

Institute of Water Research

Annual Technical Report

FY 2000

Introduction

MICHIGAN INSTITUTE OF WATER RESEARCH ANNUAL TECHNICAL REPORT FY 2000

The Institute of Water Research (IWR) at Michigan State University (MSU) provides timely information for addressing contemporary land and water resource issues through coordinated multidisciplinary efforts using advanced information and networking systems. The IWR endeavors to strengthen MSU's efforts in nontraditional education, outreach, and interdisciplinary studies utilizing available advanced technology, and partnerships with local, state, regional, and federal organizations and individuals. Activities include coordinating education and training programs on surface and ground water protection, land use and watershed management, and many others. An extended introduction can be found in our FY99 Annual Technical Report. We also encourage you to access our web site which offers a more comprehensive resource on IWR activities, goals, and accomplishments; www.iwr.msu.edu

Research Program

Area of Relevant Research

Numerous federal and state agencies are increasing their emphasis on examining water problems from the watershed perspective. The watershed perspective is being emphasized in the reauthorization of the Clean Water Act, the new Farm Bill as well as several other pieces of legislation. Because of our Institute's long term position relative to national and state water programs, we function as a coordinator to assist with linkages, support education, research, and outreach with and among agencies in the broad water arena. Accordingly, we are in a unique position to facilitate watershed policy, planning, and management with a multi-disciplinary perspective. Our proposed effort includes three major thrusts. The first is the enhancement of integrated watershed systems that can be used for analysis of various management options. The second is extended education where the internet and advanced computer systems in addition to traditional conferences and workshops are used to extend new knowledge to agencies, organizations, and local level watershed and land use groups. The third involves developing a networking infrastructure to facilitate cooperation among partners such as the USDA, Natural Resource Conservation Service, USEPA, and state Departments of Natural Resources, Environmental Quality, and Agriculture, as well as township associations and county organizations.

Results and Benefits

We will promote the dissemination and application of results through the thrusts of extended education, networking, and strong partnerships with other organizations. Thus, an excellent opportunity exists to disseminate and assure application of knowledge. Consistent with a watershed approach, emphasis will be placed on assisting individuals in understanding the interactions of human land use practices and activities on surface and groundwater. This will be accomplished by working with local professionals, practitioners, consultants, and in educating local decision makers about

watershed functions and related policy options for the facilitation of water quality protection. The extensive use of extended education over the internet using hypertext techniques will greatly facilitate the effectiveness of wide dissemination throughout the state and region relative to watershed education and applicable policies. Further, many of these modules and approaches can be used nation-wide.

Nature, Scope, and Objectives

Goal

Develop an information exchange integrated support system for watershed studies with emphasis on land use and resource stewardship. The system will support research, studies by faculty and graduate students in several departments, and planning and management by local, county, state, and federal agencies.

Objectives

1. Integrate concepts and activities in watershed systems and extended education through a networking infrastructure of organizations and digital communication pathways with integrated distributed data sources and partners.
2. A computer/network based Natural Resources Integrated Information System (NRIIS) will be developed with graphical interface and search mechanisms to access models, data, information, and GIS/graphic tools.
3. Graduate students will use the system a) to facilitate their research, b) see how their study is part of a larger system, and c) gain experience with NRIIS and its power for enhancing research, technology, and information transfer and communication for informed natural resource policy, planning, and management decisions.

Principle Findings and Significance

Watershed-Based Effluent Trading Policy Research (Elaine Brown) Over the last 18 months has been conducting a comparative analysis of the air emissions trading program with pilot watershed-based nutrient trading programs to determine if the success of the air emissions programs could be applied to water resource policy. This policy research involved an analysis of federal statutes and policies for both media as well as case studies comparing a regional air emissions trading program with five point-nonpoint trading programs. This study indicates that the property rights and institutional frameworks for air emissions trading are much more conducive to trading. It also indicates that the watershed based trading program may be in an early stage of development that requires a different approach. Since several states in the Midwest region and across the country are developing or have developed watershed based trading rules, this information can be used in the policy development process.

Michigan Agricultural Environmental Assurance Planning Committee(E. Brown) In the late 1990s, the State of Michigan developed a pollution prevention strategy. One of the action items was to establish a voluntary environmental assurance program for agriculture. The Michigan Agricultural Environmental Assurance Planning committee was tasked to develop this program. This program is a unique effort to assist producers in protecting the environment while remaining economically viable. The first phase of the program will be launched in January 2001. The goal is to have 80% of animal agricultural production in the program by 2005. IWR staff has served on the committee and aided in development of the program, and the development of content and educational outreach.

New and Expanded Animal Operations Citing and Odor Control Task Force (E.Brown) With the expansion and concentration of animal agriculture operations across Michigan, issues of appropriate citing and odor control have come to the forefront. In response to the situation the Michigan Legislature amended state law to require the Michigan Department of Agriculture to establish a program for citing new and expanding animal operations and to address odor control issues. IWR staff served on the task force that developed the new generally accepted agricultural management practice. This policy action required a state agency review and local government notification for new or expanding animal operations.

Manure Management in the New Millennium (Frank DiTri) In June 2000, the Institute of Water Research organized a tour to Japan for four Michigan State University faculty researchers to establish contacts and exchange information with Japanese researchers, equipment manufacturers and animal producers on the latest animal manure management methods being employed in Japan. The group visited five animal production farms, two cooperative manure composting facilities, two national animal industry institutes and one university to observe the latest manure management and composting methods employed by the Japanese animal industry to comply with national environmental regulations.

The latest and most important development in this area is the evolution of farmers cooperative manure composting corporations. These facilities utilized specialized equipment to continuously turn and process animal manure automatically into finished compost. Consequently, the Michigan State University Department of Animal Science is proposing to purchase and import this technology to develop a central manure composting research facility at Michigan State University. The long-term goal of this project is to help animal producers in Michigan develop similar cooperative manure composting facilities to more effectively manage and recycle the manure while minimizing its negative impact on the environment.

New Watershed Planning Guide (Lois Wolfson/Ruth Kline-Robach/Elaine Brown) The Institute, in coordination with the Michigan Department of Environmental Quality (DEQ), has developed a guidebook to help local units of government and citizens develop watershed management plans that can then be submitted to the DEQ for approval under the Clean Michigan Initiative (CMI), a multi-million dollar environmental bond initiative established in Michigan for improving water quality. The guide, "Developing a Watershed Management Plan for Water Quality," provides a process for gathering stakeholders, information, and resources to protect and improve Michigan's water resources. Once the plan is approved, a grant application for CMI funding may be submitted to implement portions of the plan.

Interactive Web-Based Watershed Management Tool (Jeremiah Asher) The institute has developed a creative interactive web-based watershed management tool. The idea spawned from observing the growing need for watershed management tools and seeing the opportunity to tightly couple with and support the watershed planning guide. The goal of the application is to assist local units of governments, interest groups, and citizens with watershed management planners by providing access to vast data sets, GIS tools, maps, and reports. The application provides an intuitive interface that allows users to simply type in their address and zip code. They are provided with a web-based mini-GIS with a point location of their address within the 14 digit watershed. This application is on the leading edge of its technology, ingenuity, and capability. Some of the data layers and capabilities are: roads, highways, hydrology, topo lines, digital elevation maps, drainage patterns, and digital orthophotography. In addition, there are capabilities to produce potential risk area maps within the watershed. These maps help citizens/planners prioritize areas within the watershed that may be at risk for erosion or nutrient loading into surface waters

Environmental Sciences in Japan: International Training for American Students (F. DiTri) The Michigan State University Institute of International Health in cooperation with the Institute of Water Research has developed a sustainable, international environmental science program in Japan for American undergraduate and graduate students which integrates courses in environmental sciences, seminars on environmental issues, field trips to environmentally sensitive sites, and internship programs with laboratories, universities, and government agencies.

The keystone course for the Environmental Sciences in Japan (ESJ) program entitled Japanese Environmental Issues from Meiji to Heisei has been developed by Professor Frank M. DiTri, Associate Director of the Institute of Water Research. Sixteen Japanese scientists and/or environmental activists will present the lectures in this course. These senior Japanese researchers will provide the students with first hand knowledge about a number of the most serious environmental problems that have occurred in Japan, primarily as the result of rapid industrialization initiated in the late 1800s (the Meiji period) and continuing through the post World War II recovery (the Showa period) to the present era (the Heisei period). The course lectures and field trips will provide the student with not only the historical perspectives of Japanese environmental issues but also an understanding of how the post World War II actions of citizen groups influenced the political process to implement legislation to more effectively protect human life and the environment.

An International Watershed Symposium (F. DiTri) The Institute of Water Research has collaborated with the Michigan State University Japan Center for Michigan Universities and the University of Shiga Prefecture in Hikone, Japan to organize and convene a symposium entitled Toward Sustainable Management of Lake Watershed Ecosystems in Hikone, Japan on July 19-20, 2001. The goals of the symposium are to: 1) critically evaluate common environmental problems related to lake-watershed ecosystems and; 2) identify reliable methods to develop sustainable management strategies to restore and protect lake-watershed ecosystems.

In addition, it is anticipated that the symposium will stimulate academic/research exchanges between American and Japanese scientists with the objective to develop methods to reduce the deterioration of lake ecosystems, especially from nutrient loadings as well as other xenobiotic contaminants from diffuse sources outside the watershed.

Pesticide Risk Assessment in Michigan (Da Ouyang/Jon Bartholic/Jeremiah Asher) The Institute has conducted several case studies on the potential risks of pesticide application in agricultural croplands in Michigan. The study areas include Clinton county, Cass county and St. Joseph county. Two models developed by the U.S. Department of Agriculture have been evaluated. Risks of pesticide application in croplands have been assessed for commonly used herbicides, different agricultural soils and tillage management practices. The goal of the study was to provide the risk assessment information needed for farmers, watershed planners, and other resource managers to minimize water contamination caused by the use of pesticides. The results of the study have been presented in national watershed conference, and provided to county extension office and crop consultants in Michigan, and the Institute of Agriculture and Trade Policy (IATP).

Development of an Online Soil Erosion Assessment Tool (Da Ouyang) Estimating soil erosion requires knowledge on soil erosion processes and information on a specific site, and can be time consuming. The Institute of Water Research, collaborated with the Natural Resource Conservation Service, U.S. Department of Agriculture (office of state Michigan), has developed the first online Soil Erosion Assessment Tool. This online tool uses the widely recognized soil erosion model Revised Universal Soil Loss Equation (RUSLE). It provides a user-friendly interface and real-time calculations. This online tool has been used by a variety of users including students, research scientists, educators, extension personal, and others.

Pilot Nutrient Trading Website (Da Ouyang/Jeremiah Asher/Jon Bartholic/Elaine Brown) The Institute of Water Research has provided consultancy and technical assistance to the World Resource Institute in launching the pilot NutrientNet.org website, an online nutrient trading marketing tool. This website aims to provide a cost-effective and market-based approach for improving water quality. Users such as farmers and industries can trade credits for nutrients (phosphorus and nutrient) discharge from non-point sources and point sources to meet the watershed water quality standards. IWR has conducted an analysis on methodologies and provided the soil erosion module, mapping, and web hosting for this pilot project.

Source Water Assessment Program (Ruth Kline-Robach) The 1996 amendments to the federal Safe Drinking Water Act (SDWA) require states to develop a Source Water Assessment Program (SWAP). The purpose of SWAP is to:

- Identify areas that supply public drinking water
- Assess the susceptibility of those water supplies to contamination
- Inform the public of the assessment results

Source water assessments will be conducted for all public water supplies (PWS). A PWS is a waterworks system that provides water for drinking or household purposes to persons other than the supplier of the water.

In addition to the 1500 Type I, community water supplies in the state, source water assessments will be conducted on each of Michigan's approximately 12,000 Type II, non-community water supplies. These non-community systems typically provide water to restaurants, churches, schools and campgrounds. In Michigan, almost all of these systems rely on ground water as the source of their drinking water. These source water assessments are being conducted by local health department personnel, with technical assistance and facilitation support provided by the MSU-IWR, in collaboration with six universities and organizations across the state.

What Will a Source Water Assessment Include?

- determine the location of each well and intake using global positioning system (GPS) technology
- use well record information to determine geologic materials or area hydrology around intakes to estimate the sensitivity of the source to contamination
- examine well or intake construction, maintenance and use information to estimate the physical condition and integrity of the well or intake
- examine existing water quality data
- determine the sources susceptibility to contamination and evaluate isolation distances from land uses that may pose a threat to drinking water quality

The SDWA requires that SWAP activities be completed by May 2003. Once completed, the source water assessments can be used to determine future monitoring requirements, provide the public with more information on water supplies throughout the state, and focus prevention resources on drinking water protection activities.

Kline-Robach, Ruth and James McEwan. April, 1999. Plugging Abandoned Wells. MSU Extension WQ40. East Lansing, MI.

Committees:

- Michigan Source Water Assessment Program Advisory Committee
- National Groundwater Education Consortium
- Regional Wellhead Protection Program Education Committee
- Regional NPDES Stormwater Regulations Committee

Conferences:

Michigan Groundwater Protection Conference, November 1999

Presentations/Training Sessions:

-Farm*A*Syst and Home*A*Syst Training -MSU Wellhead Protection Program -RISE Program
-University Committee for a Sustainable Campus -Tri-County Childrens Groundwater Festival -State
Science Olympiad Water Quality Finals

Awards/Honors:

MSU-IWR designated as a National Groundwater Guardian Affiliate

1. In central Cass County Michigan, agricultural activities have resulted in the serious contamination of the shallow drinking water aquifer. With cost share funds through the 319 and WQIP programs, hogs were removed from field pasturing and placed into confinement facilities outside the watershed. As a result, the ground water has rapidly (1-2 years) shown reduced nitrate concentrations. There are many areas in southwest Michigan where heavy concentrations of hogs now exist in confinement facilities. There is concern for the disposal of these wastes on very porous soils over shallow aquifers similar to those studied in central Cass County.
2. Working in collaboration with the Michigan Department of Environmental Quality, county health departments throughout the state, and other universities, IWR staff are developing county-wide aquifer vulnerability maps that will ultimately be used to devise new management strategies in the field to protect drinking water sources.
3. Michigan IWR staff are assisting with the state's Source Water Assessment Program, by facilitating the assessment process for Michigan's 10,000 non-community water supplies. Components include training of local health department personnel, conducting QA/QC on data collected in the field, and providing technical support to the local health departments.
4. Michigan Institute staff are writing a guide for the Michigan Department of Environmental Quality on developing a watershed management plan for water quality. The guide includes the steps necessary to apply for and receive funding under the Clean Michigan Initiative, a multi-million dollar bond proposal that was passed by Michigan voters.
5. The Michigan Institute is working with a tribal community in the southwestern part of the state where groundwater contamination is high and surface water quality is threatened. Teaming with the Potawatomi Indian Health Agency and Education Department, Institute staff are screening drinking water for nitrates, setting up demonstrations and exhibits during tribal gatherings, and monitoring the water quality of a lake located on tribal lands.
6. Michigan Institute staff are assisting with several books and booklets that will assist lake/stream riparians in their monitoring efforts. These include: A Citizen's Guide for the Identification and Management of Aquatic Plants; A Guide on Stream Macroinvertebrates as Indicators of Water Quality; and a booklet on Integrated Pest Management for Aquatic Exotic Species.
7. The development of four virtual watershed courses to be offered over the internet is being facilitated by the Michigan IWR. The first course will be offered in the year 2000 and will enhance the in-place learning opportunities for individuals around the country. The anticipated results from these virtual university watershed courses will be improved planning and management through wiser local decision

making.

8. The Michigan IWR has been working with state and federal agencies (i.e., MI Department of Environmental Quality, Natural Resources, and Agriculture, USDA Natural Resources Conservation Service, and Farm Service Agency) to develop a web site with information, data, and models to bring user-friendly access to landowners and decision makers. This site will enable them to make more science-based decisions on a watershed basis. The site is also a tool for conservation planners. A district conservationist indicated that one model saved time with calculating soil erosion losses. Instead of 30 minutes of using tables and formulas to do the calculation, he is now able to use the web-based models and obtain the answer in several minutes. This represents a substantial time-savings for the 175 certified conservation planners in the state given the numerous times per year that they calculate soil losses for landowners.

Basic Information

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|---------------------------------|---|
| Title: | Natural Resources Integrated Information System |
| Project Number: | 01 |
| Start Date: | 3/1/2000 |
| End Date: | 2/28/2001 |
| Research Category: | Water Quality |
| Focus Category: | Management and Planning, Water Quality, Models |
| Descriptors: | Data Analysis, Data Storage and Retrieval, Information Dissemination, System Analysis, Geographic Information Systems, Water Quality Management, Watershed Management |
| Lead Institute: | Michigan State University |
| Principal Investigators: | Jon Bartholic |

Publication

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Research Program – Basic Project Information

Research Synopsis – Project 01

Title: Natural Resources Integrated Information System

Project Number: 01

Start Date: 03/01/00 **End Date:** 02/28/01

Funding Source: 104B

Congressional District: 8

Research Category: Water Quality Management

Focus Category #1: M&P; **#2:** WQL; **#3:** MOD

Lead Institute: Michigan Institute of Water Research

Descriptors: Data Analysis, Data Storage and Retrieval, Information Dissemination, System Analysis, Geographic Information Systems, Water Quality Management, Watershed Management

Primary PI: Jon F. Bartholic, Institute of Water Research, Michigan State University

Other PIs: No Other PIs

Area of Relevant Research

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networking infrastructure to facilitate cooperation among partners such as the USDA, Natural Resource Conservation Service, USEPA, and state Departments of Natural Resources, Environmental Quality, and Agriculture, as well as township associations and county organizations.

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Nature, Scope, and Objectives

Goal

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Objectives

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Principle Findings and Significance

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Over the last 18 months has been conducting a comparative analysis of the air emissions trading program with pilot watershed-based nutrient trading programs to determine if the success of the air emissions programs could be applied to water resource policy. This policy research involved an analysis of federal statutes and policies for both media as well as case studies comparing a regional air emissions trading program with five point-nonpoint trading programs. This study indicates that the property rights and institutional frameworks for air emissions trading are much more conducive to trading. It also

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Manure Management in the New Millennium (Frank D'Itri)

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New Watershed Planning Guide (Lois Wolfson/Ruth Kline-Robach/Elaine Brown)

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watershed management plans that can then be submitted to the DEQ for approval under the Clean Michigan Initiative (CMI), a multi-million dollar environmental bond initiative established in Michigan for improving water quality. The guide, "*Developing a Watershed Management Plan for Water Quality*," provides a process for gathering stakeholders, information, and resources to protect and improve Michigan's water resources. Once the plan is approved, a grant application for CMI funding may be submitted to implement portions of the plan.

Interactive Web-Based Watershed Management Tool (Jeremiah Asher)

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An International Watershed Symposium (F. D'Itri)

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What Will a Source Water Assessment Include?

- determine the location of each well and intake using global positioning system (GPS) technology
- use well record information to determine geologic materials or area hydrology around intakes to estimate the sensitivity of the source to contamination
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RISE Program

University Committee for a Sustainable Campus

Tri-County Children's Groundwater Festival

State Science Olympiad Water Quality Finals

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2. Working in collaboration with the Michigan Department of Environmental Quality, county health departments throughout the state, and other universities, IWR staff are developing county-wide aquifer vulnerability maps that will ultimately be used to devise new management strategies in the field to protect drinking water sources.
3. Michigan IWR staff are assisting with the state's Source Water Assessment Program, by facilitating the assessment process for Michigan's 10,000 non-community water supplies. Components include training of local health department personnel, conducting QA/QC on data collected in the field, and providing technical support to the local health departments.
4. Michigan Institute staff are writing a guide for the Michigan Department of Environmental Quality on developing a watershed management plan for water quality. The guide includes the steps necessary to apply for and receive funding under the Clean Michigan Initiative, a multi-million dollar bond proposal that was passed by Michigan voters.
5. The Michigan Institute is working with a tribal community in the southwestern part of the state where groundwater contamination is high and surface water quality is threatened. Teaming with the Potawatomi Indian Health Agency and Education Department, Institute staff are screening drinking water for nitrates, setting up demonstrations and exhibits during tribal gatherings, and monitoring the water quality of a lake located on tribal lands.

6. Michigan Institute staff are assisting with several books and booklets that will assist lake/stream riparians in their monitoring efforts. These include: A Citizen=s Guide for the Identification and Management of Aquatic Plants; A Guide on Stream Macroinvertebrates as Indicators of Water Quality; and a booklet on Integrated Pest Management for Aquatic Exotic Species.
7. The development of four “virtual” watershed courses to be offered over the internet is being facilitated by the Michigan IWR. The first course will be offered in the year 2000 and will enhance the in-place learning opportunities for individuals around the country. The anticipated results from these virtual university watershed courses will be improved planning and management through wiser local decision making.
8. The Michigan IWR has been working with state and federal agencies (i.e., MI Department of Environmental Quality, Natural Resources, and Agriculture, USDA Natural Resources Conservation Service, and Farm Service Agency) to develop a web site with information, data, and models to bring user-friendly access to landowners and decision makers. This site will enable them to make more science-based decisions on a watershed basis. The site is also a tool for conservation planners. A district conservationist indicated that one model saved time with calculating soil erosion losses. Instead of 30 minutes of using tables and formulas to do the calculation, he is now able to use the web-based models and obtain the answer in several minutes. This represents a substantial time-savings for the 175 certified conservation planners in the state given the numerous times per year that they calculate soil losses for landowners.

Basic Information

| | |
|---------------------------------|---|
| Title: | Watershed Based Optimization Approach for Identification and Management of Non-Point Source Pollution |
| Project Number: | 02 |
| Start Date: | 3/1/2000 |
| End Date: | 2/28/2001 |
| Research Category: | Water Quality |
| Focus Category: | Water Quality, Management and Planning, Law, Institutions, and Policy |
| Descriptors: | Hydrologic Models, Nonpoint Source, Water Quality, Watershed Management, Policy Analysis, Stakeholders, Acceptance, Adoption, BMP Maintenance |
| Lead Institute: | Michigan State University |
| Principal Investigators: | Scott Witter, Ouyang Da |

Publication

Research Synopsis – Project 02

Title: Watershed Based Optimization Approach for Identification and Management of Non-Point Source Pollution

Project Number: 02

Start Date: 03/01/00 **End Date:** 02/28/01

Funding Source: 104B

Congressional District: 8

Research Category: Watershed Management

Focus Category #1:; WQL **#2:** M&P; **#3:** LIP

Lead Institute: Michigan Institute of Water Research

Descriptors: Hydrologic Models, Nonpoint Source, Water Quality, Watershed Management, Policy Analysis, Stakeholders, Acceptance, Adoption, BMP Maintenance

Primary PI: Scott G. Witter, Department of Resource Development; Michigan State University

Other PIs: Ouyang Da, Department of Crop and Soil Science, Michigan State University; John Kerr, Department of Resource Development;

Problem and Research Objectives:

Although progress has been made in controlling agricultural non-point source pollution (NPS), it is considered that NPS is the major source for impaired streams and lakes in the U.S. Pesticides, nutrients, and sediments are the primary pollutants from agricultural land. Because of the widespread, vigorous, and random nature of NPS, it is a challenge to identify and control. Developing a watershed based optimization approach will help identify and manage non-point source pollution. In this project, we have identified and evaluated several water quality models including pesticide assessment, sediment and nutrient loadings. These models will help farmers, watershed planners, and other resource managers to determine NPS, implement best management practices (BMP), and make decisions more efficiently.

Methodology

Application of pesticides in agricultural land is a continuous environmental concern because of its non-point source pollution in surface and groundwater. It is important to evaluate the potential risk of pesticide application on croplands and presented to the environment, particularly concerning water resources. The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) and Agricultural Research Service (ARS) have developed a screening procedure to evaluate the potential risk of pesticide loss from soils. WIN-PST is a Windows-based computer program developed by the USDA National Water and Climate Center (NWCC). Based on the properties of pesticides and soils, climate, and cultural practices, WIN-PST evaluates the likelihood of pesticide loss and its potential risks to both humans and fish. Compared to other simulation models, this model has a user-friendly interface and requires a minimum set of input data. WIN-PST provides comparable results with a more quantitative simulation model: the National Agricultural Pesticide Risk Analysis (NAPRA).

Sediment and nutrient are another major cause for water quality degradation. Soil erosion degrades soil productivity and causes water quality problem through sediment and nutrients. Excessive fertilization, particularly from phosphorus, leads to eutrophication which deteriorates surface water quality. Controlling agricultural nonpoint source pollution requires good

information and knowledge on identifying the source areas and quantifying the pollutant loadings. A water monitoring program is helpful but costly. A scientifically based model can provide an alternative approach to provide a quantitative estimation on soil erosion, sediment and nutrient loadings, and to help identify the source areas. A GIS based and spatially distributed approach is used to better estimate soil erosion, sediment and phosphorus loading in agricultural watershed context. This spatially distributed model, Sediment and Phosphorus Loading Model (SPLM), is based on a spatially explicit sediment delivery ratio model SEDMOD and the modified Revised Universal Soil Loss Equation (MRUSLE).

Principle Findings and Significance

Our study has shown that WIN-PST can provide reasonably comparable results with the more quantitative model, NAPRA. It works well in developing our atrazine application risk mapping system. WIN-PST somewhat over-estimates the risks for pesticides with high toxicity. In some cases, it may also “over-estimate” the risk for applications with low rates. It suggests that atrazine application risk maps based on WIN-PST provide a conservative assessment for environmental risk of pesticide applications. WIN-PST and Geographic Information System (GIS) are incorporated in risk mapping system, which provides a useful and powerful tool for crop consultants, farmers, and others to identify the areas with high leaching potential. This may guide farmers to avoid applying certain chemical compounds or reduce the application rates to maintain high water quality.

Nutrients, particularly phosphorus, are major pollutants from non-point sources due to the use of chemical fertilizers and animal manures. Phosphorus is the most prevalent cause of eutrophication and degrades water quality. The most common form of phosphorus loading is the particulate phosphorus or sediment bounded phosphorus in which phosphorus components move with eroded soil particles to water bodies. Estimating phosphorus loading can help identify the potential high risk areas and prioritize the implementation of best management practices. From this study, it is found that there is a very good linear relationship between particulate phosphorus load and sediment load. It is suggested that the large portion of phosphorus loading comes from sediment and that phosphorus reduction can be achieved from best management practices implemented to control sediment in the watershed.

The results showed that SPLM estimated sediment and phosphorus loading with an improved accuracy compared to other models. Input data required to run the model are minimum and readily available. The results of this research also demonstrate the benefits of using a spatially explicit model combined with GIS technology. SPLM allows users to identify the source areas and estimate NPS loadings which may lead to a cost-effective watershed planning and management for minimizing agricultural nonpoint source pollution.

Modeling Sediment and Phosphorus Loading (Da Ouyang)

A spatially distributed model, Sediment and Phosphorus Loading Model (SPLM), has been developed by the IWR staff. It is GIS based and capable of calculating soil erosion, sediment yield and phosphorus loading. SPLM is developed based on a spatially explicit sediment delivery ratio model SEDMOD and the modified Revised Universal Soil Loss Equation (MRUSLE). The results showed SPLM estimated sediment and phosphorus

loading with an improved accuracy compared to other models. Input data required to run the model are minimum and readily available. The results of this research demonstrate the benefits of using a spatially explicit model combined with GIS technology. SPLM allows users to identify the source areas and estimate NPS loadings which may lead to a cost-effective watershed planning and management for minimizing agricultural nonpoint source pollution.

Information Transfer Program

Michigan is appropriately called the water wonderland due to its great wealth of water resources. Michigan is surrounded by four of the five Great Lakes, has 11,000 inland lakes greater than 5 acres in size, over 32,000 miles of river channel, and a vast groundwater supply. These waters provide resources for the diverse agricultural, industrial, and recreational opportunities across the state. However, as these opportunities continue to increase, both the quantity and quality of the states water resources are at risk. Since the movement of pollutants across a watershed is not constrained by political boundaries, and activities in one political jurisdiction may lead to water degradation in another, the need for action at the watershed level becomes very apparent. The difficulty in assessing impacts from erosion, nonpoint source pollution or shoreline development lies not only in the magnitude of the data collection efforts, but in the proper analysis and interpretation of the data needed for assessing the problem.

In order to keep the citizens of Michigan informed about water quality and water quantity issues, and to promote efforts to reduce pollutants and protect the water resources of the state, an education and information transfer program are appropriate. An effective information dissemination and training program facilitates the transfer of information needed to protect the water resources in the state, and helps to inform scientists, legislators, and citizens of the most recent information available. For further effectiveness, agency personnel, riparians, educators and others interested in protecting their water resources or in teaching others about it must understand the importance of collecting and/or analyzing information at the watershed level to ensure that reliable and appropriate information is being used to make sound decisions for water quality protection.

The Institute of Water Research has a long history of providing effective information dissemination and training programs. These programs have involved close cooperation with other groups and organizations within the University and the state in order to enhance their effectiveness. Because educational levels and prior knowledge in the subject area are so varied, a number of transfer mechanisms are necessary. These range from the direct dissemination of brochures, pamphlets, and technical and nontechnical books to computer models, the publication of technical completion reports, and videos, conference and seminars for both lay audiences and professional groups throughout the state. Training sessions on water-related topics, such as lake eutrophication, nonpoint source pollution, and stream monitoring, provide hands-on experience for a number of diverse audiences.

Conferences

In FY 2000 three conferences were held. The 11th annual Great Lakes Conference titled Changes And Challenges: The Great Lakes 2000 And Beyond attracted over 150. The program focused on topics such as contaminants, fisheries management, health-related risks, exotic species, and land use impacts on the Great Lakes ecosystem. The second conference, co-sponsored with the Michigan Chapter, North American Lake Management Society, Michigan Chapter, American Water Resources Association, and Michigan Lake and Stream Associations was Managing Landscapes to Protect Water Quality. Eight speakers were invited to discuss comprehensive watershed management and protecting lakes and streams through practices such as shoreline lakescaping, buffer strips, and best management practices. Approximately 160 people attended. The third conference focused on enhancing land productivity in Michigan utilizing irrigation. Topics focused on economics, cost and benefits, weather, soil, water supply and Great Lakes water levels. An exhibit area was included to highlight new and innovative techniques being used in the irrigation field. Overall, 60 people attended.

Virtual Watershed Course

The second of four modules for the Watershed Course in the Virtual University was completed during this fiscal year. The four part course includes modules on watershed concepts; building and implementing watershed management plans, watershed assessment and tools, and legal, financial, and institutional arrangements for watershed management. Participants who complete all four courses will receive a Masters level Professional Certificate in Watershed Management. The continued development of this course, including the completion of the last two modules and an additional module on soil erosion is partially supported by information transfer personnel.

Demonstrations, Exhibits, and Lectures

The Institute presented educational interactive exhibits during MSU's Ag Expo, an agricultural oriented exposition and Outdoor Expo, a natural resources exposition. The demonstrations focused on water quality indicator organisms, nuisance aquatic species, and trophic dynamics in lakes. The two events attracted a total of approximately 20,000 people.

Institute personnel worked with the Michigan Science Olympiad by serving as State Supervisor for Water Quality in the state finals. This annual event attracted 80 junior high and 80 high schools across the state who competed in a variety of science related events.

Institute personnel also give numerous lectures and presentations throughout the year to college classes, watershed councils, riparians, farmers, local agency personnel, and extension personnel. Topics this year focused on water quality in Michigan, wellhead protection, protecting shorelines, developing watershed management plans, and groundwater contamination.

Personnel and Facilities

The Institute of Water Research maintains or has at its disposal such facilities and equipment as computers and software, video camera, digital camera, editing and other photographic equipment, and a multi-probe Hydrolab to support its Information Dissemination Program both in the office and out in the field. It also has three Sun workstations, a graphic plotter, scanner, and color laserjet printer to enhance its educational programs and production capabilities. The Institute's technology transfer program is under the direction of Principal Investigator Dr. Lois G. Wolfson, with several Institute personnel contributing to the project, including Dr. Frank DiTri, Ruth Kline-Robach, and Elaine Brown.

Workshops How to Survive in a Research Intensive Environment: A Grantwriting Workshop: This workshop, convened on October 12, 2000 and November 29, 2000, was designed to improve the grant writing skills of faculty members with less than three years service at MSU as well as more senior faculty who would like to improve their grant funding success. The information provided focused on methods to improve specific areas of the grant construction, application, review, revision, and reapplication processes. The workshop was designed to help the grantwriter develop the ability to anticipate and influence the proposal award process and, there, increase the success of their research program. In addition to increasing the participants understanding of the proposal writing process, they also learned methods to:

1. Capture the reviewers attention;
2. Acquire strategic preliminary information;
3. Establish the correct level of detail for the budget;
4. Organize a complex proposal
5. Write an effective/informative cover letter;
6. Comply with the peer review process that is used to evaluate your proposal;
7. Follow-up after your proposal is submitted; and
8. Revise and resubmit your proposal.

Basic Information

| | |
|---------------------------------|---|
| Title: | Information Dissemination and Technology Transfer Training Programs |
| Start Date: | 3/1/2000 |
| End Date: | 2/28/2001 |
| Descriptors: | Water Quality; Watershed Management; Indicator Organisms; Monitoring; GIS |
| Lead Institute: | Institute of Water Research |
| Principal Investigators: | Lois G. Wolfson, Frank M. D'Itri |

Publication

1. Mokma, D., G. Schultink, E. Dersch, and L. Wolfson. 2000. Methods and Guidelines for Local Wetland Protection and Related Land Use Planning. Special SAPMINAR Report, Michigan Agricultural Experiment Station, Michigan State University, East Lansing, MI. 16pp.
2. Brown, E., A. Peterson, R. Kline-Robach, K. Smith, and L. Wolfson. 2000. Developing a Watershed Management Plan for Water Quality: An Introductory Guide. Institute of Water Research, Michigan State University, East Lansing, MI. 52 pp.
3. Wandell, H. and L. Wolfson. 2000. A Citizen's Guide for the Identification, Mapping, and Management of the Common Rooted Aquatic Plants of Michigan Lakes. WQ 55. Michigan State University Extension, East Lansing, MI. 90 pp.
4. Hart, S, M. Klepinger, H. Wandell, D. Garling, and L. Wolfson. 2000. Integrated Pest Management for Nuisance Exotics In Michigan Inland Lakes. WQ 56. Michigan State University Extension, East Lansing, MI. 28 pp.
5. Wolfson, L. and M. Higgins. 2000. Aquatic Ecosystems, Unit 8, in Module 1: Virtual Watershed Program in Watershed Management. (www.h2oshed1.vu.msu.edu) Michigan State University, East Lansing, MI
6. Wolfson, L. 2000. Prioritizing Pollutants, Sources, and Causes, Unit 6 in Module 2: Building and Implementing Watershed Management Plans. (www.h2oshed2.vu.msu.edu). Michigan State University, East Lansing, MI
7. Schultink, Ger, R. Moore, L. Wolfson, J. Dischinger-Smedes. 2000. Guidelines for Wetland Identification and Evaluation: Needs and Opportunities for Local Protection. Agricultural Experiment Station, Research Report No. 572. Michigan State University, East Lansing, MI.
8. DItri, F.M. 1999. Environmental Contamination and the Information Highway. In: Integrated Environmental Management: Development Information and Education in the Asian Pacific Region, Ann Arbor Press, Chelsea, MI, pp. 211-222.
9. DItri, F.M. 1999. Environmental Contamination and the Information Highway. In: Integrated Environmental Management: Development Information and Education in the Asian Pacific Region, Ann Arbor Press, Chelsea, MI, pp. 211-222.
10. DItri, F.M. 1999. What Education and Information Systems Can Do To Help Solve Environmental Problems: A Summary. In: Integrated Environmental Management: Development Information and Education in the Asian Pacific Region, Ann Arbor Press, Chelsea, MI pp. 271-277.
11. DItri, F.M. 1999. What Education and Information Systems Can Do To Help Solve Environmental Problems: A Summary. In: Integrated Environmental Management: Development

Information and Education in the Asian Pacific Region, Ann Arbor Press, Chelsea, MI pp.
271-277.

Information Transfer – Basic Project 22

Introduction

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In order to keep the citizens of Michigan informed about water quality and water quantity issues, and to promote efforts to reduce pollutants and protect the water resources of the state, an education and information transfer program are appropriate. An effective information dissemination and training program facilitates the transfer of information needed to protect the water resources in the state, and helps to inform scientists, legislators, and citizens of the most recent information available. For further effectiveness, agency personnel, riparians, educators and others interested in protecting their water resources or in teaching others about it must understand the importance of collecting and/or analyzing information at the watershed level to ensure that reliable and appropriate information is being used to make sound decisions for water quality protection.

The Institute of Water Research has a long history of providing effective information dissemination and training programs. These programs have involved close cooperation with other groups and organizations within the University and the state in order to enhance their effectiveness. Because educational levels and prior knowledge in the subject area are so varied, a number of transfer mechanisms are necessary. These range from the direct dissemination of brochures, pamphlets, and technical and nontechnical books to computer models, the publication of technical completion reports, and videos, conference and seminars for both lay audiences and professional groups throughout the state. Training sessions on water-related topics, such as lake eutrophication, nonpoint source pollution, and stream monitoring, provide hands-on experience for a number of diverse audiences.

Research Synopsis – Project 22

Title: Information Dissemination and Technology Transfer Training Programs

Project Number: 22

Start Date: 03/01/2000 - **End Date:** 02/28/2001

Funding Source: 104B

Congressional District: Eighth

Lead Institute: Michigan Institute of Water Research

Descriptors: Water Quality; Watershed Management; Indicator Organisms; Monitoring; GIS

Primary PI: Lois G. Wolfson, Institute of Water Research, Michigan State University

Other PI: Frank M. D'Itri, Institute of Water Research, Michigan State University

INFORMATION TRANSFER - FY 2000

Conferences

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Publications and Web-based Programs

The following publications and programs were partially supported with information transfer funding or personnel

Mokma, D., G. Schultink, E. Dersch, and L. Wolfson. 2000. Methods and Guidelines for Local Wetland Protection and Related Land Use Planning. Special SAPMINAR Report, Michigan Agricultural Experiment Station, Michigan State University, East Lansing, MI. 16pp.

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WORKSHOPS

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5. Write an effective/informative cover letter;
6. Comply with the peer review process that is used to evaluate your proposal;
7. Follow-up after your proposal is submitted; and;
8. Revise and resubmit your proposal.

STUDENT SUPPORT

| Category | Section 104 Base Grant | Competitive Awards | NIWR Internship | All Other | Total |
|---------------|------------------------|--------------------|-----------------|-----------|-------|
| Undergrad | | | | 4 | 4 |
| Masters | 1 | 3 | | 7 | 11 |
| PhD | | 2 | | 3 | 5 |
| Post Doc | | | | | 0 |
| Totals | 1 | 5 | 0 | 14 | 20 |

NOTABLE AWARDS AND ACHIEVEMENTS

Using Risk Maps to Manage Atrazine Application (Da Ouyang and Jon Bartholic)

Atrazine has been widely used for weed control in corn and may cause water pollution in Michigan waters. To help corn growers identify the areas that may be vulnerable to atrazine leaching to the groundwater, the Institute of Water Research has developed an atrazine application risk mapping system. This risk mapping system produces maps for atrazine application risk ratings based on soil texture, slope, herbicide application rate and method, and probability of rainfall. We have applied this system in St. Joseph County which is in St. Joseph River watershed. This watershed is considered the major contributor of atrazine to Lake Michigan. By providing color-code risk maps, farmers will be able to identify the fields with high probability of atrazine leaching and informed decision can be made for minimizing the risk. The rate of atrazine needs to be reduced and/or an alternative herbicide with lower toxicity may be used if the area is labeled as high risk. The risk mapping system is also available online (<http://www.iwr.msu.edu/nps/atrazine.html>) and map products have been distributed to crop consultants and corn growers in the area.

USGS Summer Intern Program

Student Support

| Student Support | | | | | |
|-----------------|------------------------|------------------------|----------------------|---------------------|-------|
| Category | Section 104 Base Grant | Section 104 RCGP Award | NIWR-USGS Internship | Supplemental Awards | Total |
| Undergraduate | 0 | 0 | 0 | 4 | 4 |
| Masters | 1 | 3 | 0 | 7 | 11 |
| Ph.D. | 0 | 2 | 0 | 3 | 5 |
| Post-Doc. | 0 | 0 | 0 | 0 | 0 |
| Total | 1 | 5 | 0 | 14 | 20 |

Notable Awards and Achievements

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Publications from Prior Projects

1. Brown, Elaine M. 2000. Lessons for Trading Program Design to Protect Water Quality: A Synetic Analysis of Air and Water Quality Protection Programs, M.S. Dissertation, Department of Resource Development, East Lansing, MI 48824
2. Ouyang, D., and J. Bartholic. 2001. Web-Based GIS Application for Soil Erosion Prediction. In: Proceedings of An International Symposium - Soil Erosion Research for the 21st Century. Honolulu, HI p 260-263
3. Brown, E., A. Peterson, R. Kline-Robach, K. Smith and L. Wolfson. 2000. Developing a Watershed Management Plan for Water Quality: An Introductory Guide. Institute of Water Research, Michigan State University, East Lansing, MI 48823 p 52
4. Hart, S, M. Klepinger, H. Wandell, D. Garling, and L. Wolfson. 2000. Integrated Pest Management for Nuisance Exotics In Michigan Inland Lakes. Water Quality Series No 56. Michigan State University Extension, East Lansing, MI 48824 p 28
5. Schultink, G., R. Moore, L. Wolfson, and J. Dischinger-Smedes. 2000. Guidelines for Wetland Identification and Evaluation: Needs and Opportunities for Local Wetland Protection, Research Report 572. Michigan Agricultural Experiment Station, Michigan State University, East Lansing, MI 48824 p 82

6. Wandell, H. and L. Wolfson. 2000. A Citizen's Guide for the Identification, Mapping and Management of the Common Rooted Aquatic Plants of Michigan. MSU Extension Water Quality Series No. 55. Michigan State University Extension, Michigan State University, East Lansing, MI 48824 p 82
7. Witter, Scott G., Ruth Kline-Robach, D.L. Long, Jon Bartholic and Fred Poston. 2000. MSU-WATER: A New way of Addressing Water Quality Challenges in Water Resource Update, Universities Council on Water Resources
8. Yongsheng, Ma, Jon F. Bartholic, Jeremiah A. Asher, Yi Shi, Da Ouyang, and Jerry Grigar. 2001. To Establish Morrow Lake NPS Assessment Model: An Example of AGNPS Application for Watershed Erosion and Phosphorus Sedimentation. Institute of Water Research, Michigan State University, East Lansing, MI 48823 p 6