

SURVEYS OF GIS USAGE AND NEEDS AMONG NATURAL RESOURCE MANAGERS, EXTENSION AGENTS, AND LAND USE PLANNERS

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Abstract

During 2006 and 2007, three separate surveys were conducted by the University of Georgia to determine the usage and needs of geographic information systems (GIS) by natural resource professionals. The first two studies were conducted to determine the needs of extension agents and land use planners as they relate to landscape visualization and change. These studies included some questions regarding the availability and use of GIS in the extension and planning process. The third study concentrated on determining the extent of use of GIS by natural resource professionals who had recently graduated college. A synthesis of these results is provided. A discussion of anecdotal information related to various phases of the surveys are also provided, and includes information obtained by the researchers that has not previously presented in the literature. Results suggest that geospatial analysis is needed in today's management, planning, and outreach environment, yet the ability to fully utilize the capabilities of GIS may be limited.

Keywords. Needs assessment, education, geospatial technologies

Introduction

During 2006 and 2007, three surveys were conducted by the University of Georgia in order to assess the needs and patterns of the use of geographic information systems (GIS) by natural resource professionals. The first two surveys focused on Georgia's Agriculture and Natural Resources Extension professionals and land use planners. The first two surveys were part of a larger project entitled *Visualizing Impacts of Local Land Use Decision and Plans on Forest Resource Management: Setting the State for Community-Based Forestry Decision-Making*, and were developed following the advice of our project advisory panel. The focus of the project was to identify geospatial technologies, specifically land use / land cover change models, that can inform policymakers, landowners, and the general public about changes in land cover trends and

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how those changes may impact ecological systems and natural resources. Specifically, the surveys wanted to gain more insight into perceived drivers of land cover change in Georgia, familiarity of Extension professionals and land use planners with land cover change models and GIS, and their interest in these technologies. Additionally, the surveys were designed to identify the most appropriate visualization and outreach techniques for distributing land cover change model information to natural resource professionals.

The third survey was conducted in order to assess what GIS techniques entry-level natural resource professionals (recent graduates from the Warnell School of Forestry and Natural Resources) were using in the current employment positions. This survey was developed in order to determine if course work provided within the college is appropriately preparing entry-level natural resource managers to implement GIS skills following graduation. Previous surveys (Brown and Lassoie 1998; Sader et al. 1989; Sader and Vermillion 2000; and Sample et al. 1999) focused on the educational systems training GIS users or the employers who hired GIS users. To our knowledge, this survey is unique due to its focus directly on the employees and their GIS usage. The goal of this survey was to determine the duration graduates had been in their position and the frequency with which they use GIS. Also, the researchers wanted to determine what GIS processes and databases these managers were using. Finally, the researchers wanted to investigate what products these users were creating in GIS and what software was being used.

Methods

For all three surveys, Survey Monkey (2006) was used to develop the surveys and collect the results. All participants were given a brief explanation of the goals of the surveys. Additionally, they were given the option to participate or exit the survey. Participants in all surveys were given the option to skip a question if they desired, therefore not all questions were answered by all participants.

Natural Resources Planning and Extension Professionals

The two surveys of planning professionals and Extension agents were very similar, and covered the same basic topics. Contact information for Georgia's city and county land use planning professionals was acquired from the Georgia Department of Community Affairs (2006a and 2006b). In order to disseminate the survey to extension professionals in Georgia, the four Agriculture and Natural Resources Program Development Coordinators for the state were contacted and asked to distribute the survey to agents within their district. An e-mail was sent to potential participants containing a link to each of the two surveys. Two weeks later a reminder e-mail and the link to the survey was sent to potential participants. Finally, an additional reminder was sent out two days prior to the close of the survey.

Entry-Level Natural Resource Professionals

Contact information for recent graduates from the Warnell School of Forestry and Natural Resources at the University of Georgia was obtained from the Alumni Association. For the purpose of our survey, "recent graduates" were those students who had graduated between 2000 and 2006. In some instances, the Alumni Association database included employment

information. While these sorts of databases are valuable, they are limited due to the fact that employment information along with contact information, specifically e-mail, are provided voluntarily and may be completely absent or not current. As a result, an initial e-mail was sent to people whose employment information clearly indicated that they held natural resource management positions. All other graduates in the database, when e-mail information was provided, were contacted asking them to participate if they were currently employed in natural resource positions. Recent graduates in post baccalaureate degree programs were excluded.

Results

Natural Resources Planning and Extension Professionals

After accounting for undeliverable surveys, a total of 172 planning professionals and 155 Extension professionals were asked to participate in the survey. Eighty-four percent (n=130) of Extension professionals chose to participate in the survey (Merry et al., in press A), while only 34% (n=59) of planners chose to participate (Merry et al., in press B). This response rate for the planners' survey was acceptable although it was lower than expected. A few potential respondents in the planning professional groups replied to e-mail requests with pointed remarks on the usefulness of the survey and simply refused to participate. A few respondents indicated displeasure with the survey because they could not see the need for a discussion along these lines. Nevertheless, a reasonable number of planners did want to participate and provided useful insight into GIS usage in Georgia.

Sixty-nine percent of Extension professionals indicated that land cover change was a problem in their county. Similarly, 64% of Georgia's planning professionals identified land cover change as a problem in their county / municipality. The majority of Extension professionals (60%) identified their county as rural. Responses for planners were more evenly distributed. Twenty-four percent identified their county as urban, 33% rural, and 44% mixed. When asked if they felt that land use / land cover change was a problem in their county / municipality, 69% of Extension professionals identified it as a problem. The majority of planners (64%) also identified land use / land cover change as a problem. Both planning professionals and Extension agents said that they envisioned land use / land cover change as a problem in 5 years, 10 years, and 15 years.

In order to assess the pervasiveness of GIS usage in Georgia, planning professionals and Extension agents were asked if their county / municipality have a GIS staff or department. Fifty-eight percent of Extension professionals indicated that their county did not have a staff or department. Comparatively, nearly 60% of planning professionals indicated that they did have a GIS staff or department. Seventy-two percent of planning professionals indicated that they did use GIS in their planning process while only 36% of Extension professionals used GIS.

The majority of planning professionals (67%) identified several different natural resources issues that they incorporated into their planning process. These included water resources issues, storm water management, stream buffers, and wetlands. Less than half of Extension professionals indicated that natural resource issues such as watershed protection, sediment and erosion control, stream buffers, and Best Management Practices (BMP) were part of their county's planning process.

Both planning and Extension professionals were asked what was driving land use / land cover change in their county / municipality. Planners cited development pressure, lack of infill development, lack of sewer infrastructure, and shifts in industry, while Extension professionals indicated that residential development, spill-over from larger cities and rapidly growing counties, and population migration. Specifically, several Extension professionals suggested that people in their counties were losing interest in agriculture and forestry. They were selling off their land and changing to more lucrative professions. In turn, historically agricultural land was transitioning to other uses.

Land use / land cover change model projections were thought to be very valuable in the planning process for both planning professionals and Extension agents, 87% and 85%, respectively. Neither group used them or was aware of their use in the planning process. Both planners and Extension agents felt that land use / land cover change projections of 10 years would be the most valuable for their county / municipality's planning process. Additionally, 47% of planning professionals felt that land use / land cover change projections provided in a 5-year increment would be the most valuable. Extension professionals agreed, indicating that almost 60% of respondents would find that model output in a 5-year increment would aid in the planning process. When asked how land use / land cover change projections would be used in the planning process, planning professionals and Extension agents suggested they would be used to:

- guide comprehensive plan development,
- analyze the impact of potential zoning policies on future development,
- aid in infrastructure decisions,
- provide insight into conservation issues,
- designate greenspace, and
- inform the public on resulting landscape following zoning and planning decisions.

In an attempt to investigate potential audiences for outreach education programs and land use / land cover change information dissemination, researchers discovered that over 70% of planning professionals incorporated Regional Development Centers (RDC) in their planning process. When asked how they used these centers, those that responded indicated that they were predominantly used in the Development of Regional Impact (DRI) planning. DRI's are defined by the Georgia Department of Community Affairs as "large scale developments that are likely to have effects outside of the local government." This sort of development includes hospitals, hotels, wastewater treatment, etc.

In order to guide the development of future outreach programs for visualizing future landscapes under alternative scenarios, planning professionals and Extension agents were given a list of potential tools for distributing land use / land cover change projections. Both planners and Extension professionals responded favorably to digital maps / GIS databases and web-based maps. Both planners and Extension agents were supportive of the development of a research center to aid in land use / land cover change scenario development. To date, the project has developed a website (www.vizlan.org) that guides users to more information on a subset of land use / land cover change models. Additionally, the website provides information on forest fragmentation, and links to free GIS databases and more detailed model information. Also, the

project team developed three alternative scenarios using three models for four different case study cities. The output from these scenarios is offered as both a change-over-time animation and as digital maps for a 5-year interval of twenty-year scenarios developed by the researchers.

Entry-Level Natural Resource Professionals

A total of 108 Warnell School of Forestry and Natural Resources recent graduates were invited to participate in the survey of entry-level natural resource professionals (Merry et al. 2007). Fifty-seven percent (n=62) chose to participate. Participants were asked what degree they completed before entering their current position. Sixty percent completed Bachelors of Science, 21% Masters of Forest Resource, and 19% Masters of Science degrees. The majority of respondents (49%) indicated that they worked in forestry. Nineteen percent were working in wildlife, 15% in “other” (ecology, land conservation, natural resource conservation, environmental economics, etc.), 8% in fisheries, 5% in hydrology, and 4% in soils or recreation. The majority of respondents (81%) had been in their current position for more than one year.

Almost half of the respondents indicated that they used GIS either every day or every other day. Twenty-three percent used GIS once a week and 34% used it once a month or never. Over half of respondents answered that they used ArcView (3.2-3.3) and ArcMap (ArcGIS 8+) GIS software, 59% and 57%, respectively. Nearly 30% of respondents answered that they used other commercial software packages than were offered in the survey. These packages included Google Earth, DeLorme, Landmark Systems, SoloField CE, Davey Resources, and Forestry GIS (fGIS).

Participants were given a list of processes and asked if they used them “very frequently”, “often”, “sometimes”, “rarely”, and “never.” Those processes that were identified by respondents as used very frequently included heads-up digitizing (14%), manual editing of attributes (12%), manual editing of spatial positions (11%), and querying of attribute tables (11%). Processes that were more moderately used included combining features (45%), erasing features (42%), spatial queries (44%), and splitting polygons (42%). Clipping, erasing, buffering, and merging processes were identified as rarely or never used by recent graduates.

Recent graduates participating in the survey were given a list of vector point databases, line databases, and polygon databases and were asked to indicate the frequency with which they were used. The most frequently used point databases included waters sources, culverts, and water diversions. Moderately used point databases included political point databases, home locations, recreation areas, and research plots. Rarely used vector point databases used by respondents were fire towers, fire ignition points, and water towers. The most commonly used line databases included roads and streams, 53% and 39%, respectively. Recreation trails and contour lines were the most rarely used line databases. Commonly used polygons included vegetation polygons, compartment boundaries, and ownership boundaries. Lakes, land classes, political boundaries, and wildlife management areas were used moderately by recent graduates. Congressional boundaries, visual quality areas, and land exchanges were rarely used by respondents.

Additionally, entry-level natural resource managers were given a set of raster databases and were asked to identify their frequency of use. Digital aerial photos were used frequently by almost half (46%) of respondents. Digital line graphs (DLG) were moderately used by nearly a quarter of

respondents and light detection and ranging (LiDAR) remote sensing and Digital Elevation Models (DEM) were rarely or never used.

Most commonly, respondents created basic stand location maps. Other commonly created maps and databases included clearcut harvest maps, planting maps, and thinning area maps. Other maps and databases created by respondents included conservation easements, invasive species distributions, soils maps, and wildlife location maps.

Finally, recent graduates were asked what types of GIS support they use. Twenty-five percent indicated that they relied on their GIS managers for support. Twenty-three percent took advantage of “help” topics accompanying their GIS software. Books and manuals were used by 17% for GIS support. Surprisingly, nearly 80% responded that they rarely used online support. GIS software packages such as ESRI’s ArcMap and ArcView provide extensive online support including discussion groups, help topic forums, and online tutorials. Perhaps respondents were unaware that online support exists and provides an extensive support resource.

Discussion

The first two surveys of Georgia’s land use planners and Agriculture and Natural Resource Extension professionals were successful in identifying drivers of land use change, pervasiveness of GIS, interest in geospatial technologies, and preferred methods of land use / land cover change projection dissemination. In addition, these surveys highlight the opportunity that exists for Extension professionals to develop training and outreach programs for educating the Georgia land use planning community on the value of incorporating land use / land cover change models into the planning process.

Surveying recent graduates provided insight into how entry-level natural resource professionals are using GIS. Instead of focusing on the educational system or an employer's assessment of employees, this survey focused on the end-user. Also, surveys such as this can help inform future curriculum decisions in forestry and natural resources departments. On the other hand, this survey did have limitations. Specifically, survey questions were focused on how respondents used GIS but not how they needed to use GIS. Also, responses did not provide insight on whether or not GIS users are actually using GIS efficiently since there can often be multiple paths to one solution in GIS. Finally, there was a small group of survey respondents working predominantly in forestry from one forestry and natural resources department at one university which may have skewed some of the results. Nevertheless, this survey had a simple design, making it transferable to other university’s forestry and natural resources departments.

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