related projects.

However, not every staff member of Town Hall is anticipating great improvements with a GIS. Although a majority of the respondents are in favor of an improved database and mapping program, others believe their needs are currently being fulfilled and that there is no need for a GIS. As evidence, one representative responded to the *User Needs Assessment* with a note that

read, "You're wasting my time!" Despite such resistance, a majority of the representatives participating in the *Assessment* support a change in Milford's technology requirements.

As a result, the authors conducted a second *User Needs Questionnaire* in order to pinpoint the mapping and database functions used most frequently among town officials. Through this process, the needs of likely GIS users could be determined and an appropriate software package could be identified. Similar to trends noted by the Regional Planning Commissions, results of the survey reveal daily use of Street/Road maps and infrequent use of almost half of the town's other available maps and databases (Table 2). More importantly though, many of the respondents also claim that their own use of the maps and databases would increase with GIS implementation and correlate with a subsequent decrease in dependence on the Nashua Region Planning Commission for GIS service. Additionally, several of the applications that are not being used on a regular basis are primarily seasonal maps or databases. A majority, if not all, of the applications that received the most use can be easily performed through a majority of the desktop GIS software packages.

For the Milford GIS Committee, these two surveys are valuable pieces of information because understanding the specific needs of the town officials is crucial when selecting a GIS package. Realizing which functions of a GIS will be utilized the most and which ones may be neglected is important. One of the worst detractors from the political support of a GIS is to purchase a system and then decide a short time later that the system cannot support the users' needs. Consequently, any funding requests by the committee could lead to a denial of funds, in turn leaving projects incomplete, as well as creating distrust between the GIS and Budget Committees (Huxhold 1991).

Table 2 Frequency of map and database use by Milford town officials.

Daily	Weekly	Monthly	Yearly	Never
• Street/Road Maps	• House # Atlas • Land Use Maps • Sewer Line Maps • Storm Sewer Maps • Tax Parcel Map • Tax Parcel Info. • Topographic (USGS) Maps • Water Distribution Maps • Zoning Maps	• Choropleth Maps • Traffic Control Maps • Resource Maps • Resource Allocation/ Emergency Services • Underground Conduit • Construction/ Paving Plans	• Crime Statistics • Incident Maps • Parking Maps • Redistricting • Snow Removal • Traffic Signal Records • Violation Inspections • Violation Mapping	• Election District Mapping

Furthermore, the assessment of system requirements, as well as current software, can help town officials save money when purchasing a GIS. Although the purpose of a GIS is to increase the efficiency in database and mapping operations, it does not mean that all of the information in the current systems must be abolished and reconfigured. In fact, "if an existing system provides adequate information service to its users, then an interface between it and the new GIS may be more beneficial by avoiding the expense of redesigning it for the GIS" (Huxhold 1991, p.241). Not only can this interface save expenses in the purchasing of software, but in labor as well. Database development is traditionally one of the most time-consuming functions in GIS implementation and as a result, many municipalities begin GIS operation without complete databases (Budic 1994). Henceforth, database systems currently in use in Milford may be compatible with a particular GIS package, thereby allowing them the opportunity to avoid the labor-intensive task of database development.

Though easy in theory, achieving this savings in expense and labor may be a difficult task for the Milford committee since many of the town's database requirements are being fulfilled through several different software packages (Milford GIS Committee 1999). Several departments utilize Microsoft Access or Excel, while others, like the Ambulance Corps, have systems that are specific to their daily requirements. However, the one theme common to most departments is that much of the data is still stored on index cards or other paper files. Consequently, town officials will have to budget time and money on numerous hours for data entry, regardless of the chosen package, while searching for a GIS that will incorporate as many of the current database systems as well.

Another key component to the successful implementation of a GIS is determining the objectives of the users. In a roundtable discussion with Milford's GIS Committee, representatives from each department expressed the objectives for their own department. Despite the inimitability of the department projects, one objective common to all was time management. Each representative expressed anticipation of more efficient daily operations with the implementation of a GIS. Altogether, the Committee responded unanimously that GIS would improve efficiency in time management. Although an improvement in efficiency will help persuade the Budget Committee to purchase a GIS, most departments are likely to be pressed to demonstrate a need for the system. A majority of the departments in Milford have more than a single objective for GIS use, though even a cursory review of the primary objective of each department shows wide dispersion of potential GIS use among Milford officials (Table 3).

For instance, the Planning Department expresses the intention of utilizing GIS for more enhanced professional presentations. Similarly, the Town's Conservation Commission, which

often finds a necessity for displaying the location of wetlands and soils types, is also interested in data display considerations. In addition to data display, improved decision-making through the use of GIS is anticipated. As an example, the director of the Ambulance Corps wishes to use GIS to find the best route for transport of patients. In another context of decision-making, the Ambulance Corps is also looking to relocate their facility. The use of GIS can aid this process by displaying possible relocation sites and their attributes, such as proximity to frequent response areas and accessible routes from the station.

Table 3 *Milford departments and their primary GIS objective.*

	Ambulance	**Tax Assessor**	**Public Works**	**Planning**
Objective	Provide directions to- and hazards at- emergency response locations	Analysis of properties for tax purposes	Maintenance log for all infrastructure repairs	Presentation tool

Development Stage

Similar to other communities implementing a geographic information system, one of Milford's biggest hurdles is the conversion of base maps into digital form. As this procedure generally creates the platform from which a municipality's GIS operates, selecting the appropriate method of base map generation is a critical step in launching a successful GIS. Base maps can be generated through several methods, including survey mapping, converting parcel maps to digital form, digital orthophotos, and street network databases (Somers 1998). The appropriate method of base-map generation is often determined by the needs of the particular municipality involved. Oftentimes, cost and functionality play key roles in determining which form to use. Survey maps tend to be very costly to towns, whereas converting parcel maps is not

as expensive. However, parcel maps tend to be less accurate than survey maps, and though they will support most initial GIS applications, updates will need to be made periodically to ensure higher accuracy and greater functionality (Somers 1998).

For officials in Milford, the appropriate steps have already been undertaken in their base map generation. Beginning in the summer of 1999, the town contracted for aerial photos to be taken of the municipality, and at the same time began to convert their parcel maps to digital form. Upon completion of these procedures, Milford officials will have the opportunity to take advantage of the power and efficiency of a geographic information system.

A Pilot Project exemplifying this potential efficiency is the mapping and analysis of those portions of Milford located within the 100- and 500-year flood plain districts. Currently, town officials must overlay a paper parcel map with a flood plain map from the Federal Emergency Management Agency. However, as the maps were generated at two different scales, officials are forced to estimate which parcels, or portions thereof, lay within the flood plain. Once the parcel maps are generated for use with GIS, the flood plains can be digitized and subsequently added as layers. Although Milford's parcel map for this Pilot Project is as yet incomplete, the current map reveals the relationship of the flood plains and Milford and the ease with which those parcels that lie partially within the flood plain can be determined through use of a GIS (Figure 4).

A second use for which geographic information systems would likely prove beneficial to Milford is the downtown revitalization effort. Although much work has already been completed, including aesthetic enhancements and publication of a "Downtown Guide to Milford," the process of recruiting new businesses is still underway. With a GIS and a digital parcel map,

business clusters can be easily identified and displayed in a recruitment guide for potential businesses. Currently, the revitalization committee must hand-draw these maps and color the parcels according to business type, a process that must be repeated with every change that occurs in the downtown district. With the implementation of a GIS, the initial "cluster map" and any changes could be made in a matter of a few minutes. Concurrently, a database containing such important information as business name, owner, address, business type, and square footage of the building, could be created with the map. The quality of presentations would also be enhanced, as would Milford's ability to 'sell' itself in terms of image and attracting economic development.

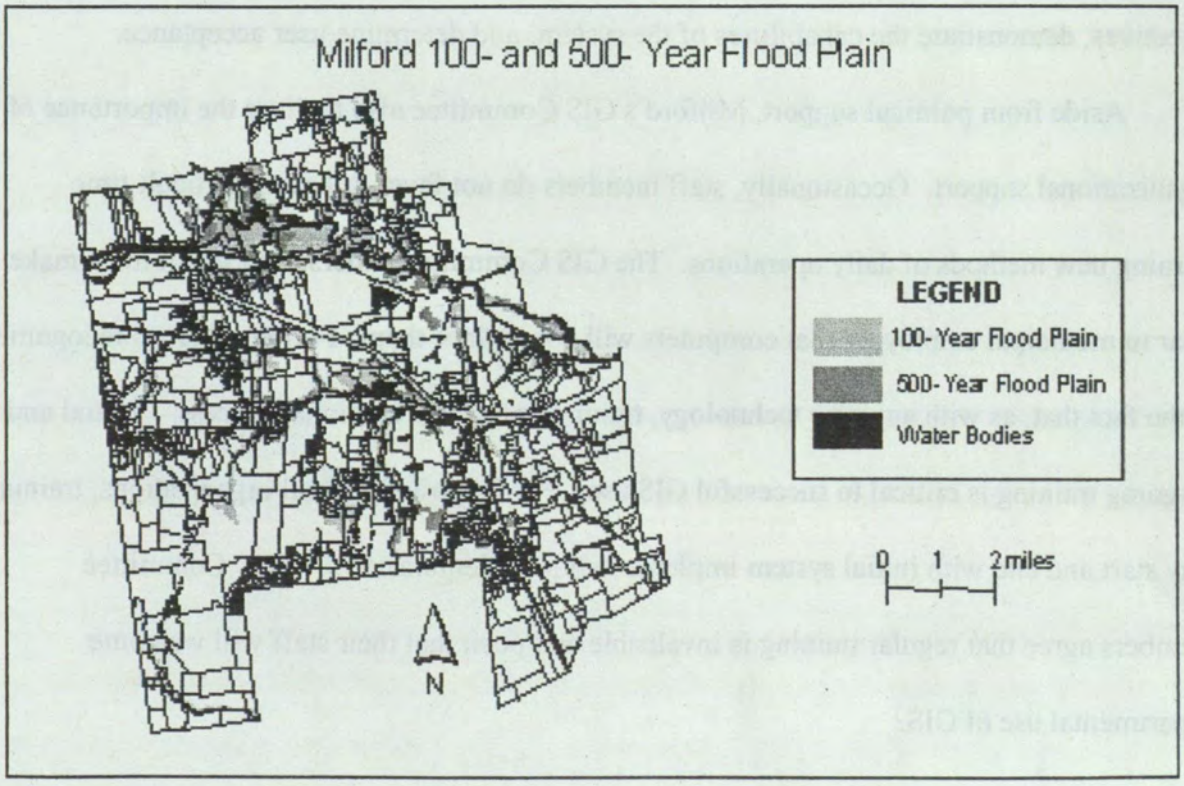

Figure 4: Floodplains of Milford, New Hampshire.

Future Actions

Milford's GIS implementation process is currently at the point of base map generation and software research. Although these are two key components to the implementation process, town officials realize they have additional barriers to overcome before the system is fully operational. One of these barriers remains a lack of political support. The GIS Committee is continually building a portfolio with examples of how a GIS could improve the efficiency of daily operations. However, as funding for GIS still remains a critical issue, the Committee members are developing a detailed cost/benefit analysis of GIS. The Committee also anticipates utilizing the flood plain and parcel data in a pilot project in order to outline the town's GIS objectives, demonstrate the capabilities of the system, and determine user acceptance.

Aside from political support, Milford's GIS Committee also realizes the importance of organizational support. Occasionally, staff members do not favor or have a difficult time learning new methods of daily operations. The GIS Committee understands that it must make clear to municipal employees that computers will not replace them. Further, there is recognition of the fact that, as with any new technology, training must be a continual process. "Initial and on-going training is critical to successful GIS use...Particularly for small organizations, training may start and end with initial system implementation" (Ventura 1995, 464). Committee members agree that regular training is invaluable and posit that their staff will welcome departmental use of GIS.

Conclusion

Milford, like many smaller communities throughout New Hampshire and the United States, is a municipality that can reap multiple benefits from the services of geographic information systems. Officials within the town recognize these potential services and, with an immediate goal of an in-house GIS system by the end of 2000 and a fully operational system by 2003, are in the process of making them a reality. Milford has recognized the need to implement a GIS, and through the town's implementation process and personnel involved will make it a successful investment. In their approach, Milford stands as an example for all New Hampshire municipalities. With Milford as an example, other New Hampshire municipalities have a model upon which to evaluate their efforts towards acquisition and implementation of a GIS.

Noted as one of ten geographic ideas that changed the world, the development of geographic information systems has facilitated decision-making and coordinated efforts at the municipal level across the United States (Hanson 1997). In New Hampshire, however, municipal GIS use remains less common than not, as the state's Regional Planning Commissions continue to perform the bulk of geo-technological work. Yet, as exemplified by Milford, municipal recognition of the need for in-house geographic information systems is increasing in the state of New Hampshire. The first step to the adoption and utilization of GIS on a local level throughout the state, increased awareness may well lead New Hampshire municipalities to integrate this technology into the complex but collaborative world of planning, development, engineering, and environmental assessment.

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