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National “e-Extension” Programs: Feasibility and Structure

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National “e-Extension” Programs: Feasibility and Structure

Background

The National Association of State and Land-Grant Colleges (NASULGC) awarded the W.K. Kellogg Foundation \$1.2 million in 1996 to assist NASULGC in defining the direction of public universities in the 21st century. The Kellogg Commission on the Future of State and Land-Grant Universities produced six reports and an executive summary that replaces the traditional roles of research, education, and extension with much broader categories of learning, discovery, and engagement. These reports and public discussions of the recommendations are available at NASULGC’s website (<http://www.nasulgc.org/Kellogg/kellogg.htm>).

Public universities and their support organizations reacted positively to the reports with new initiatives. Regarding engagement, the Extension Committee on Organization and Policy (ECOP) responded to the Kellogg Commission’s third report (1999), “Returning to Our Roots: The Engaged Institution”, by creating the Extension Vision for the 21st Century Committee and charging them to formulate a vision and action plan. In February 2002, the committee released its report, “*The Extension System: A Vision for the 21st Century*” (http://www.nasulgc.org/publications/Agriculture/Ext_Sys_Vision.pdf). The “e-Extension Initiative” (<http://asred.msstate.edu/national/>) is an outgrowth of this report. Members of the “e-Extension Initiative” released a draft report, “*e-Extension: Synthesis of a National Extension Initiative*,” in January 2003 (<http://asred.msstate.edu/national/synthesis.doc>) describing a “...national web-based information and education network for current and new Extension clientele.” The authors identified critical components of an “e-Extension” such as easy and seamless access to unbiased, localized and research-based information and education, responsiveness to clients’ needs, local and state identity, and branding; benefits to agents, specialists, and the public; measures of success; priority areas, and possible management systems. Noticeably absent from the draft document were discussions of past, current, and proposed e-Extension programs and explicit details by program area. To facilitate the planning and implementation of this web-based information and education network that allows our constituents to tap into the public universities’ research and expertise for “just-in-time” learning, we identify and review several innovative University of Illinois agriculture and natural resource e-Extension programs. As part of this review, we describe each program’s focus, current activities, and strengths and weaknesses. Using this review, we make recommendations for shaping the development of the national e-Extension program.

Innovative Illinois Agriculture and Natural Resource Programs

The latest iterations of e-Extension agriculture and natural resource programs at the University of Illinois share a common objective and framework. The objective is improvement in the well-being of human and natural communities. This objective complements the words of the Kellogg Commission where they state that, “...it is the fundamental, inescapable obligation of public higher education to ...engage directly with society and its problems—all in the service of advancing the common good” (Kellogg Commission on the Future of State and Land-Grant Universities, 2000; page 6). This objective focuses the talents and expertise of university researchers and specialists on their constituents’ problems and finding solutions that balance the competing needs of individuals, communities, states, and nations within healthy, functioning ecosystems.

Given this objective, we find it useful to categorize programs in terms of three development phases. A phase 1 program consists of fact sheets, publications, work sheets, videos and other educational materials regularly produced and distributed by the University in paper and electronic format that contribute to the building of a constituent's knowledge base. Constituents may also interact with research and extension staff using the phone, fax, or e-mail, visiting state and county offices, or attending workshops and other programs. Except when a constituent is part of a university project or a case study, the University remains a step removed from the decision process.

A phase 2 program incorporates decision support tools that comprise part of a structured decision support system. A second important feature of a phase 2 program is funding from the constituents' groups, foundations, and the public. The support tools contribute directly to the constituent's decision process through the identification of alternatives and likely consequences based on the best available science and data at that moment in time. A decision support system consists of "*...a suite of computer programs with components consisting of databases, simulation models, decision models, and user interfaces that assist a decision maker in evaluating the economic and environmental impacts of competing watershed management alternatives*" (National Research Council 1999, page 20). A geographic information system (GIS) plays a critical role within the framework for four reasons: (1) the spatial impacts of almost all of the decisions, (2) the software's storage, mapping, analysis, and visualization capabilities for multiple scenarios, (3) the software's flexibility in adding modular decision tools, (4) the cross-disciplinary attributes of GIS, and (5) a continually improving user-friendly web-based interface.

A phase 3 program closes the loop and includes active participation of the end-user who provides data to improve not only his/her decisions given the available science but also allows use of proprietary data for new research. The importance of these phases will become clearer in the program reviews that follow.

Watershed Management Program

In response to the public's demand for more local control, federal natural resource and environmental agencies gradually switched from a command and control framework to locally led watershed management during the late nineties. The University of Illinois as well as many of the other land grant institutions established programs to assist local groups in managing their watersheds. Private organizations also host watershed websites that rival the university sites. The easiest way to find these sites is to run a "Google" search using the word watershed.

The recently revised Illinois Watershed Management Clearinghouse, (<http://www.watershed.uiuc.edu/index.cfm>) shown in Figure 1, exhibits many of the elements of a phase 1 program. The site focuses on watershed problems and presents the available information to the individuals and groups interested in watershed management at a central location in a user-friendly format. Branding is evident as is cooperation among the University, Illinois Environmental Protection Agency, Illinois Department of Natural Resources, and members of the Illinois Council on Food and Agricultural Research. The flexible, consistent navigation system combined with the site's search tool provides many avenues for users to access the information and materials at the site. Other important elements of a phase 1 program

Figure 1. Illinois Watershed Management Clearinghouse



include a calendar, new content or information section, an ability to interact with experts, and a discussion group component. Behind the scenes, University staff dynamically generate new information and materials through the use of web content management software.

The links to mapping tools located in the center column represent the beginning of a decision support system, a key element of a phase 2 program. Users of the mapping tool have access to most of the freely available natural resource, administrative, and demographic GIS datasets. Though not as full-featured as a desktop GIS system, users can view their watersheds, create maps, measure distances, identify features, buffer points, lines and polygons, and conduct simple analyses such as unions and intersections of attributes associated with the various data layers. We review mapping tools more extensively in the next two examples.

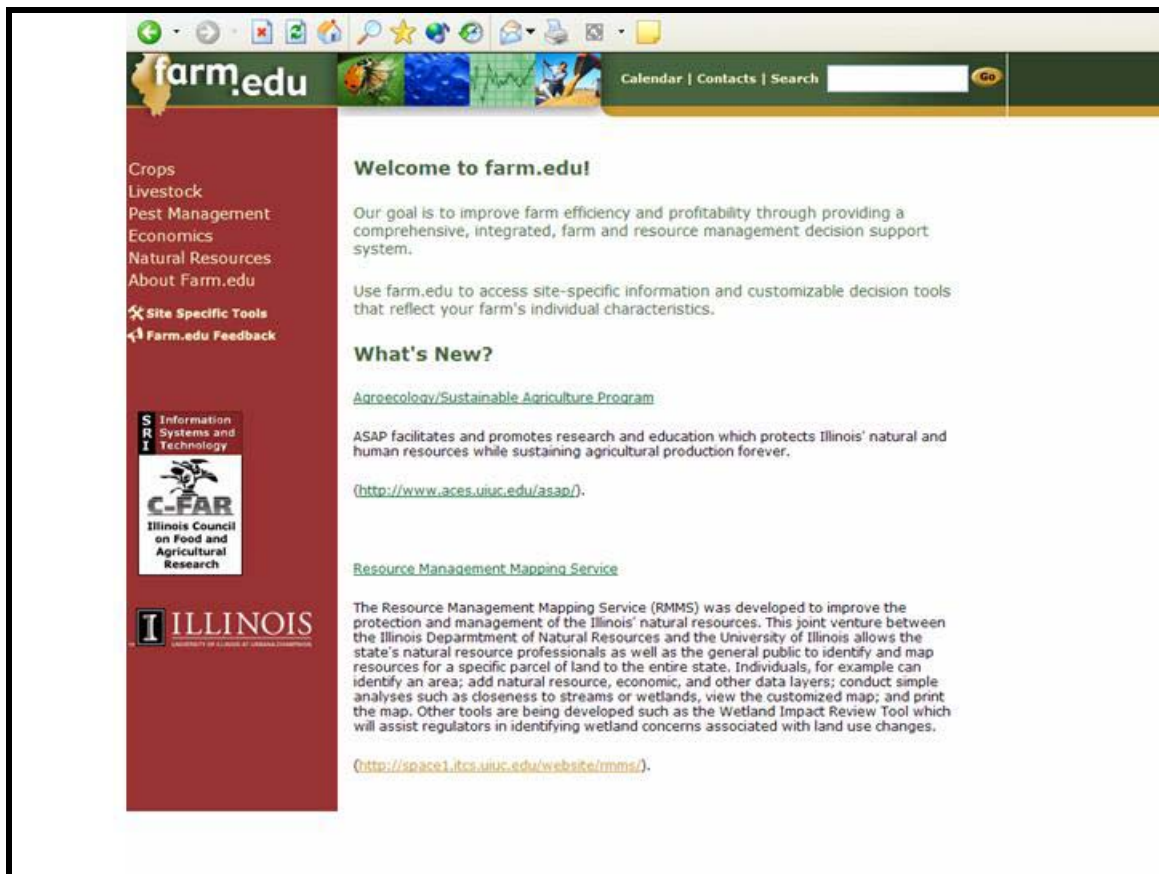
As mentioned above, partnerships form an important component of a phase 2 program. The University, the Illinois Department of Natural Resources, and the Illinois Environmental Protection Agency contributed funds for two new educator positions in watershed management. These positions contribute to a consistent statewide approach as already demonstrated by the e-watershed management program and the ability to respond to requests such as training workshops or crises that require face-to-face interaction.

Aside from occasional instances, the Illinois Watershed Management Program has not progressed to Phase 3. Several watershed groups have posted their watershed management plans at the site. In addition, the program's managers receive occasional offers of GIS data layers from other agencies and groups to add data to the mapping tool. An online data entry system is proposed for 2004, though it is contingent upon new funding.

Agricultural and Natural Resource Management Program

The objective of the Agricultural and Natural Resource Management Program is the adoption of profitable, resource conserving farming systems and practices. The audience consists of producers, farm managers, and professionals who serve the agricultural sector. The public face of the program is Farm.edu located at <http://www.farm.uiuc.edu/> and shown in Figure 2.

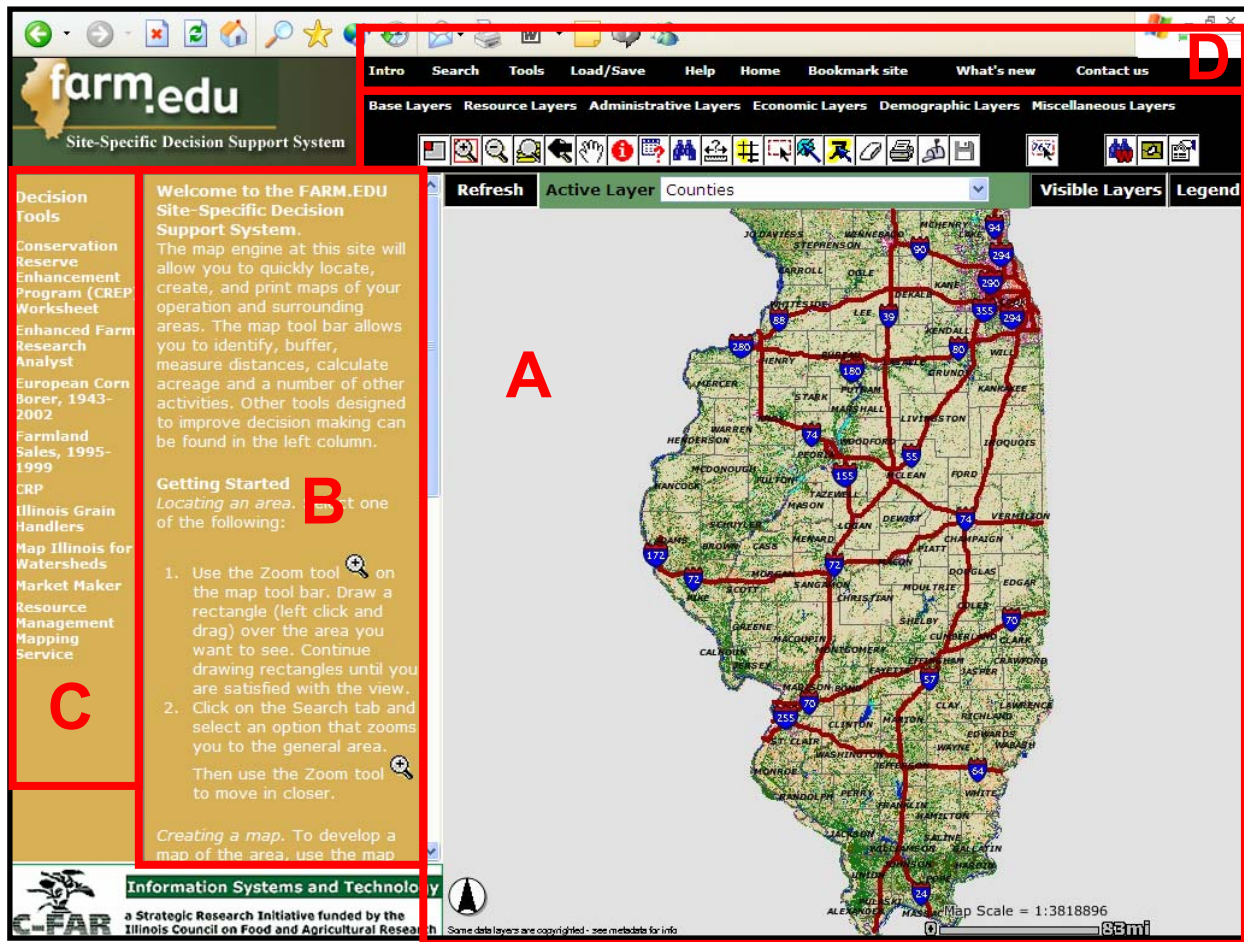
Figure 2. Farm.edu



Regarding Phase 2, farm.edu's online decision support system is taking shape. The "Site Specific Tools" button transfers you to the program's evolving decision support system (<http://space1.itsc.uiuc.edu/website/farmedu/>) shown in Figure 3. The site shown in Figure 3 consists of four areas: data (A), information (B), decision tools (C), and a catchall for other important activities (D). Areas A and B are self explanatory. The information area displays text and options associated with the other tabs and tools. Here, the text associated with the "Intro" tab (in area D) is displayed. Area D consists of important activities that complement the overall site.

The “Load/Save” tab, for example, allows users to save locations and layers viewed in the interactive session and reload both later to resume work in progress.

Figure 3. Homepage of Farm.edu: Site-specific Decision Support System

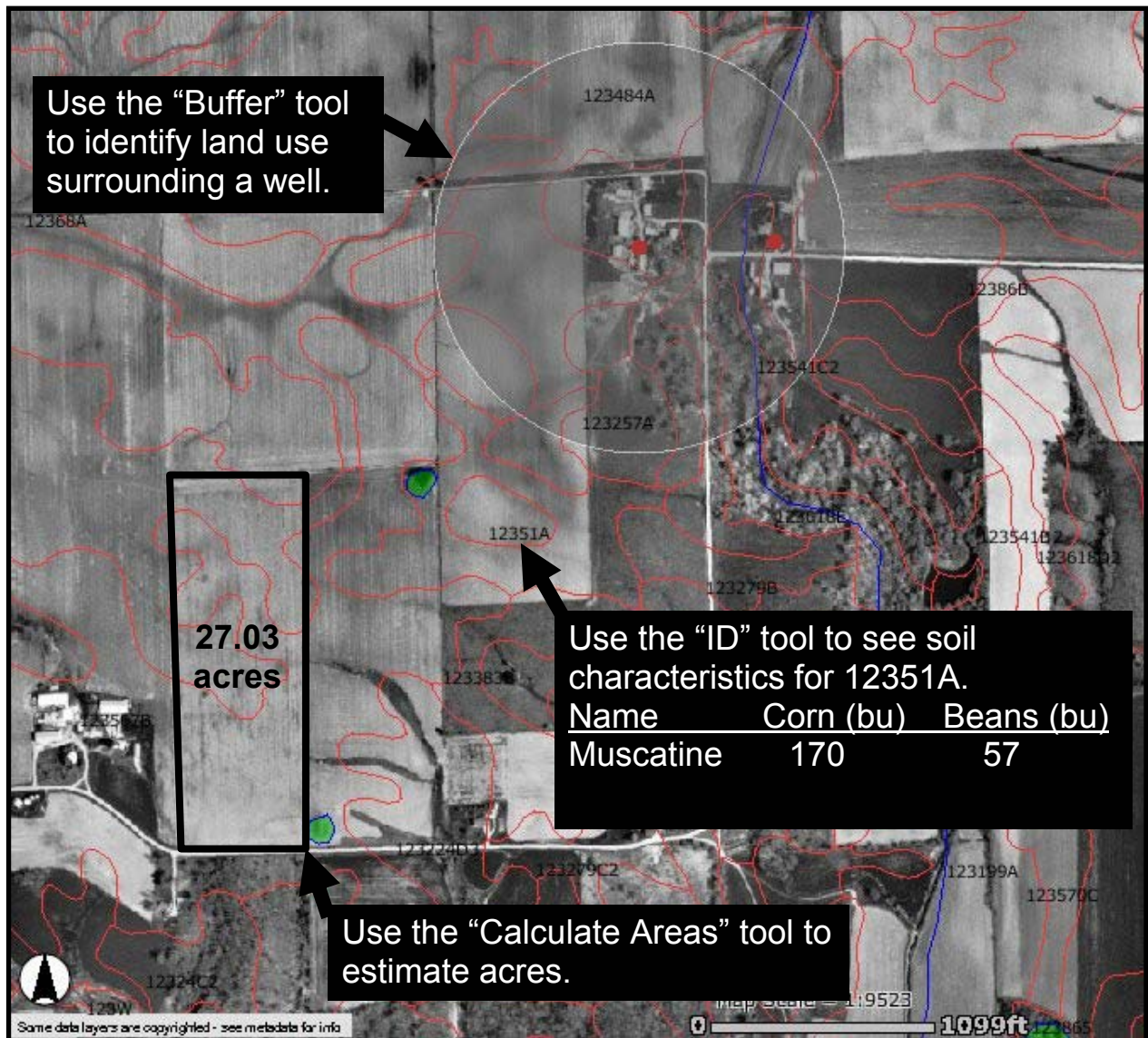


The data section, labeled “A,” forms the base of the site’s decision system. Users have instantaneous access to several dozen natural resources, economic, and administrative layers of data via the site’s mapping tool. In a few clicks, a producer can zoom to a field or farm and learn about that site’s characteristics such as land use, soils, and topography as well as characteristics of the surrounding area. Using the ID tool which is located in the icon bar (red dot with the letter “i”) directly above the map pane, a producer can click anywhere on the map and generate a table that gives the major attributes of the visible data layers. The ID tool, for example was used to identify soil 12351A in Figure 4 as Muscatine Silt Loam and its expected corn and soybean yields. Currently, digitized soils information is available for 14 counties in Illinois at this site.

Other map tools in the tool bar (see Figure 3) support basic decision making. The “Buffer” tool (tic-tac-toe icon) is useful for establishing buffers around features such as streams and roads (lines on a map), wells (points), or wetlands and lakes (polygons). In Figure 4, for example, we created a 1000-foot buffer around a private well to identify land use and possible contamination sources if the well’s recharge area falls within the circle. The “Area calculate” tool (dashed rectangle containing numbers) is another extremely useful tool that improves the

efficiency of decision-making. The tool was used to estimate the acreage of the field outlined in Figure 4. The “E-mail map” tool allows users to send maps instantaneously to contractors or to

Figure 4. Farm.edu’s Mapping Service: Map of an Area in Marshall County, Illinois



agencies such as the Natural Resources Conservation Service to learn possibly about a field’s eligibility for one or more conservation programs. Finally, the “Load/Save” tab shown in area D of Figure 1 can be used to save map views for later use. Regular visitors of the site use this feature to save their views of individual fields and other areas.

The area labeled “C” in Figure 3 contains problem-specific decision tools under development by faculty and staff in response to stated needs of the agricultural sector. Tool-specific instructions and choices appear in area B. For example, the group led by Dr. Bruce Sherrick (Agricultural and Consumer Economics) developed the “Farmland Sales, 1995-1999” tool which returns land sales by township. The information for Allen Township in LaSalle

County is shown in Table 1. Users have the option to zoom to the township to view the area. The next revision of the tool will overlay the actual sales on a map. Users have also suggested a

Table 1. Farmland Sales for Allen Township, LaSalle County, 1995-1999

Farmland Sales 1995-1999(pt)							
Zoom to townships							
Rec	Year Sold	Acres Sold	Assessment-Land	Assessment-Building	Assessment-Total	Land Price	Township Name
<u>1</u>	1999	78	20050	0	20050	69271	ALLEN
<u>2</u>	1998	38	7719	0	7719	52600	ALLEN
<u>3</u>	1997	10	2943	17537	20480	136000	ALLEN
<u>4</u>	1996	40	4260	0	4260	70000	ALLEN
<u>5</u>	1996	174	35475	0	35475	299327	ALLEN
<u>6</u>	1995	260	29372	15194	44566	481000	ALLEN
<u>7</u>	1995	93	9423	600	10023	155000	ALLEN

search tool that allows them to identify and map land sales within a specified area of a point or field. Both suggestions bring the tool more in line with constituents' needs.

The group led by Dr. Kevin Steffey (Crop Sciences) directed the development of the European Corn borer, 1943-2002" tool which returns borer counts per 100 plants by county. The data comes from the University's insect monitoring program. Other options allow users to select a subset of years, generate summaries by crop reporting district or statewide, and create thematic county maps of pest intensity. Substantially more data interactions are provided with the corn borer tool than the farmland sales tool primarily because it was developed after the sales tool. The next revision will likely tie the relevance of the monitoring data to fields identified by producers, thus directly helping them with their insecticide decisions.

The last tool, "Conservation Reserve Enhancement Program (CREP) Worksheet," helps landowners decide between land retirement and crop production. Though the CREP tool only works in Marshall County, it captures the framework of an automated decision system. A producer zooms to the parcel of land under consideration, activates the CREP tool, and outlines the parcel. Second, the tool returns information on the parcel's offered annual rental rate. Annual rental rates by soil type for the field outlined in Figure 4 are shown in Table 2. Currently, a

Table 2. Data Generated by the CREP Tool: Federal Portion of Illinois CREP Program

Soil Map Unit	Soil Name	Acres	Base rental rate/acre
567B	ELKHART SILT LOAM, 2 TO 5 PERCENT SLOPES	17.42	110
484A	HARCO SILT LOAM, 0 TO 2 PERCENT SLOPES	09.61	131
Total acres in parcel		27.03	
Eligible CREP acres			

producer can download a fact sheet that describes CREP and a worksheet that allows the producer to compare returns from crop production versus land retirement. The option exists for a producer to send an e-mail (the mailbox icon in the map tool bar) to the county NRCS office for further assistance. The next generation conservation program tool will likely focus on the Conservation Reserve Program because CREP achieved its acreage enrollment goal.

Two lessons became apparent during the development of this first set of decision tools. First, researchers who have not been associated with GIS require additional time to learn how it can be used effectively within and across disciplines. Second, decision support tools go through several iterations, initially satisfying the needs of researchers followed then by the needs of end users.

To date, very little phase 3 activity is occurring in this program. Several commercially funded data management efforts failed recently due to lack of participation by farmers.

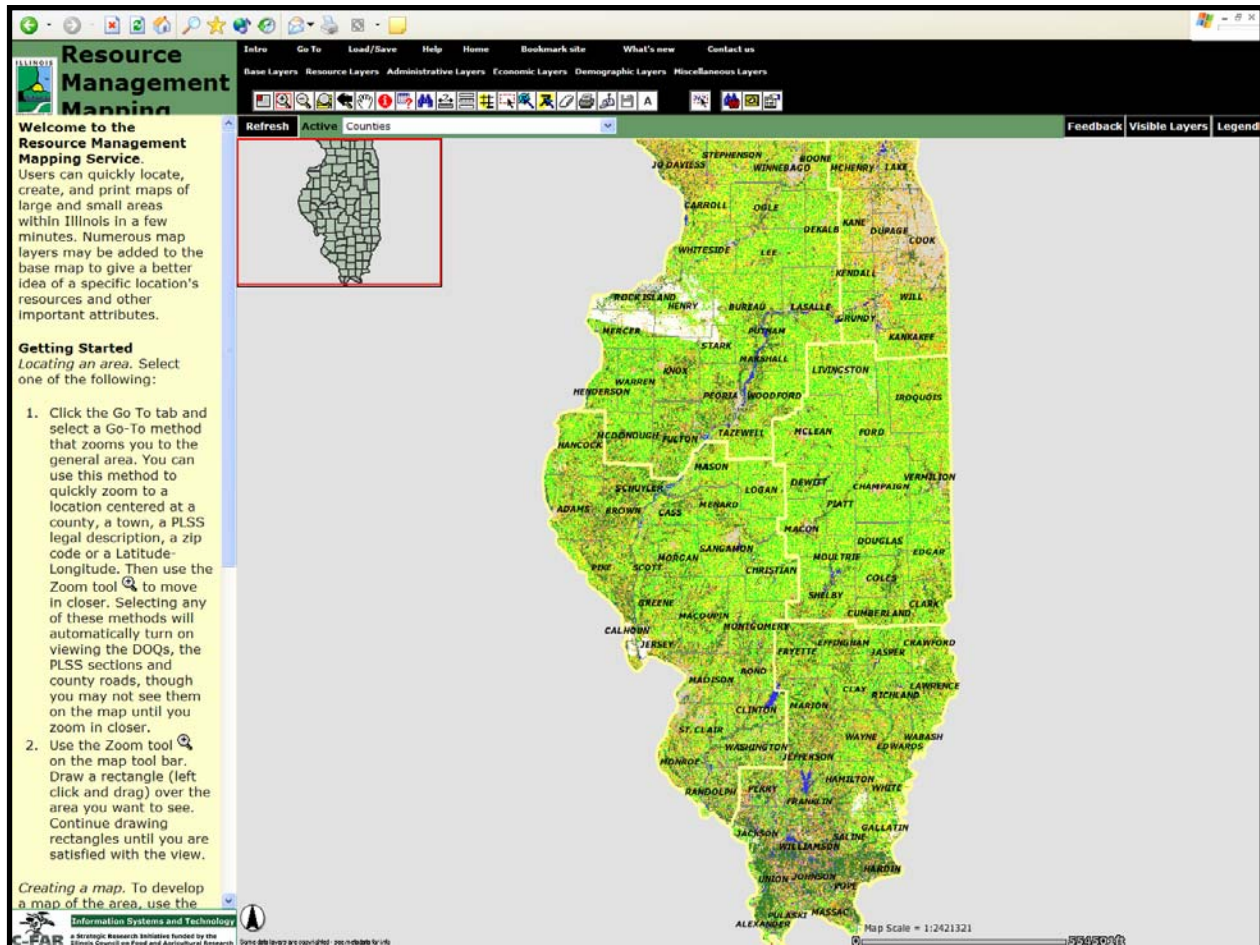
Management of Public Resources Program

The Kellogg Commission on the Future of State and Land-Grant Universities (1999) identified seven characteristics that define an engaged institution: timely responsiveness to our constituents' needs, respect for partners, academic neutrality, accessibility, integration of institutional scholarship with service, coordination of service activities within the institution and among partners, and resource partnerships. The Management of Public Resources Program comes closest to satisfying these characteristics largely because the ongoing activities fall into phases 2 and 3.

The objective of the Management of Public Resources Program is improved management of the natural resource bases in Illinois. The program's audience consists of state and federal natural resource managers, regulators and policy makers. In support of the program's objective, personnel from the University and the Illinois Department of Natural Resources (IDNR) are developing a natural resource decision support system. Similar to farm.edu, the Resource Management Mapping Service (<http://space1.its.uiuc.edu/website/rmms/>), currently exists as a separate link from IDNR's homepage (<http://dnr.state.il.us/>). As shown in Figure 5, the system's design looks similar to farm.edu. Furthermore, the basic system does double duty by serving as the mapping tool for the Illinois Watershed Management Clearinghouse. Given the similarity of the farm.edu and RMMS mapping tools, we will move directly to other phase 2 and phase 3 project activities.

To protect the state and the nation's water, wetlands and other natural resources, IDNR and other agencies use a costly, time-consuming permit process. Landowners, developers and others must file a permit that documents their projects, and then the agencies examine the projects and determine if they create problems with respect to wetlands, cultural resources, endangered species and a host of other natural resources. The Wetland Impact Review Tool (WIRT) partially automates this labor-intensive process.

Figure 5. The Resource Management Mapping Service

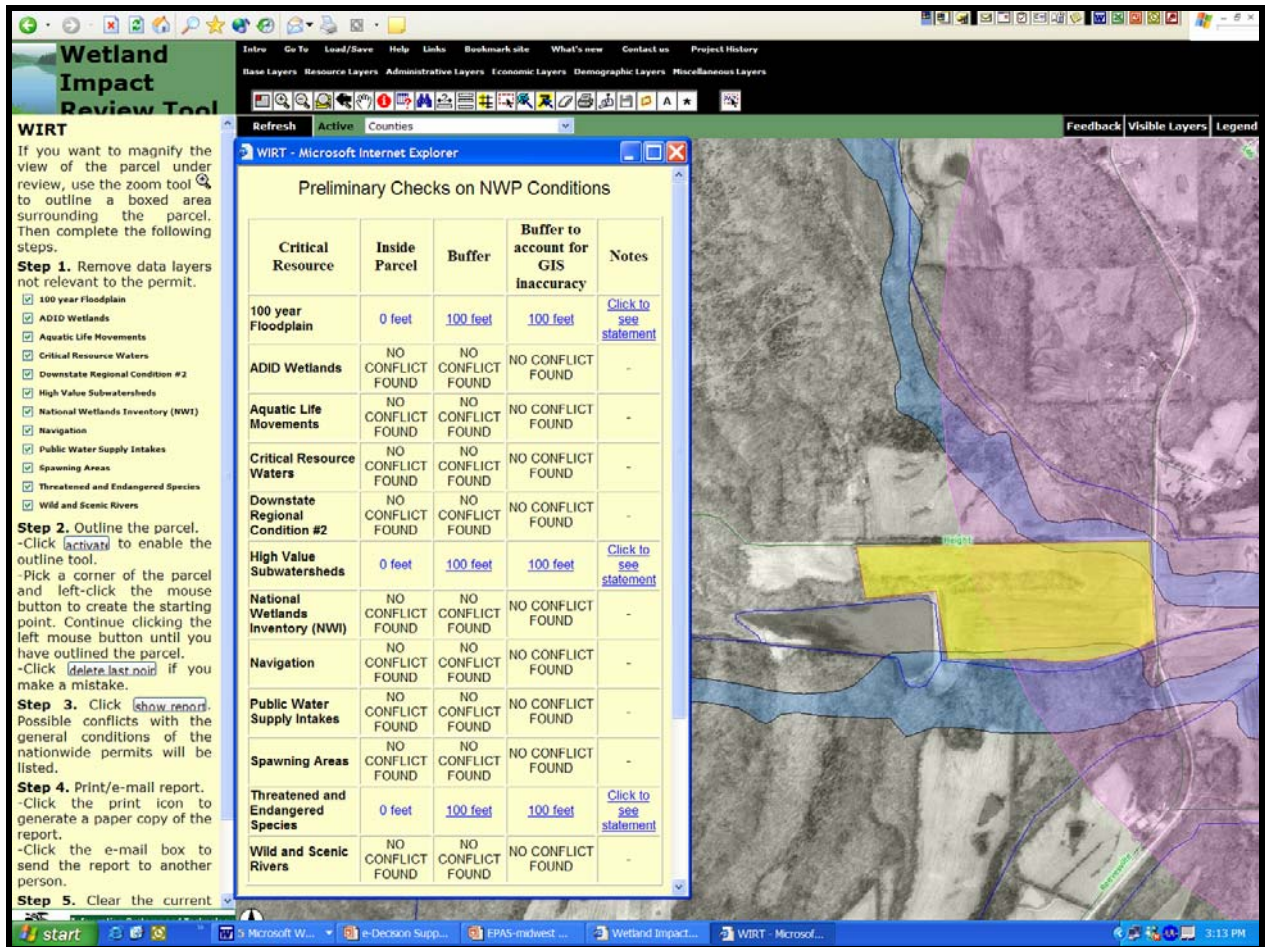


Authorized users of WIRT enter the legal description given in the permit into a custom-made search tool that zooms them to the PLSS section where the project is proposed. The user finds and outlines the project's area online and then clicks on the WIRT icon. In a few seconds, the user receives a report of possible conflicts for 12 conditions stated in the nationwide permit program as shown in Figure 6. Users may use the print function to obtain a printed copy of the assessment for filing, e-mail the results to people coordinating the agency's review or conduct other analyses.

Another important element of the Management of Public Resources Program and Phase 3 activity is the Illinois Conservation Practices Tracking System. IDNR, the U.S. Farm Services Agency and the University of Illinois Extension agreed to identify and digitize conservation practices applied to the land under the various state and federal conservation programs. In 2003 and 2004, an online digitizing and data entry tool may be available for county staff to enter new practices as they are applied. This enhancement requires additional funding.

Finally, this program area's activities have generated new data and research among the partners. In a series of publications, Drs. Yang, Khanna, Onal and Farnsworth (2000, 2003a, 2003b) assessed the likely sediment, cost, and acreage impacts of a buffer program similar

Figure 6. The Wetland Impact Review Tool



to the Illinois CREP program. In their latest study, they compare the cost, acreage, and sediment impacts of actual enrollments against their model's results. These analyses contributed to easier enrollment of sloping cropland near streams.

Summary and Recommendations

The massive downsizing and total reorganization of Extension in Illinois and new requests for natural resource assistance from the state's citizens and resource agencies beginning in the mid-nineties forced us to migrate to what is now being called e-Extension. The move proved to be extremely beneficial for the three programs reviewed above and summarized in Table 3. The move allowed us to forge new two-way partnerships, serve new clients, tap previously unavailable external funds and satisfy increasing demands for service with fewer staff.

Table 3. Summary of Reviewed Agricultural and Natural Resource Programs

Integrated Watershed Management Program	
Category	Description
Audience	Citizen groups, watershed consultants, resource managers
Goal	Assist clients in writing, implementing and revising watershed plans.
Portal	http://web.aces.uiuc.edu/watershed/ ; 1998
Progress	Phase 1: Information and education materials, interactive map engine, meetings, workshops, and participation in watershed management efforts. Beginning in 2003, new and revised information and education materials, a directory of watershed management committees, help, and list-serve. Phase 2: On-line planning tool in 2003-04. Erosion calculation and sediment transport tools for subwatersheds in 2004. Phase 3: On-line user entry of watershed data in 2004. Ph.D. and M.S. work.
Agricultural and Natural Resource Management Program	
Category	Description
Audience	Producers, farm managers and consultants
Goal	Adoption of profitable, resource conserving farming systems.
Portal	http://www.farm.uiuc.edu/ ; 2002
Progress	Phase 1: Continual updating and addition of information and education materials, interactive map engine; meetings, workshops, and participation in farm management efforts. Phase 2: Several generic decision tools already available. Field erosion calculation tool, CRP tool, crop insurance calculator available in late 2003. Phase 3: Farmer entry of production data in 2003-04; Ph.D. and M.S. work.
Management of Public Resources Program	
Category	Description
Audience	State and Federal natural resource managers, regulators and policy makers.
Goal	Improved management of the natural resource bases in Illinois.
Portal	http://space1.ites.uiuc.edu/website/rmms/ (staff only portal also available); 2001.
Progress	Phase 1: Interactive map engine; meetings and workshops; linkages to information and education programs of Illinois agencies. Phase 2: Prototype, password protected wetland impact tool available in 2003. Phase 3: Development of statewide conservation practices data in 2002-07; on-line data entry by agencies in 2003; assessment of CREP; Ph.D. and M.S. work.

We also learned some lessons that relate directly to the new national e-extension initiative. Based on our experiences, we make several recommendations to facilitate the development of e-Extension national agriculture and natural resource programs as well as other programs in other areas.

First, tailor programs to answer your clients' needs. Discipline-centric programs do not serve constituents as efficiently as programs that consolidate the relevant physical, biological, economic, and information in one location. You also need to add value to standard information and education programs through active engagement in a clients' decision-making. As an example of what we mean, consider GIS. Our initial efforts of making GIS data layers available to the public did not generate much interest among our constituents. GIS only became useful when we embedded it in our programs in a supporting decision making role.

Second, develop and populate the site with user-friendly, science-based decision tools supported by default data and automated models. Our constituents have embraced the revolution in information technology and expect "state-of-the-art" programs that help them make decisions quickly and efficiently. Fill-in-the-blank worksheets, the backbone of most currently available online programs, are no longer sufficient. As stated by one user, "That's so last century." Today's users expect answers in three to four mouse clicks with links to the science that supports the answers.

Third, restructure the academic reward system to value interdisciplinary discovery and engagement. A reward system driven by a "publish or perish" mentality leaves little time for improving the public good, the end result being significant research advancements locked in dust covered publications sitting on bookshelves.

Fourth, adopt a decentralized, team management approach and use the web for seamless integration. National coordination may be a valid option in reducing duplication and improving the competitiveness of phase 1 programs. The spatial and temporal complexities that one must address to build phase 2 and phase 3 programs, however, will likely hinder rapid development of national e-Extension programs. For the time being, a better approach may be to develop a shell that bundles the individual programs under a common theme.

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