

National Integrated Water Quality Program (Section 406)

FY 2000 110.D INTEGRATED RESEARCH, EDUCATION AND EXTENSION

Use of Research and Modeling Information in Community-based Watershed Planning

PROGRESS REPORT FY2001-2002

Principal Investigator: Gerald A. Miller
Iowa State University College of Agriculture
132 Curtiss Hall
Ames, IA 50022

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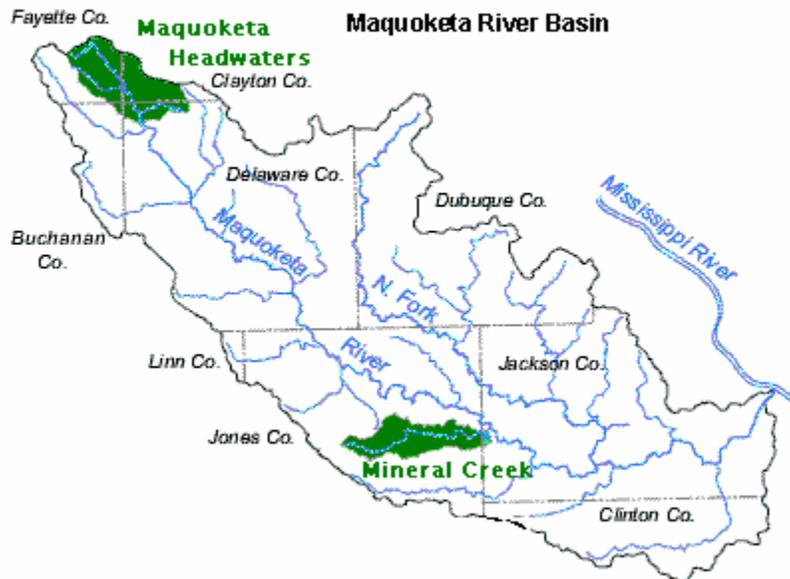
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Use of Research and Modeling Information in Community-based Watershed Planning

Accomplishments and Impacts, FY2001-2002

Objective 1. Increase the capacity of communities in agricultural watersheds to manage water resource protection based on local, democratic processes.

The Upper Maquoketa (Maquoketa Headwaters) and Mineral Creek watersheds within the Maquoketa River Basin are the first watersheds in Iowa where Extension Community Development Specialists were involved specifically to facilitate emergence of citizens' councils capable of taking the lead in setting watershed environmental goals and performance measures. Their work has been supported by this CSREES Section 406 project and by a grant from U.S. EPA Region 7. Northeast Iowa Extension Field Specialists for Community Development met with local groups, providing process expertise in group dynamics for the emerging watershed councils. They facilitated early community meetings, ensuring that a range of local stakeholders and respected leaders were represented, and that all attendees had an opportunity to air their ideas and concerns. They monitored subsequent council meetings for up to two years, until the councils were organized with elected leaders and goals for going forward on their own.



The extension project coordinator and other staff also see their roles as unique in these watersheds. They provide science-based, technical resources in response to questions and initiatives raised by the watershed councils, rather than trying to lead the process. Facilitation by staff who listen and respond sparks the engagement of council members in a process of participatory discovery about local water quality issues. Intervention by extension in these watershed communities was specifically designed to foster this process and thereby increase proactive community-based leadership for successful non-regulatory problem solving.

Accomplishments and Impacts:

- Two residents' councils, in the Headwaters and Mineral Creek watersheds, have been established and are now firmly committed to water quality protection. Both councils have elected leaders and meet monthly except during planting and harvest. The first public meeting in each of the two sub-watersheds produced more than 25 volunteers willing to form a watershed council. Both councils started with the goal to inform themselves and others of watershed issues. They have called on many sources for information and assistance, including community, environmental, farm and commodity organizations, wildlife protection groups, county supervisors, conservation district commissioners, state elected representatives, county conservation directors and boards, and local sanitarians.
- Council members have taken ownership of environmental issues in their communities. Within their watersheds, these councils now form a core of concerned, educated citizens who can respond to water quality issues on the basis of knowledge rather than rhetoric.
- The Headwaters Council has been proactive in addressing their concerns, and shown a willingness to act independently of state and federal watershed cost share programs. They have:
 - studied the results of model scenarios and set a goal of 50 percent reduction in nutrient and sediment delivery from the headwaters sub-basin to Backbone Lake, a recreation lake on the main stem;
 - submitted a set of specific recommendations for practice priorities to meet their goal to their Soil and Water Conservation Districts (SWCDs) and to the state agencies responsible for conservation programs;
 - sponsored annual tours of their on-farm best management practice (BMP) demonstrations, and in 2002 arranged a watershed tour and discussion for their state legislators;
 - obtained grants and other support for research and educational projects from local businesses, the Iowa Farm Bureau, Fayette Corn Growers, and the Iowa Beef Center, among others;
 - with assistance from extension project staff, established cooperating site for the Midwest Water Quality Project. This project, whose goal is to refine nitrogen use to protect water quality, is being conducted in cooperation with the University of Minnesota, coordinated by the Center for Agricultural Partnerships, and funded by the Shell Oil Co., the EPA and the McKnight Foundation. In 2002 ten Fayette County producers established 50-acre large block nitrogen rate studies using GPS. Their yield monitor data will be analyzed by the University of Minnesota Precision Ag Center for response to nitrogen by soil type, hybrid, population and other factors;
 - contributed to the joint EPA/USDA study referred to as the "Cost and Capability Assessment". The Maquoketa Headwaters was one of only two watershed communities in the nation chosen to contribute case studies for this report, requested by Congress, which sought to develop a "snapshot" of the local cost of developing and implementing Comprehensive Nutrient Management Plans by animal feeding operations.

The state cost-share project in the Headwaters predated council formation and is being carried out independently by conservation district staff.

- The Mineral Creek citizens' council was allowed to play a substantive role in prioritizing BMPs in a watershed project proposal submitted by the Jones County SWCD to the Iowa unified state/EPA 319 watershed program. Mineral Creek watershed has since become widely recognized as an outstanding example of targeting and use of special funding. Adoption of cost-shared BMPs has outperformed expectations, as producers enthusiastically embraced the opportunity to implement targeted water quality management practices. No 2001 cost share funds reverted unused to the sponsoring agencies - unusual in a project's first year. In fact, a supplemental allocation was also committed by June and mainly used by mid-August. The SWCD had requests for more than two thirds of the 2002 funds even before they were available.

Effective use of special cost-share funds for BMPs in the Mineral Creek watershed is largely due to successful mobilization of many forms of “local capital” through the council process. Early involvement of the council in the budget proposal assured that targeted practices were locally feasible and acceptable. Participatory learning facilitated by Extension staff allowed council members to evaluate water quality evidence for themselves. Therefore, they also felt empowered to identify specific problem areas, volunteer their own farms, and actively recruit their neighbors for specific practices.

In addition, the Conservation Districts have been highly supportive of the council. The NRCS District Conservationist and the Iowa Department of Agriculture and Land Stewardship (IDALS) employee serving as coordinator of the cost-share project are strong advocates of the council process, as are two District Commissioners, Larry Manternach and Pauline Antons. Antons is also a watershed resident and council member. A well-respected local conservation district employee, Marvin Parmer, was hired part-time out of retirement to work on cost-share contracts alongside the IDALS project coordinator. The trust and credibility Parmer enjoys in the community have also contributed to acceptance of the project's targeted BMPs.

- A “modeling committee” formed by the Mineral Creek council has provided detailed input on local landuse and livestock management practices to refine model baseline assumptions. The application of models in the watershed has proved to be an interactive process, involving modeling team scientists, extension staff and members of the Mineral Creek Council. The scientists involved say this level of cooperation with local land managers is unique in their modeling work.
- Economic and environmental benefits of nutrient and manure management BMPs are increasingly recognized in the community. Forty-five farm operations have participated, without compensation, in on-farm demonstrations related to control of nitrogen and phosphorus loading in their watersheds. Cooperating producers are comparing manure applications with and without additional N and P, evaluating reduced N rates, elimination of P application to high-testing soils, and using GPS and GIS technologies to compare N treatments across different soils. Extension staff provide assistance with plot design, layout, harvest and data analysis. The demonstrations have yielded solid documentation that reduced fertilizer application and improved manure management provide economic as well

as environmental advantages under local conditions. Reports can be found on the project web site at: www.extension.agron.iastate.edu/waterquality/projects/maquoketa.html. (See also Attachment 1).

When staff of the Center for Agricultural Partnerships conducted pre-project interviews in the Headwaters for the Midwest Water Quality Project, they commented to Extension staff on what they perceived as local producers' extraordinary high level of awareness of the potential impacts of their N management on water quality.

- Twenty-six producers have completed one to two years of a three-year nutrient management incentive (NMI) education program in which they learn to apply nutrient and manure BMPs *to their own operations* (Fact Sheet 1). Currently there are 24 participants with 5,200 acres enrolled in the program. Their annual evaluations prove the profitability of reduced fertilizer rates. Their comments also show that they are taking increased credit for manure nutrients, implementing practices such as managing fertility by soil map unit (and thus, potential yield) on more acres, and becoming more educated consumers of the advice and products presented by suppliers.
- Eight of eleven producers in the NMI program reported reducing nitrogen rates in their 2001 end-of-season surveys. Their increased profitability averaged \$2880 per farm. Six of eleven producers also reported reducing phosphorus applications because soil tests were high or very high. Seven producers increased the credit taken for manure applications, increasing profits by \$1870 per farm.
- The NMI program has resulted in a set of teaching materials (Fact Sheet 1) to clarify implementation steps for crop and manure nutrient management. They include worksheets, scouting forms and workshop agendas for the three-year course. The materials were standardized for use in the Maquoketa at the request of the Iowa DNR. Extension Field Specialists/Crops, state specialists, a local crop consultant, and project staff contributed.
- Extensive media coverage is creating a social context of expectation to support producers in changing their manure, nutrient and soil management practices. An extension information specialist is funded for northeast Iowa water quality projects by the U.S. EPA Section 319 Program through the Iowa Department of Natural Resources (IDNR). A bi-monthly Extension newsletter, *Water Watch* (Attachment 1), and frequent news releases feature local water quality issues, economic results of nutrient and manure management BMP demonstrations, profiles of council members and demonstration cooperators, and the work of other volunteer conservation and monitoring groups in the area. *Water Watch* affords direct contact with nearly 2000 people with each printing. In FY2002, 22 news releases resulted in forty-two articles in nine northeast Iowa newspapers, as well as articles in regional newspapers and SWCD reports. Issues of *Water Watch*, results of on-farm demonstrations, posters and other information prepared by the specialist are available on the Web at www.extension.agron.iastate.edu/waterquality/projects/maquoketa.html.
- The ISU Extension to Communities program has recognized and promoted involvement of field specialists in facilitating watershed councils. In the past two years, citizens' groups and conservation district staff in more than ten other Iowa watersheds have received assistance for:

- a. Initiating local councils;
- b. incorporating local citizen's input into the development of watershed project proposals and budgets for cost-shared practices;
- c. establishing networks of voluntary on-farm demonstrations of nutrient and manure management BMPs;
- d. making nutrient management educational programs available to producers.

Experience gained by staff in this project has also contributed to new tools for watershed management. The manual *Renewing Local Watersheds: Community Leader's Guide to Building Watershed Communities* was developed in 2002 by ISU Extension to Communities with support from EPA Region 7 and Conservation Districts of Iowa. The information in this manual is a direct result of approaches piloted in the Maquoketa Headwaters and Mineral Creek watersheds, among others. It is available on the ISU Sociology Extension web site at http://www.soc.iastate.edu/Extension/Watersheds_manual/index.htm

Objective 2. Conduct applied research to help define nitrogen and phosphorus losses in runoff and subsurface drainage under various management practices/systems characteristic of agricultural watersheds in northern Iowa and southern Minnesota.

Monitoring Accomplishments:

Stream Research Monitoring (Attachment 2). Monitoring of the Upper Maquoketa (Headwaters) watershed was funded by the U.S. EPA 319 program through IDNR, a National Pilot Project conducted by the Texas Institute for Applied Environmental Research (TIAER) at Tarleton State University, and this CSREES 406 project. Water samples taken at four sites have shown consistent seasonal trends and within-season response to rainfall events. In brief, the results show that temporal variation in the quality of stream flow is dependent on the changes in the proportions of stream flow made up by the surface runoff and subsurface drainage components.

Overall N losses are dominated by NO₃-N losses, mostly taking place as leaching losses in this watershed, which has significant subsurface drainage. NO₃-N loss ranged from 20-36 Kg/ha and was transported primarily with subsurface flow, with concentrations being highest during baseflow periods. In typical rainfall conditions, the well-structured soils of the basin result in NO₃-N moving readily with water infiltration into the soil before surface runoff begins. In contrast, soluble phosphorus is transported mainly in surface runoff, and concentrations increase at peak flow. Nitrate losses on a pound per acre basis are generally at least 20 times greater than P losses.

Scientists and producers are concerned that average concentrations of NO₃-N and soluble P at all monitoring sites exceeds the proposed EPA benchmark for *total* nitrogen and phosphorus for flowing waters by an order of magnitude. Proposed criteria for standing waters are even lower. The average NO₃-N concentration from over 250 analyses per year from the 39,250-acre watershed is 10.08 ppm compared to the proposed EPA benchmark of 0.7 ppm for lakes. Average total phosphorus delivery ranged from 0.26 ppm in 1999 to 0.31 ppm in 2000, compared to the EPA proposed benchmark of 0.035 ppm. At \$0.25/lb of N, the 36 lb/ac (40 kg/ha) N loss for the watershed in 2001 represents over \$350,000 (or \$9/ac). If

corn is to continue to be the dominant crop, “fine-tuning” the rate of N application, including giving credit for manure applied, is one of the first considerations in reducing N losses. If improved in-field practices are not adequate to meet water quality goals, then off-site practices such as constructing/reconstructing wetlands may be necessary to reduce field-to-stream transport of NO₃-N.

On-Farm Monitoring of Nutrient Flow Through a Vegetated Filter Strip (VFS). A local operation, CJ Farms, constructed a vegetated filter strip to receive post-settling effluent from their 800-head beef feedlot. They have allowed monitoring of nitrogen and phosphorus in runoff, subsurface drainage and soils of the filter strip. This research began as a local initiative to address questions raised by the CJ Farms owners themselves on the effectiveness of VFS to remove nutrients from the effluent. Details are summarized in Fact Sheet 2.

Student Monitoring Projects The Headwaters council obtained a Farm Bureau mini-grant for *tile outlet monitoring* by the Agriculture and Life Sciences classes at Starmont High School. The Starmont School district roughly coincides with the watershed, and the school building is the central location that has also been used for council meetings. The Associated Milk Producers Inc., located near the watershed town of Arlington, agreed to provide sample bottles. Students obtained rain gauges from Monsanto/DeKalb Corporation. About 21 students have participated each year in 2001 and 2002. They have monitored nitrates and total phosphorus for 81 tile lines on 39 cooperator farms.

For monthly samples taken from April through July in 2001, NO₃-N averaged 16.9 ppm, with a maximum of 19.9 ppm in April. For samples taken January through April in 2002, NO₃-N averaged 12.3 ppm. Phosphorus measurement was inaccurate due to problems with equipment.

Maquoketa basin-wide scan. In response to a request from the Mineral Creek council, scientists from the IDNR Geological Survey Bureau used a state mini-grant to conduct a base-flow and ‘modest-flow’ “snapshot” (single event sampling) survey of nutrient and microbial parameters for 19 HUC 11 watersheds in the HUC 8 Maquoketa Basin. The initial “modest-flow” same-day sampling took place on June 18, 2001. The second, “base-flow” sampling took place August 20. Results were published in the August, 2001 *Water Watch* newsletter and were of interest to many community groups because of microbial contamination at Backbone Lake swimming beaches. Compared to the June results, the August samples contained lower and more uniform levels of fecal coliform.

IOWATER volunteer monitors. Both watershed councils include members who are providing leadership for local volunteer water monitoring and who have received training from IOWATER, Iowa’s IDNR-managed statewide volunteer monitoring network. In the Headwaters, eighteen volunteers (two with IOWATER training) monitor 13 sites on the Maquoketa mainstem and tributaries. The volunteers have involved the Starmont eighth grade science class in macroinvertebrate identification. In Mineral Creek, 24 volunteers, 15 of whom have IOWATER training, are monitoring 14 sites. Council member Jerry Gnade was one of the first graduates of the IOWATER Level 2 monitoring training. Two additional IOWATER participants in Mineral Creek received Level 2 training during 2002.

Extension project staff assist these groups to enter their data into the state databank, to extract information for presentation of results, to consult with scientists when they have technical questions, and with grant applications to support their work (the Iowa Farm Bureau and IDNR both have monitoring minigrants available to local groups.)

Impacts of monitoring efforts:

- Research monitoring in the Headwaters showed the subwatershed above site 3, with current and historical high livestock populations, delivers substantially higher nutrient concentrations compared to the other intra-basin sites. According to the 1998 pre-project survey, this high-testing watershed (3,600 acres) received 21.92 T/ac of manure compared to the average of 6.64 T/ac for the 39,260 acre total Headwaters watershed. Producers have responded to this information with a high participation rate in extension-sponsored nutrient management education and on-farm manure management demonstrations. Demonstration and workshop cooperators operate over 60 percent of the land in the subwatershed.
- Angela Rieck-Hinz, manager of the Iowa Manure Management Action Group information clearinghouse (<http://extension.agron.iastate.edu/immag/>) has praised the VFS research: "...this project is a prime example...of the role research and outreach extension can play in providing solutions to concerns about manure control from open feedlots. It would be good to see more of this type of work, and more publicity for this type of work."
- The VFS monitoring project demonstrates how project staff tied to a land grant institution can leverage additional resources for a watershed community in the form of research scientists' involvement.
- The tile line monitoring project has allowed students to analyze and present data. It has also given them an opportunity to interact with professional researchers, and has made them aware of tile lines and their impact on nutrients leaving the watershed.
- Research monitoring results have improved the output of applied models that council members and SWCD staff are using to prioritize BMPs for their watersheds (Objective 3).
- Bacteria monitoring by the Jones county sanitarian confirmed concerns of the Mineral Creek council about contamination originating from two small towns lacking secondary wastewater treatment. The council then provided a stimulus for the County Board of Supervisors to enable small towns in their area to begin jointly addressing wastewater contamination issues.

Objective 3. Enhance the practical connection between development of computer simulation models and the process of watershed nutrient load planning and management.

Applied modeling in Maquoketa Basin watersheds.

Background on the CEEOT Model System: Since 1992, TIAER, the Center for Agricultural and Rural Development at Iowa State University (CARD), and the Texas Agriculture Experiment Station-Blackland Research Center (TAES) have worked together to develop applied mathematical models to assess the environmental and economic impacts of policies intended to

reduce livestock-related water pollution. Environmental effects are measured as changes in the concentration and loading of in-stream pollutants. Economic impacts are measured as increases or decreases in farm income. This system, known as CEEOT (Comprehensive Economic and Environmental Optimization Tool), relies on both environmental and economic models. Environmental models include the field level Agricultural Policy/Environmental eXtender (APEX) model and the watershed level Soil and Water Assessment Tool (SWAT) model developed by the TAES and the USDA Agricultural Research Service's Grassland Soil and Water Research Laboratory. The Farm Economic Model (FEM) developed by TIAER is the main economical model used in CEEOT system.

Scenarios for watershed planning: A key component of the watershed council facilitation projects in the Headwaters and Mineral Creek watersheds is the application of an environmental and economic modeling system to provide insights as to which tillage, nutrient, cropping, conservation, and other practices can provide cost effective water quality benefits. Council members have an opportunity to work directly with scientists on developing models for their watersheds. Beginning in 1999, as part of a national pilot project, scientists from the CARD and TIAER generated computer model projections of loading reductions and economic costs/benefits for 22 modified soil, manure and fertilizer management scenarios, VRT technology and improved secondary wastewater treatment in the Headwaters watershed. Research monitoring data were collected as described in Objective 2. The Extension project coordinator collected baseline information on local crop and livestock practices through personal interviews.

Extension project staff collaborated with TIAER and CARD scientists to develop graphical presentations and news articles describing results of the model scenarios (Attachment 3). The information helped the councils focus their discussions, set goals, and prioritize practices and sites to attain the greatest environmental benefit. The Maquoketa Headwaters council set a 50 percent reduction in nutrient and sediment delivery from the headwaters sub-basin to Backbone Lake, a recreation lake on the main stem, as an achievable goal for their watershed.

Citizen participation in modeling the Mineral Creek watershed. In Mineral Creek watershed, detailed research monitoring information is not available to calibrate the models. Funds for technical and computing time to develop a large number of BMP scenarios is also limited. In the future, this situation is likely to be common for many other watershed groups. Therefore, the results obtained from the Headwaters are very important for calibrating and applying CEEOT for similar watersheds such as Mineral Creek.

Even without research monitoring, however, management assumptions for simulating baseline conditions can be improved with input from watershed producers. Local watershed council members, in consultation with Iowa State University Extension and other agency personnel, have also participated in the selection of the management scenarios that have or will be executed in the modeling system.

Accomplishments and impacts of applied modeling efforts:

- Model scenarios have helped the councils focus their discussions, set goals and prioritize cost-share funding for practices and sites to attain the greatest environmental benefit.

- The Mineral Creek watershed council established a monitoring subcommittee, which met with TIAER and CARD scientists four times during FY01 and three times during FY02. The group has:
 - Surveyed their watershed concerning attitudes and practices;
 - Reviewed model assumptions in depth with the scientists - including local resources and crop and livestock management information;
 - Targeted the scenarios to be generated for their watershed and for subwatersheds.
- Scientists from TIAER and CARD have been enthusiastic about the cooperation received from the Mineral Creek watershed council, and say the depth of local management and landuse information gained is unprecedented due to citizens' direct involvement with the modeling activity.
- The survey sponsored by the Mineral Creek council was implemented in a novel way compared to typical district surveys. The questionnaire was explicitly identified with the citizens' watershed council, rather than with local agencies, although Conservation District and Extension staff assisted in its design. The monitoring subcommittee signed the cover letter, and the "mail to" address at the end of the questionnaire was the council co-chair. The council's intent was to make sure people understood it was their neighbors, not just 'the government' asking for the information.
- Explicit sponsorship by the watershed council helped make the survey successful (increase the response rate). Over 42% of the 110 farm owners/operators of record in Mineral Creek watershed returned the detailed, 12-page survey concerning attitudes, practices and management plans on their farm and farmstead. Twenty-four respondents signed their names indicating their willingness to be interviewed for additional soils, tillage and manure management information to aid in computer modeling for the watershed. Nineteen others who did not wish to give their names marked the general location of their farming operations on a watershed map. Thirteen of 38 non-farming rural residents (34%) also returned shorter surveys concerning their drinking water wells and septic installations.
- The Mineral Creek council identified two priority scenarios for the modelers: the impact of fertilizer application by variable rate technology (VRT); and the impact of septic loading from small communities in the watershed. CARD and TIAER scientists are working with the citizens' priorities, even though average N and P applications calculated from watershed surveys do not suggest that, overall, current users of VRT have significantly lower fertilizer inputs. The modeling will also allow evaluation of other factors' pollution prevention impact. A council member brought a local supplier and the Soil Technologies company to this project. Council members would like to test model predictions in a 2,500-acre subwatershed where most producers are using or plan to use the technology.
- The extension nutrient/manure management specialist has calculated from the survey that the manure inventory in Mineral Creek, if applied at crop removal rate, could provide enough N for 2,581 acres. The manure supply could provide enough P at crop removal rate for 3,634 acres. Approximate value of plant nutrients in manure in the watershed is over \$138,000. The project field coordinator has also used the surveys to calculate average nitrogen, phosphorus

and potassium applications to corn and soybeans, for conventional versus VRT application, and by soil associations within the watershed.

- A water quality scan was completed for the entire Maquoketa Basin at the initiative of the Mineral Creek council.

Research Modeling

Adequate research data for technical evaluation of water quality problems and potential solutions are rarely available for large, complex systems such as watersheds. As a result, models are of increasing interest as tools for watershed analysis and planning. Models can determine the principal factors affecting water quality and quantity in a watershed. They can also help evaluate the potential impacts of alternative agricultural and other land management practices prior to implementation.

The University of Minnesota scientists associated with this project are investigating the ability of the Agricultural Drainage and Pesticide Transport model (ADAPT) to predict surface water flow, nutrient and sediment responses in the climates and soils characteristic of Minnesota and northern Iowa. It is crucial to determine if the model component that describes subsurface drainage does it appropriately, since the exploitation of the highly productive soils of the region depends on extensive subsurface drainage. It is also important to determine if the snowmelt and soil freeze and thaw components work properly, since considerable subsurface drainage flow occurs in this period.

Subsurface drainage increases productivity of agricultural land, but also increases crop nutrients delivery to surface water. Producers and regulators alike depend on current field research and modeling to help understand how these economic and environmental impacts can be balanced. If the ADAPT model successfully represents conditions in Minnesota and northern Iowa, it can be used for predicting nutrient, sediment and flow impacts of various drainage and crop management scenarios.

Accomplishments of research modeling efforts:

- The ADAPT model has been calibrated for flow rate at a field scale with data from the Red Top Farms, south central MN. A poster was presented on this work - Modeling the Impact of Drainage at Field and Watershed Scales - at the American Institute of Hydrology meeting in October 2001.
- ADAPT was then used to evaluate water quality scenarios for conventional versus conservation tillage for four combinations of drain tile depth and spacing. Several conference presentations were made of this work, and a research paper, "Simulating the impact of tile depth and spacing on the soil water balance using ADAPT" was submitted to the J. of AWRA in 2002.
- A study has been completed comparing the performance of DRAINMOD and ADAPT for Minnesota conditions. Both models were calibrated with data from the Red Top Farms. The models have some similar hydrologic components but also differ in a number of aspects. Initial results suggest that it seems to be simpler to achieve satisfactory results with

DRAINMOD than with ADAPT, for the region studied. A paper on this work has been accepted for publication by the Transactions of the American Society of Agricultural Engineers.

- The method used to calibrate these models has also been a subject of study. Model calibration is very time consuming, and the quality of the calibration and hence, of the model results, depends how thorough the calibration is and the method used. A procedure is being investigated to make the calibration process more precise and faster. It has so far been applied to a simple equation for the calibration of a single parameter. The ultimate goal is to link the procedure to an optimization algorithm to use it for the simultaneous calibration of parameters of a hydrologic model (such as ADAPT). In 2002 two oral presentations were made of this work, including one at the 2002 International ASAE Conference.
- The project is collaborating with Dr. Prasana Gowda, who has developed a methodology to use ADAPT, a field-scale model, within a framework to predict water flow and nutrients to the outlet of a watershed. In this scheme, the watershed is divided, for modeling purposes into transformed hydrologic unit responses: pieces of land with the same soil units, slope, soil curve number and first crop of a rotation.
- One of the goals for FY2002 was to calibrate the flow and nitrate components of the ADAPT model with data from the 1,879-square-mile Maquoketa Basin, using monthly flow and nitrate data collected in 1994, 1995 and 1996 by the USGS and the Upper Midwest Environmental Sciences Center. This application has been challenging. In initial results, ADAPT underpredicts streamflow during two of the three simulation years. The model generally overpredicts flow in March and April and underpredicts flow in the other months. Modifications to soil freeze/thaw parameters have not solved the problem and work is ongoing. ADAPT does not predict baseflow, so methods are being evaluated to separate baseflow from streamflow in order to compare the observed and predicted streamflows. A poster on the calibration was presented at the 2002 International ASAE Conference and a paper “Using ADAPT to Study Alternative Drainage and Crop Management Practices at a Watershed Scale” was written for the 2002 International ASAE Conference Proceedings.
- During the year, this work resulted in one research publication accepted to a refereed journal, two papers in ASAE proceedings, three oral presentations and three poster presentations at conferences local and national conferences (see listing). An additional research paper has been submitted and another is in preparation. See Attachment 4 for listing.

The third annual Minnesota-Iowa Drainage Research Forum was held on August 13, 2002, at Fairmont, MN. The featured topic was modeling of N losses in small watersheds. About 85 people attended. Based on responses to the exit evaluation, the audience included about 33% university personnel, 33% government agency personnel, 4% farmer, 4% extension educators, 4% contractors, 11% consultants, and 11% industry or sales representatives. Ninety-six percent rated the forum as good to very good and most of the sessions received positive comments. Topics included a presentation by Dr. Gyles Randall which questioned the sustainability of present corn-soybean cropping systems; state research updates; a discussion comparing the new Phosphorus-Index tools developed by Iowa and Minnesota to help manage this nutrient; and a

presentation about wetland mitigation. Suggestions for next year's event include further discussion about environmental impact of drainage on watersheds. Project investigators Busman, Sands and Baker helped organize the event and this project was discussed in their presentations on current drainage research in Iowa and Minnesota.

All presentations from the forum are available as power point files on the University of Minnesota's "Drainage Outlet" web site at <http://d-outlet.coafes.umn.edu> (Attachment 5).

An Agricultural Drainage and Water Quality Field Day was held in conjunction with the research forum on August 14, 2002 at the University of Minnesota Southwest Research and Outreach Center, Lamberton, MN (Attachment 6). This was the first field day at this newly established (3 years) research facility. About 200 people attended. Nitrogen loading was the main problem discussed by scientists as they presented sites designed to research surface and subsurface drainage and rock inlets; open-ditches and wetlands; and agricultural drainage in row crop production and alternative management strategies. The respect and interest of local producers and land contractors for the new Southeast Research and Outreach Center demonstrates an emerging awareness of drainage as an important environmental issue.

Related accomplishments

Project PIs Dr. Saleh, Mr. Gassman, Dr. Baker and Dr. Wilson all served on the planning committee and as session chairs for the ASAE conference "Watershed Management to Meet Emerging TMDL Environmental Regulations" which was held in Fort Worth, TX, March 11-13, 2002. Dr. Saleh served as the conference chair. Mr. Gassman chaired a session on model applications for assessing TMDLs. Co-sponsors of the conference included USDA NRCS, USDA Forest Service and US EPA. There will be a second TMDL meeting in Albuquerque, NM, November 8-12, 2003, which will be chaired by Dr. Saleh.