Embracing Information Technology:
A New Era for Water Resources Programming

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Introduction

The current dramatic growth in the use of information technologies worldwide provides educational institutions with an unprecedented opportunity to expand the impact of instructional programming and technology transfer. Largely underserved segments of the population are increasingly becoming electronically linked with these information technologies, and data and information that has traditionally been out of reach of the general population is becoming widely accessible.

With the explosion of technology, however, comes the challenge of providing site-specific data in an educational context that is not only comprehensive, but usable by citizens and leaders who are ultimately responsible for making decisions that affect the quality of land and water resources. In addition, linking local communities with water resources professionals and assisting them in accessing the enormous amounts of on-line information are also critical components for the successful utilization of information.

The Institute of Water Research (IWR) at Michigan State University (MSU) seeks to utilize information technologies to encourage electronic communications, increase information exchange, and enhance citizens' access to land and water resources data. By increasing outreach education and water resources technology transfer through advanced information systems, IWR plans to lay the foundation for decision making based upon sound scientific information, and to augment the water-related educational programming offered throughout the state and region.

Specifically, the IWR will continue to build upon work in the following areas: 1) providing cost-effective electronic networking opportunities to local organizations which address water resources issues; 2) expanding access to educational resources via the Internet; 3) developing land and water resources-related curricula to reach remote audiences throughout the state; and 4) developing and supporting multimedia educational opportunities for K-12 educators.

Background

With a notable history in water resources technology transfer and education, the IWR has entered into the Land and Water Systems (LAWS) Partnership, a cooperative relationship with MSU's Center for Remote Sensing (CRS). To help MSU strengthen its non-traditional education, outreach, and interdisciplinary studies in Michigan and the nation, LAWS dedicates its efforts to addressing current problems and issues. Utilizing the multidisciplinary expertise of both units as well as a multitude of resources, such as the CRS's data archive of nearly 150,000 aerial photographs, LAWS assists organizations and individuals in making decisions that affect land and water resources.

The development of on-line information resources has been a natural progression for the LAWS staff, who have produced and supported a variety of information technologies. Activities have included developing C-Map, a Geographic Information System for data sharing, problem analysis and problem solving; developing a Wetlands Information Management System for assessing wetland functions and types; and exploring data access, integration and analysis through environmental information systems.

The IWR also provides networking support for local and regional organizations. In 1988, through a unique partnership with the W.K. Kellogg Foundation, the IWR launched the Groundwater Education in Michigan (GEM) Program. Initiated to explore opportunities for changing the way Michigan citizens think and act about groundwater, GEM has supported the development of more than 35 diverse groundwater education and protection projects, with goals ranging from the development of groundwater education curricula for school children to assisting communities in the development and implementation of local wellhead protection programs.

GEM grantees have included many diverse organizations, from local groups such as nature centers and health departments, to regional organizations such as watershed councils and councils of government. Six universities throughout Michigan serve as GEM Regional Centers, providing technical and program support to the local projects. As the GEM Program facilitator, the IWR encourages communications and networking among GEM grantees and other organizations which deal with water resources and related issues. A key to GEM's success has been the informal information sharing among these groups. The backbone for this exchange was established with the launching of GEMNET, an electronic communications tool for the GEM network of organizations and individuals.

GEMNET: Electronically Linking Michigan's Water Resources Community

Pooling knowledge and information can clearly be advantageous for any resource professional. Increasingly, "electronic communities" are being formed to assist interest groups in addressing problems, establishing forums and seeking solutions. Who knows of the latest wellhead protection area delineation in Michigan? What are the advantages and disadvantages of a particular GIS system? What is the reasoning behind proposed changes to a particular piece of water resources legislation? Questions such as these are routinely asked and discussed by individuals utilizing GEMNET.

GEMNET is a user-friendly, menu-driven, PC-based electronic mail and Bulletin Board System (BBS), designed to allow users to quickly become proficient at using the system's capabilities. Originally supported for GEM Program grantees, the system has expanded to provide cost-effective communications to a variety of individuals and organizations. Similarly, the topical emphasis has also expanded from primarily groundwater to include surface water and other environmental issues. GEMNET allows local organizations which may not otherwise have access to electronic mail or conferencing to access a user-friendly communications system. The only requirement is a personal computer and a modem.

In addition to offering electronic mail capabilities to users of the system, GEMNET provides a forum for discussions on various topical areas through its Special Interest Groups (SIGs). SIGs are a venue for conferencing on specific issues, allowing users to air their views, share experiences, and request information or advice in a bulletin board format. Since SIGs take on the role of an electronic periodical related to a certain theme, new users may read through previously-posted messages. Currently, all SIG messages since 1991 have been preserved.

The topics of the SIGs change as needs arise, and currently include forums for discussing environmental issues, planning and zoning for wellhead protection, upcoming events, and computer hardware and software technical issues, among others. One of GEMNET's most active SIGs is *GIS-Talk*, which has been used as a support and discussion tool for GIS users. Users share concerns and information on software upgrades, offer tips for dealing with GIS software or simply discuss the relative merits of a particular GIS package.

Mass mailings can be used as an alternative to posting SIG messages, and are especially useful for messages whose contents need to be read immediately. For specific interest groups, customized system mailing lists may be set up by the systems operator. Personal mailing lists can also be configured for individual users.

In addition, GEMNET has the ability to facilitate the archiving and transfer of electronic files in most formats. File archiving and transfers can be performed in three ways: as e-mail and SIG attachments, direct SIG uploads and downloads, and archived items in the file library.

Until now, GEMNET has existed as a stand-alone BBS. However, the IWR will soon upgrade the system to allow for connectivity to the Internet. Users will have access to Internet e-mail and select newsgroups through a Unix to Unix Communications Protocol host. Depending upon a user's individual system, the benefits may include:

> send/receive electronic mail to/from any Internet user;
> log onto host computers (if the user has an account) anywhere on the Internet;
> transfer files to/from host computers via anonymous file transfer protocol (ftp);
> access select Internet newsgroups;
> enhanced internal GEMNET features

Readers are encouraged to access GEMNET and share their expertise. At the host prompt, type: **telnet gemnet.rs.msu.edu**. The numerical address is **35.8.121.101**. If direct access or a local number to access the Internet is unavailable, users may, using a modem with communications software, dial MSUnet at 517-353-8500 (300-2400 Baud) or 517-432-3200 (9600-38400 Baud). At the MSUnet prompt, telnet using the above address. Long distance charges will apply. Communications parameters should be set to 8 data bits, 1 stop bit, no parity.

Showcasing Materials and Services Via World Wide Web

Anyone with access to the Internet knows of the voluminous amount of information currently available. Where else can resource professionals chat on-line with researchers and specialists from around the world, transfer text and graphics files, or download the latest software? Linking these resources provides a tremendous opportunity to share information and expand educational programming.

GEMNET has been particularly attractive to organizations which may not have the equipment or software that is necessary to access and display graphical information. However, the annotation and graphics capabilities that are available through the World Wide Web (the Web) greatly enhance the "Internet experience." To capitalize upon the dynamic capabilities of the Web, LAWS is currently in the process of developing its home page (see Figure 1).

Providing new access to the IWR and CRS has been the initial goal in the development of the LAWS home page. By introducing educational materials that are available from the IWR and CRS, providing clickable images for educational purposes, and hyperlinking to other sources of information, LAWS is able to offer users instant access to information that otherwise might take days or weeks to obtain through traditional channels.

Further, since the LAWS home page provides hyperlinks to other sites and sources of information, including Purdue University's WETNET, the Universities Water Information Network, the National Institutes for Water Resources and others, users are continually exposed to new information and resources.

Currently under construction, the LAWS home page introduces the four functional areas of the Partnership, including:

> Knowledge Generation/Applications;
> Advanced Technology Development;
> Data Access and Information Technology;
> Training and Education

General information about the IWR and CRS, samples of educational materials and basic educational information regarding water resources are available.

The home page also provides an index which catalogs aerial photography and other spatial data in Michigan which are currently housed at the CRS. Aerial photos that are available on a county by county basis are indexed using a hierarchical classification system. Users will be able to browse the information, determine if the aerial photograph that they require exists in the archive, and immediately contact LAWS on-line for more information about obtaining the photo.

Updates are continually being made to the home page, and suggestions from users are welcome. To explore the LAWS home page, the address is: **http:\\www.rs.msu.edu/**

In cooperation with Purdue University's Water Resources Research Center, the IWR will develop educational modules which address land use planning and water issues. The modules will be produced by creating numerous hypertext markup language (HTML) documents which can be accessed and displayed through a Web client. Using the Web's capacity to handle graphics, sound, text, video and animation, the modules will be multi-media in nature, and will draw upon the extensive data and information holdings at LAWS. Initially working with three educational institutions in Michigan, the IWR hopes to expand both the development and use of these modules in the future. These educational modules may also be offered in a CD-ROM format.

Universities are certainly not the only educational institutions "catching the wave!" Increasingly, K-12 educators are becoming involved and seeking to link up with others to share experiences and data. In cooperation with a Math and Science Center in Michigan, the IWR will help teachers integrate groundwater and surface water studies and monitoring data with on-line resources. Priority future goals include providing technical support to teachers as they develop water-related databases, offering networking capabilities within and outside of particular school districts and helping to identify and access water-related information over the Internet. In addition, the IWR will work with the Math and Science Center to provide site-specific spatial information and GIS training to teachers, and assist them in integrating the information with their surface and groundwater studies to enhance the learning experience for their students.

Further, LAWS will continue to expand the information that is available via its home page, potentially including additional graphics, animations and other educational materials. Hyperlinks to other home pages and information sources will be expanded on an ongoing basis, and on-line ordering capabilities and other options will be added. In addition, GEMNET itself may potentially serve as a stand-alone Web server, with hyperlinks to the LAWS home page and other related resources.

Future Efforts of the Institute of Water Research

Considering the hypermedia capabilities of the Internet, the use of information technologies to teach a variety of courses is becoming a feasible addition to traditional education. The IWR is working to develop water-related

curricula for use by diverse, non-traditional audiences, targeting areas of the state not routinely visited by the university.

Summary

Information technologies are propelling this generation into a data-rich world, and the opportunity for educational institutions to both reach new audiences and enhance instruction is excellent. The linkages available through these technologies will expand the flow of information across universities and allow them to capitalize on the strengths and expertise of water resources organizations

worldwide. These interactions will ultimately lead to more comprehensive information dissemination and synergistic programming efforts. The MSU Institute of Water Research will continue to utilize the dynamic capabilities of the Web and other technologies to support water resources professionals, reach non-traditional students, and provide ready access to data and information that will help citizens make more informed land and water resource decisions.

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Figure 1. The Land and Water Systems (LAWS) Partnership Home Page

Welcome to the
Land & Water Systems Partnership (LAWS) at
Michigan State University

This home page is under construction!! Last update: March 13, 1995.

LAWS is a partnership between the Institute of Water Research and Center for Remote Sensing providing multidisciplinary research, education and technology in land and water issues.

LAWS Functional Areas

- **Knowledge Generation/Applications Team**
  – Applied research and model development.

- **Advanced Technology Development Team**
  – Development of information systems software.

- **Data Access and Information/Technology Service Team**
  – Access to data and information; data conversions, manipulation and analysis.

- **Training and Education Team**
  – Training courses, workshops, conferences, videos and educational materials.