Applying knowledge to improve water quality
National Water Program
A Partnership of USDA CSREES & Land Grant Colleges and Universities

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Nonpoint Source Pollution and TMDLs in a Geographically Diverse Watershed

GREAT LAKES REGION

National Themes:
Nutrient and Pesticide Management, Watershed Management

Project Description

Despite significant advances in the control of point sources for water pollution, widespread degradation of stream and river water quality continues to occur due to nonpoint sources.

This project brought together research-based information and community education and outreach to address the ongoing problem of nonpoint source pollution in the Cottonwood River Watershed in Minnesota.

Alternative (65 ha) and conventional (65 ha) management areas, including surface and subsurface drainage systems in southwest Minnesota

Project Goals

- Develop a comprehensive GIS database and predict flow, sediment, and agrichemical discharges for the study sub-watersheds.
- Estimate the cost effectiveness of reducing loads for sediment, phosphorus, and nitrate associated with alternative management practices.
- Develop educational programs and materials on pollutants, sources, control measures, TMDLs, and economics of attaining and maintaining water quality for stakeholders.
- Provide technical assistance to farmers within selected sub-watershed areas including development and evaluation of whole-farm nutrient and residue management.

PROJECT CONTACTS

Jeffrey Strock
University of Minnesota
SW Research and Outreach Center
23669 130th St.
Lamberton, MN 56152
Phone: (507) 752-5064
Email: jstrock@umn.edu

PROJECT PARTNERS

Minnesota Department of Agriculture

Local Soil and Water Conservation Districts

Pheasants Forever

Redwood-Cottonwood Rivers Control Area

MATERIALS AND PUBLICATIONS:

Cottonwood River Major Watershed Study Area Nutrient Management Summary.

Evaluation of Alternative versus Conventional Farming Systems Impacts on Subsurface Drainage Flow and Water Quality.

Farm Nutrient Management Practices in Two Geographically Diverse Watersheds in the Cottonwood River Watershed of Minnesota, USA.

Influence of Alternative and Conventional Management Practices on Soil Physical and Hydraulic Properties.

Influence of Alternative and Conventional Management Practices on Subsurface Drainage and Water Quality.

Nonpoint Source Pollution and TMDLs in Three Geographically Diverse Watersheds

Implications of Conventional and Organic Farming Practices on Nonpoint Source Pollution and TMDLs

Targeting Agricultural Drainage to Reduce Nitrogen Losses in a Minnesota Watershed

Modeling Agricultural Production Considering Water Quality and Risk

For more information about the Great Lakes Regional Water Program, please contact:

Rebecca Power
University of Wisconsin
Regional Water Liaison
Phone: (608) 263-3425
rebecca.power@uwex.edu

Actions

Education and outreach programs served as a unifying component of this project and provided a forum for stakeholder input into improving water quality in the watershed. The outreach component of this project served to improve communication between interested groups operating in the project area and accelerate the adoption and implementation of BMPs. The research provided valuable information concerning losses of nitrogen through tile drains given a variety of soil, crop, and landscape management practices and conditions.

Given the national concern for nitrate loadings through tile drains to the Gulf of Mexico hypoxic zone, this information will be useful in assessing various strategies for controlling nitrogen losses throughout the Upper Midwest. The economic analysis of the costs and benefits of reducing sediment, phosphorus, and nitrogen loadings from the Cottonwood River watershed under a variety of management scenarios will provide valuable information for decision-makers as they try to establish procedures for setting TMDLs in watersheds with similar characteristics, and as restoration efforts for the Cottonwood River proceed.

Management Practice	Water Quality Parameter			
	Drainage	NO3-N	DRP	TP
	cm		kg ha-1	
Organic	6.9	5.8	0.03	0.04
Conventional	11.6	21.9	0.06	0.08

Mean annual drainage, nitrate-nitrogen (NO3-N), dissolved reactive phosphorus (DRP), and total phosphorus (TP) loss from subsurface drainage under conventional (65 ha) and organic (65 ha) production systems in southwest Minnesota from 2002-2004.

Outcomes/Impacts

A detailed farm management and GIS database was developed, and is being used for new projects and watershed studies. Water quality data integrated with the economic analysis has been useful for predicting potential water quality and farm management outcomes given different management scenarios. New relationships/partnerships have formed among project staff and stakeholders working toward a common goal. Experiments evaluating the effects of long-term alternative, including organic production, and conventional management practices on soil physical and hydraulic properties revealed that alternative management practices improved soil physical properties and should provide environmental benefits to improve water quality compared with conventional management practices.

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