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Dreux J. Watermelon
Wisconsin Department of Natural Resources, dreux.watermelon@wisconsin.gov

Elaine Andrews
University of Wisconsin- Extension, eandrews@wisc.edu

Suzanne Wade
University of Wisconsin- Extension, suzanne.wade@ces.uwex.edu

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Return to Current Issue

Extension Educators Can Use Internet GIS and Related Technologies

Dreux J. Watermolen
Chief, Science Information Services
Wisconsin Department of Natural Resources
Madison, Wisconsin
dreux.watermolen@wisconsin.gov

Elaine Andrews
Acting Director, Environmental Resources Center
University of Wisconsin-Extension
Madison, Wisconsin
eandrews@wisc.edu

Suzanne Wade
Rock River Basin Educator, Senior Lecturer
University of Wisconsin-Extension, Jefferson County
Jefferson, Wisconsin
suzanne.wade@ces.uwex.edu

Abstract: A variety of Internet GIS tools can support Extension's educational programming focused on land use planning and related issues. According to our Web-based survey, Extension educators have a high degree of interest in Internet GIS and related technologies, but limited exposure to or experience with these resources. Our experience suggests that workshops, supported with printed materials and Internet resources, appear effective in helping educators use these tools. Most educators have access to limited support services. Using these technologies requires a broad understanding of many different and disparate concepts, but many contemporary tools are designed to minimize this concern.

Introduction

Communities often call upon Extension educators to supply technical expertise in local planning and decision-making processes. As a result, Extension faculty are uniquely situated to play an important role in increasing public understanding of planning laws, the consequences and impacts of development, and alternative growth management approaches. Extension professionals may also facilitate community efforts to build consensus regarding land use solutions.

Internet and geographic information systems (GIS) technologies can help Extension educators make scientific data available, provide decision support functions, and enhance public participation for these local processes (Wisconsin DNR, 2004a). Milla, Lorenzo, and Brown (2005), however, describe how the rapid development of spatial technologies has created "many new tools for Extension professionals, but have also

widened the 'digital divide,' leaving many with little understanding of the technology and potential applications." These authors further observe that "to the uninitiated Extension specialist, the complexity and vast array of potential applications can be confusing and intimidating" and that "as a result of the relatively fast evolution of geospatial technologies, many professionals may either be unaware of their capabilities or may have an obsolete understanding of their potential and current implementation." These observations coupled with the phenomenal growth of the Internet (Horrigan, 2006; Netcraft, 2007) suggest a need to build competencies among Extension professionals to tap effectively into these technologies.

In Wisconsin, a unique partnership spearheaded by the Wisconsin Department of Natural Resources (Wisconsin DNR) and University of Wisconsin-Extension's Environmental Resources Center is working to address this "digital divide." We are implementing a training and technical assistance program for Wisconsin's Extension educators based on contemporary program planning approaches and a wealth of recent research on educational theory and adult learning. The program is based on a conceptual framework and learning outcomes that reflect what Extension participants learn (Wisconsin DNR, 2004b), the resulting changes from that learning, and the operational aspects of our program.

In this article we describe our approach to help Extension educators apply Internet GIS technologies in their educational programming and discuss lessons learned over the first years of our program.

Methods

In fall 2004, we conducted a Web-based survey of Wisconsin Extension educators to determine their interest in Internet GIS tools and assess their technical assistance needs (see Wisconsin DNR [2004c] for survey design and methods). The survey instrument included 26 questions related to Internet tools and their application. The results suggested that an approach focused on workshops supported with printed materials and Internet resources could be an effective means of building technical competencies within Wisconsin's Extension community.

Based on these results and our stated learning objectives, we developed a 2-day, hands-on workshop for UW-Extension educators, which we offered twice (February 2005, August 2005), after a pilot test with a small group of educators (November 2004). We publicized the workshop through previously established partner groups within the Extension network.

Scientists and engineers from a wide range of disciplines have developed a broad range of Internet-based tools to support various types of decisions. Based on earlier work conducted in Wisconsin (Lucero, 2003, 2004; Lucero, Watermolen, & Murrell, 2004), we selected training resources by applying specific criteria to the broad range of existing tools used for natural resources management and land use planning.

The tools included in our "tool box" met many, if not all, of the criteria listed in Tables 1 and 2. Criteria in Table 1 consider usefulness and accessibility (adapted from Lucero, 2003; Lucero, 2004; Lucero et al., 2004); those in Table 2 consider relevance to Wisconsin and natural resources management topics. Others may find these criteria helpful in considering how to increase the accessibility and usability of their tools.

Table 1.
What Makes a Tool Useful?

Characteristic	Explanation
Web-based	

	Accessible via the Internet; only required software or hardware is an Internet browser.
Cost-free	Housed within the public domain; no purchase cost. Our research indicates that tools that perform basic functions like data access, interactive mapping, and routine modeling increasingly will be made available in the public domain.
Data included	Data required for the tool to function is implicit to the tool. For example, all mapping tools contain spatial data sets that can be customized and displayed to illustrate local conditions. For modeling tools, only the most basic inputs are required. Thus, there is no cost to create unique scenarios when using the tools.
Scalable	Data are accessible at various spatial scales. Tool allows user to assess local conditions within a regional context.
Customizable	Users can address specific needs through features inherent in the tool or through "plug-in" components.
Relatively intuitive	Tools have a user-friendly interface. As users and tool developers increasingly rely on Internet-based services for their daily activities (e.g., travel arrangements, news sources, search engines, etc.), consistent, intuitive navigation features are becoming increasingly common.

Table 2.
What Makes a Tool Relevant?

Characteristic	**Explanation**
Has a natural resource component	Tools that address natural resource issues. Tools incorporating multiple issues—environmental features, social issues, economic development, etc.—may be the most useful tools.
Applicable for use in Wisconsin	The geographic scope of the tool includes part or all of Wisconsin, at minimum. Many tools capture national data sets and also can be applied elsewhere.
Useful for resource inventory	Cataloging and inventorying resources and environmental features is an essential step in the planning process. Tools that allow this enable decision makers and planners to address current issues and plan for future scenarios.
Can help fulfill requirements or meet regulations	Tools that help citizens and government accomplish their central roles, make informed decisions, or otherwise support government functions with regard to natural resource management and environmental protection.
Useful for developing or implementing natural	Tools that help municipal staff, elected officials, nonprofit groups, environmental educators, consultants,

resource programs or plans	and others prepare programs and plans to preserve or manage important environmental resources.
Connect natural resources and comprehensive planning	Tools that allow natural resource issues can be integrated within the context of various plan elements. Comprehensive planning defines a process and framework for considering how disparate issues fit together.

The workshop included direct instruction on specific tools for finding information, for creating maps, and for modeling decision impacts (Table 3). Learning outcomes for the session focused on identifying and using tools in the education and community planning work that Extension educators routinely undertake. The workshop agenda incorporated an introduction to GIS and related technologies, an overview of various federal government GIS activities, and resources for accessing Internet tools.

Table 3.
Tools Included in Workshops for Wisconsin's Extension Educators.

Internet Tools		
Tool	**Developer**	**Internet URL**
Window to My Environment	U.S. Environmental Protection Agency	http://www.epa.gov/enviro/wme/
ATRI Metadata Explorer	Wisconsin DNR	No longer available on the Internet
Comprehensive Planning Mapping Site	Wisconsin DNR	http://maps.wiatri.net/Landuse/
WISCLINC	Wisconsin State Cartographer's Office	http://www.sco.wisc.edu/wisclinc/
GeoSpatial One-stop	Federal Geographic Data Committee	http://gos2.geodata.gov/wps/portal/gos
EnviroMapper for Water	U.S. Environmental Protection Agency	http://www.epa.gov/waters/enviromapper/
Registry of Closed Remediation Sites and Brownfields Remediation &	Wisconsin DNR	http://dnr.wi.gov/org/aw/rr/gis/

Redevelopment Tracking System		
Digital Watershed	Michigan State University	http://www.iwr.msu.edu/dw/
Long-term Hydrologic Impact Assessment (L-THIA)	Purdue University	http://www.ecn.purdue.edu/runoff/lthianew/
Non-Internet Tools		
Tool	**Developer**	**Internet URL**
CommunityViz	Orton Family Foundation	http://www.communityviz.com/
What if?	What if?, Inc.	http://www.what-if-pss.com/
Place IT	University of Wisconsin Land Information & Computer Graphics Facility	Currently no Internet site available for this tool

Classroom instruction and hands-on experience focused on day-to-day applications of the tools, including various entertaining, but real-world techniques to help participants determine if they had mastered each new skill. Because Extension's primary focus is on education, we also placed an emphasis on educators developing technology transfer skills (i.e., an ability to convey information about the tools to others). Participants received a booklet with instructional worksheets and guided activities for each tool, and we distributed a CD with all handouts and presentations to all workshop participants following the workshop.

At the beginning of each workshop and prior to any instruction, we administered a short questionnaire to assess participants' current use of the tools, future interest in using the tools, and previous GIS experience. We wanted to confirm our earlier assessment work and have a basis for determining, at a future time, if the workshop changed participants' use of the Internet GIS tools.

At the conclusion of each workshop, participants completed evaluation forms, the results of which we tallied. To more fully assess the effectiveness of the workshops and find out how the Internet tools were being used, we also asked an independent researcher to interview workshop participants 10 to 11 months following the actual workshops (January 2006, June 2006). She interviewed all participants for 30 to 55 minutes and asked questions related to the educators' use of the tools, technology transfer to others, and use of available resources, such as Web sites.

Results and Discussion

A report by Wisconsin DNR (2004c) documented the results of the Web-based survey and detailed implications for our program. Here, we summarize the most relevant findings from that effort.

We asked educators to rank, based on the anticipated needs of their county, how important they felt various program emphases were (e.g., developing public participation plans, designing community planning processes, collecting GIS or other data, monitoring and evaluating plan effects, etc.). Most educators (>80%) considered "assessing the impacts of options using decision-support tools" to be important to very important. They also considered "using GIS data to help groups make decisions" and "proposing alternative future community scenarios" to be somewhat important to important. In contrast to this finding, many educators (> 70%) felt collecting and analyzing GIS data were among their least important program emphases. This may be because Extension educators rely on others (government employees or consultants) to do that job, or it could be due to the "digital divide" phenomenon.

The Web survey results support earlier findings related to the accessibility and usability of Internet GIS tools (Lucero 2003; Lucero, et al., 2004), which indicate that the most useful modeling tools have the necessary databases imbedded within the tool structure (i.e., users do not have to independently obtain data needed to use the tools effectively) and have intuitive interfaces that make the underlying GIS functions transparent to the user.

In a related finding, 50% of surveyed educators felt they were either "not too experienced" or had no experience with Internet GIS tools. Nonetheless, a community of users exists within many county offices.

- 55% of respondents indicated others in their office regularly use these tools.

- 66% replied that they have access to needed technical support.

In addition, educators expressed interest in the tools: 57% indicated being "very interested" in learning more about the tools.

We also asked educators what formats both they and their audiences prefer for receiving training and technical assistance related to the tools. Survey results suggested that workshops supported by Web modules and printed materials would be the most effective means of reaching Extension educators. The results also suggested that printed materials and workshops supported by online resources would be the most effective approaches for helping Extension educators meet the needs of their audiences. Finally, survey responses suggested educators would like statewide specialists to conduct workshops, both for Extension agents and their local audiences.

Consistent with these Web survey results, tallies from our pre-workshop questionnaire highlight a discrepancy in action versus attitude.

- 52% indicated they used the tools occasionally, but 43% indicated they rarely or never use these types of tools in their work.

- 39% indicated they felt these tools were essential to their work, and another 61% indicated the tools were somewhat important.

Prior to the workshop, none of the participants felt that they were highly proficient with GIS, and only 11% indicated they were somewhat proficient. On the other hand, 68% reported having some exposure, but 21% indicated having no GIS experience at all. Interestingly, this measure illuminated the increasing transparency of GIS; i.e., many participants who have used applications that rely on GIS are unaware of the underlying technology.

The immediate feedback provided on the post-workshop evaluations suggested the training sessions were relatively effective in building knowledge and skills.

- 91% indicated that they "understand how the tools can be used for planning, conservation, and environmental protection."
- 73% indicated that "the tools can enhance the work that I do."
- 80% felt the tools could enhance the work of others they interact with.

Similar positive responses were provided when participants were asked about specific individual tools.

- 91% stated "I understand what it does."
- 77% felt they could use it on their own.
- 59% stated "I could use it in my work."
- 59% indicated "I could show others how to use it."
- 51% stated "I plan to use it in the future."

Results form the follow-up interviews support the workshop evaluation findings.

- 72% of the educators used at least one tool following the workshop, but none of the educators used all nine tools. (Average number of tools used was 1.9)
- Each tool was used at least once by at least one educator, but the frequency of use was low.
- All but one educator expected they might use the tools at a future time.

The primary reason educators cited for not using tools was a lack of a specific opportunity or need for using the tools in their jobs since the workshop.

Following the workshops, 78% of educators had made someone else aware of the tools, and 11% organized or sponsored workshops focused on the tools. One educator used Web-based tools in high school classrooms to identify and map urban development and its contribution to storm water runoff (see Welch, 2005). Generally, however, the participants did not consider teaching about Internet GIS tools to be part of their job responsibilities. Rather, they indicated a preference for having a "computer expert" either do the teaching or at least support them in their efforts.

We hoped to identify specific decision outcomes and environmental results from use of the tools. We found

this was not always possible, partly because the educators do not always know what comes out of their provision of information, sharing of tools, presentation of maps, etc. At the time of the interviews, most of the educators had not yet applied the tools to any conservation or land use decisions being made.

Two educators, however, did say their use of the computer tools influenced a decision. One indicated that using EnviroMapper for Water and Digital Watershed resulted in refocusing a community group's efforts on a lake's riparian area rather than at the watershed boundaries. The other used the Registry for Closed Remediation Sites to discover a former dumpsite near a house being considered for purchase, a factor that ultimately influenced the selection of a different location.

Lessons Learned

Assisting local governments and community groups in making informed decisions remains a common role for Extension educators, and the application of GIS data in local decision-making processes continues to increase. Thus, our experiences can inform Extension programming.

We identified a variety of available Internet tools that can assist Extension educators in carrying out educational programming focused on comprehensive planning and related land use issues <http://dnr.wi.gov/org/es/science/landuse/CompTools/>. Workshops, supported with printed materials and Internet resources, appear effective in helping Extension educators use these tools.

Similar to High & Jacobson (2005), we found the Internet has become "an important addition to the natural resource learning community." We confirmed that these educators liked making scientific data accessible and having an increased awareness of available tools for their conservation and planning work. Given their lack of confidence in using GIS, however, it is unlikely that Extension educators would explore many Internet GIS tools in the absence of workshops like ours.

Therefore, a need remains for continuing professional development opportunities focused on these resources and their applicability to Extension programming. Also, because Extension educators did not consider teaching about Internet tools to be part of their Extension job responsibilities, educators will need to rely on other sources of expertise for training community groups to use the tools to access information and planning resources. Perhaps as important, Extension educators could also use additional experience in how to use maps and data most effectively in an outreach scenario.

Our experience illuminates the importance of increasing the visibility of the data and processes that allow the creation of GIS images. Many participants who use applications that rely on GIS remain unaware of the underlying technology. Milla et al. (2005) caution that using these technologies effectively "requires a broad understanding of many different concepts, including map projections and coordinate systems, data types and formats, computer literacy, and proper documentation of data." Our experience, however, suggests that when tool developers consider these types of issues (Table 1) during design and development, their efforts result in more user-friendly tools that require less of this technical knowledge to operate effectively. Our earlier needs assessment demonstrated that users more readily embraced such tools (Lucero 2003, 2004).

Carefully documented case studies would allow identification of decision outcomes or environmental results resulting from the use of specific tools. Extension educators might wish to document such results to show the value of their educational efforts.

Unfortunately, participants did not perceive many post-workshop opportunities to use the Internet tools in their jobs prior to our interviews. Among the obstacles to increased use were perceived difficulty in accessing the tools, in remembering the tools, and in applying the tools. Some clear requests and

recommendations came out of our surveys and follow up interviews, and we offer these here for others seeking to increase Extension's ability to use these tools.

- Create an easier path to access the tools through a single website. A portal could list each computer tool with a short description of what to use it for and how to use it, along with a link. (e.g., <http://dnr.wi.gov/org/es/science/landuse/CompTools/internet.htm>).

- Emphasize "hands-on" aspects in training sessions. Although they generally felt okay about their ability to use computer technology, educators said they needed more practice using the specific tools so that they would remember which tools they could use and how they could use them. Learning to use a new tool remains difficult when one is in a time crunch of necessity; it simply is easier to fall back on familiar methods, like asking someone else for needed information.

- Include a limited number of tools in training sessions. This reduces the overwhelming aspect of workshops, allows adequate time for hands-on "practice," and increases the likelihood of post-workshop use.

- Plan training in modules focused on tools for specific purposes. Adults generally like to learn what will help them perform tasks or deal with problems they confront in everyday situations (Knowles, Swanson, & Holton, 2005; Caffarella, 2002). Therefore, to strengthen the application aspect of the workshop, participants could work on sample real-life problems. For example, a workshop could be designed around a specific land use planning project so that tools are introduced as they are needed to gather and present information for the project.

- Include case studies that illustrate the tools being used. Using case studies can result in better recall, retention, and use of learning following the training (McKeachie, 2002).

A number of participants requested post-workshop follow-up. One recurring suggestion focused on periodic electronic newsletters that would remind participants about the tools, update them on new data and tool developments, inform them about related resources, describe examples of uses of the tools, and provide direct links to the tools. This follow-up might increase use of the tools simply by reminding recipients that the tools exist as well as providing models of their application. We have begun implementing this idea.

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