Paired Watershed Studies

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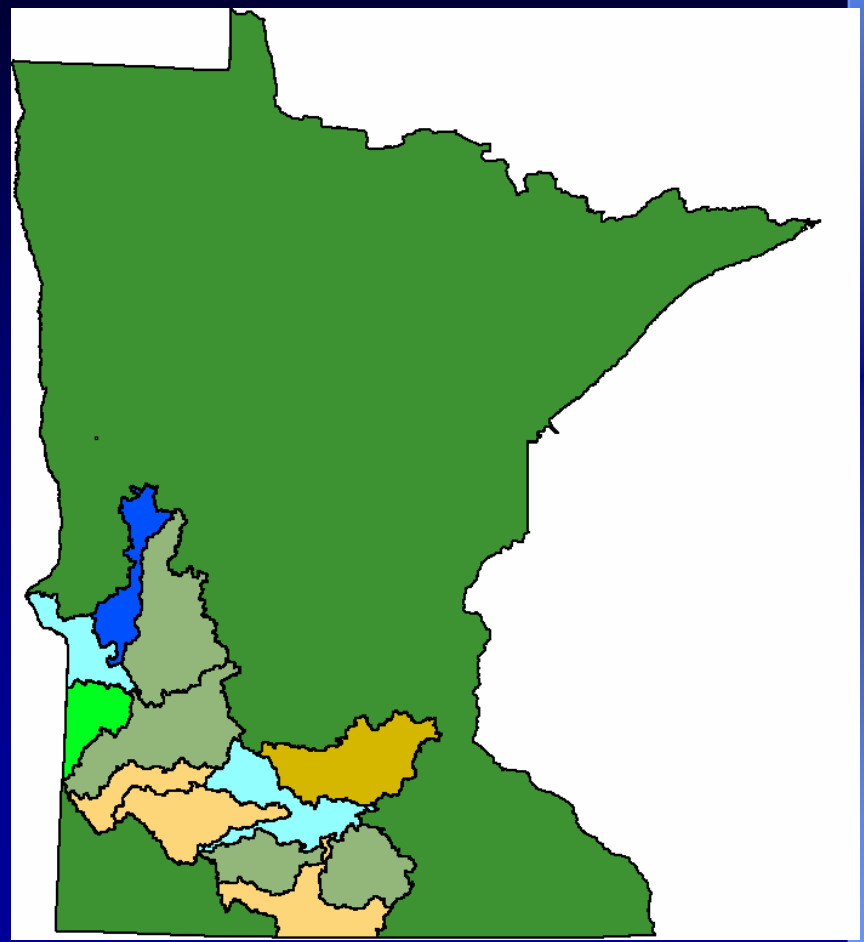
Identifying the Problem

- Farmer led initiative arising out of concerns for water quality in the Minnesota River and the role of farmers in addressing this issue
- Concern over lack of scientific data to evaluate effectiveness of BMPs in improving water quality
- Concern over differences of opinion about how much water quality degradation arises from farming

Minnesota River Basin

- Most impaired river basin in Minnesota
- Flows 335 miles and drains 16,770 square miles
- Basin contains 12 major watersheds
- Major source of sediment, phosphorus, nitrate-N to Mississippi River

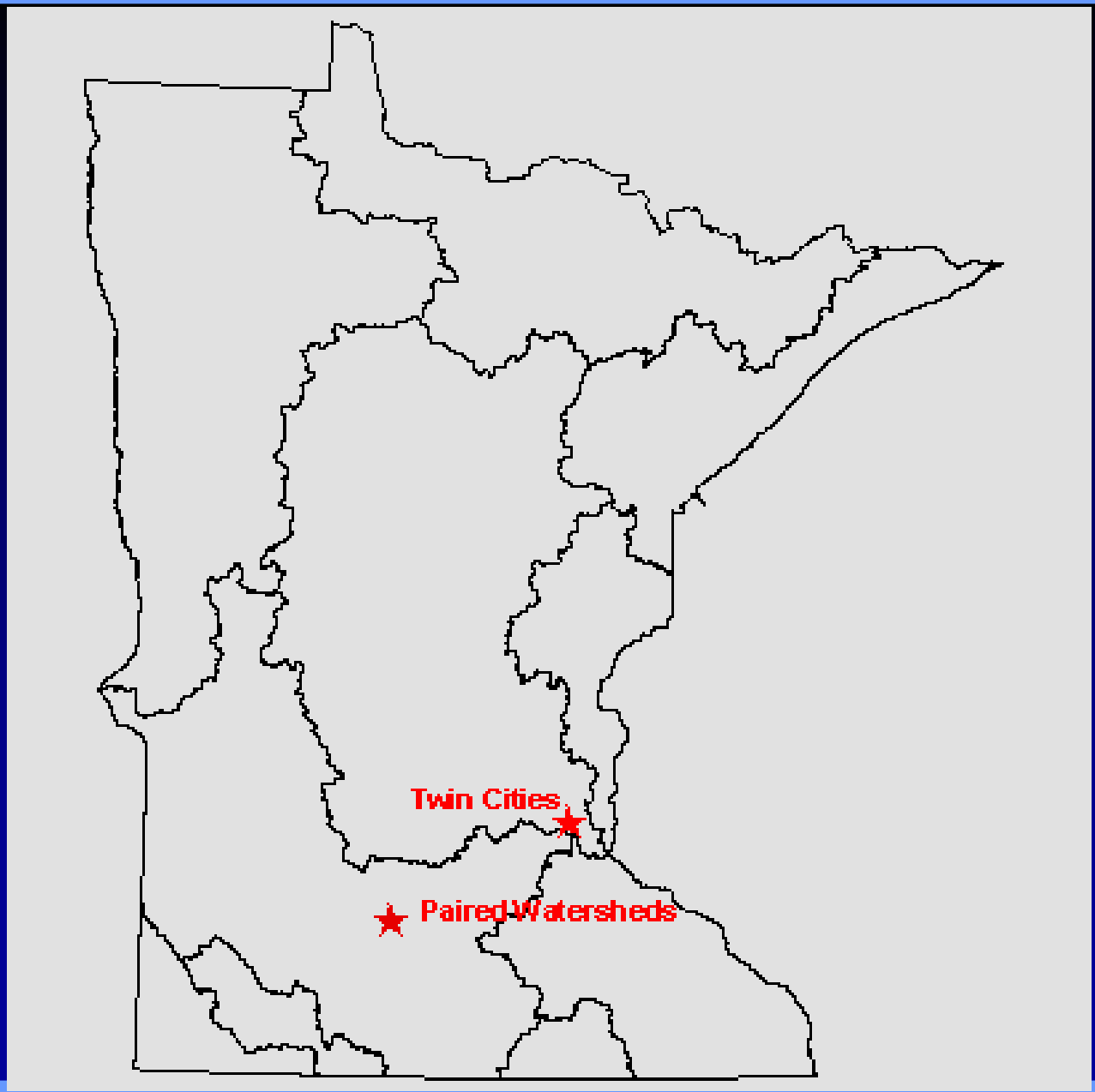


Minnesota River Land Use

- 92% of the land is associated with agricultural activity
- 8.7 million acres of tillable land, produces 41% of Minnesota's corn, 51% of its soybeans, and 11% of its wheat, and several billion dollars in state revenue
- 9700 feedlots with 41% of Minnesota's hog production and 22% of its beef production
- 367 million cubic feet of manure are produced every year
- 30,000 septic systems discharging untreated sewage directly into streams and ditches
- 138 municipal wastewater treatment facilities

Project Overview

- Farmer led and initiated effort to accelerate voluntary adoption of BMPs
- Develop and implement BMPs
- Measure water quality in paired watersheds before and after BMPs
- Estimate costs and benefits of BMPs
- Develop public education to increase adoption of BMPs

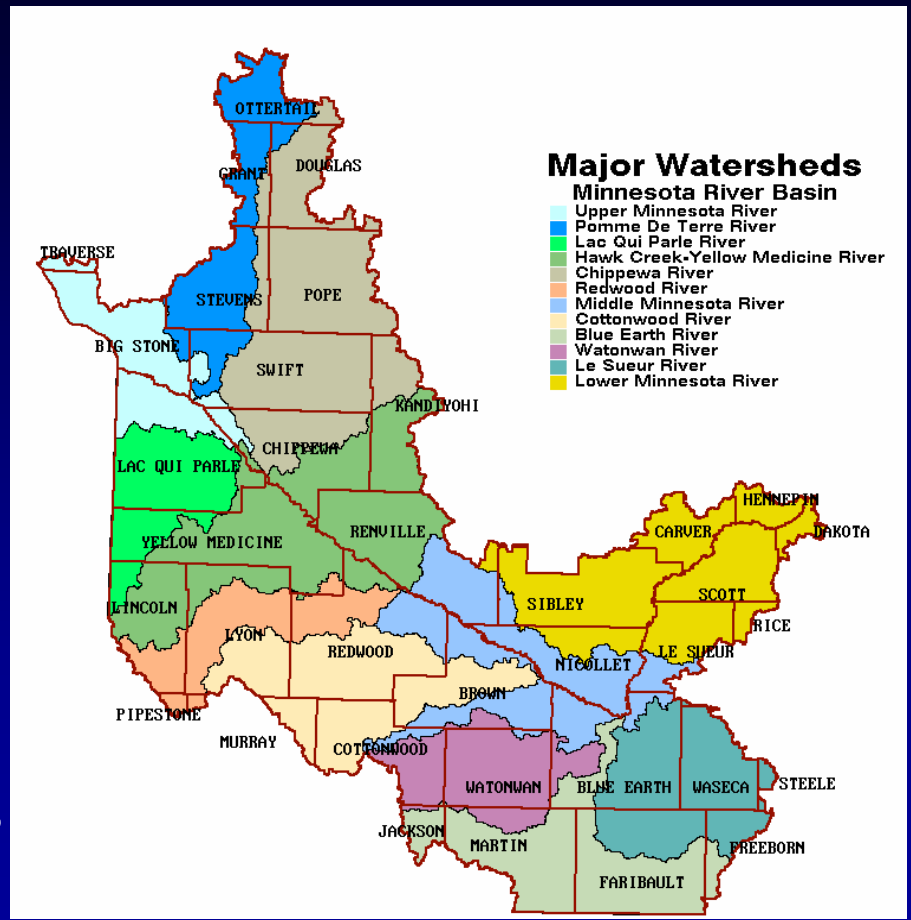

Twin Cities
Paired Watersheds

Project Goals

- Accelerate the voluntary adoption of BMPs in MN River Basin
- Achieve measurable improvements in water quality using paired watersheds
- Develop and disseminate farmer led and farmer sanctioned water quality initiatives in the MN River Basin

Project Actions

- Build stakeholder team
- Water quality monitoring
- Survey of existing practices and yields
- Economic evaluation
- BMP selection and promotion
- BMP implementation
- Water quality modeling
- Education and dissemination of results



Project Development

- Process
  - Collaborative development of proposal by University of Minnesota, Minnesota Dept Agriculture (MDA), farmers and commodity groups
- Timeline
  - Long-term process started in 1995 or so
  - Minnesota River Agricultural Team (MnRAT)
    - Reviewed Minnesota River Assessment Project
  - 319 project (not funded)
  - 406 Proposal submitted once before approved
  - Funding started in 2001, no cost extension in 2004

Project Team Members

- Farmers and Co-op agronomist
- Mary Hanks, Paul Burns, MDA
- David Mulla (soils), Mary Renwick (economics), Jim Anderson (outreach), Univ. Minnesota
- Judy Hansen (county commissioner), Tina Rosenstein, Pam Rivers, Nicollet County Environmental Services
- Kevin Ostermann, Nicollet County SWCD
- Gary Hachfield, Minnesota Extension Service

Team Building

- Farmers
- Minnesota Department of Agriculture
- MnRAT (pre-existing since 1995)
  - Involved in high level discussions concerning strategy for cleaning up Minnesota River
- University of Minnesota
  - COAFES
  - Extension
  - Water Resource Center
  - Soil, Water and Climate

Stakeholder Input

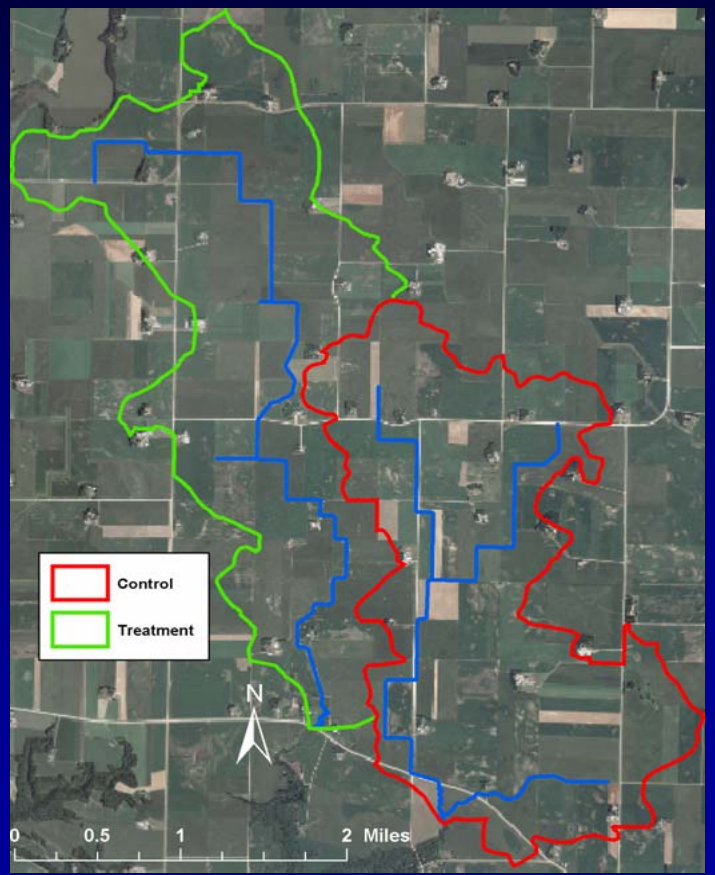
- Proposal writing phase
- Watershed team building phase
- Farm survey phase
- BMP implementation

Proposal Writing Phase

- Took ideas from core group
- Heavy input on writing from MDA
- Had strong letters of support from a diverse group of stakeholders because they had been engaged from an early stage

Selection of Study Area

- Nicollet county water quality projects existed
- Strong support from county staff (Judy Hanson, Extension, SWCD, Tina Rosenstein)
- Needed a rural area with no lakes
- No previous water quality data to base selection, no known water quality problems



Watershed Team Building Phase

- Initial team meetings with small core group to identify strategy
- Meetings with county partners (agency partners)
  - Decided to include watershed farmer representatives
- Discussed idea of including agronomist from local farm co-op
- Finalized project strategy after including farmer and co-op representatives

Farm Survey Phase

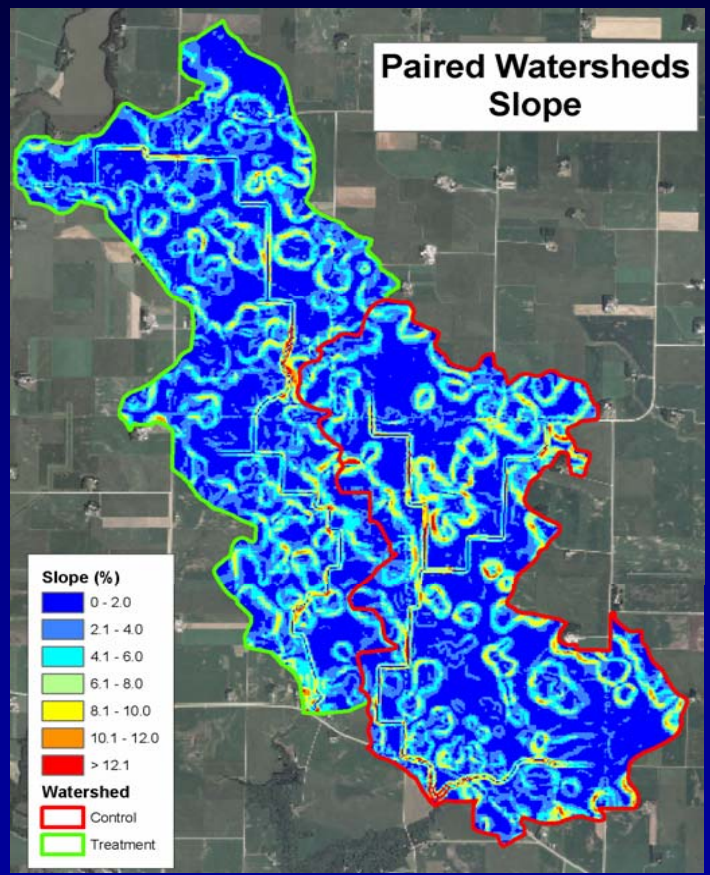
- Co-op agronomist and farmer representatives promoted project to farmer participants
- Sent letters about introductory meeting, presented project to farmers
- Farmers willing to participate because they felt we were listening to them

Developing Farm Surveys

- Adapted pre-existing farm survey used by MDA, some difficulties in this process
  - Everyone had different conceptions about how the survey results would be used
- Pre-tested surveys with farmer representatives and other producers
  - Eliminated questions about land rental rates
- Built up relationships with farmers through one-on-one surveys

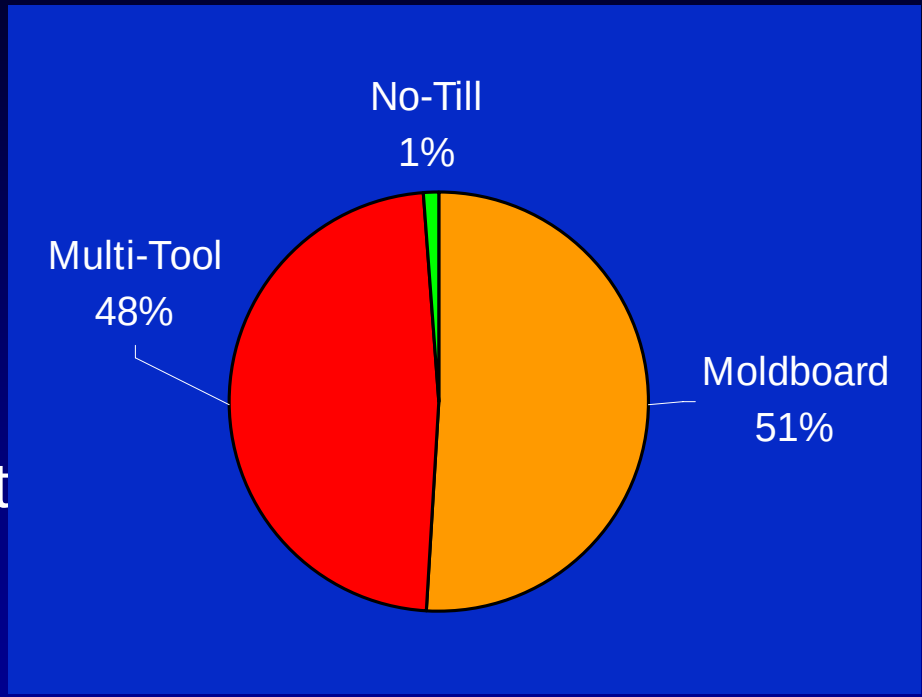
Farmer Surveys

- Met with each farmer in their house one-on-one for about 3 hours, paid each farmer $100
- Surveys covered 84% of study area (only 1 farmer with significant land area chose not to participate)
- Surveys used to identify existing practices and diversity of management systems
- Surveys helped establish sense of group identity among farmers

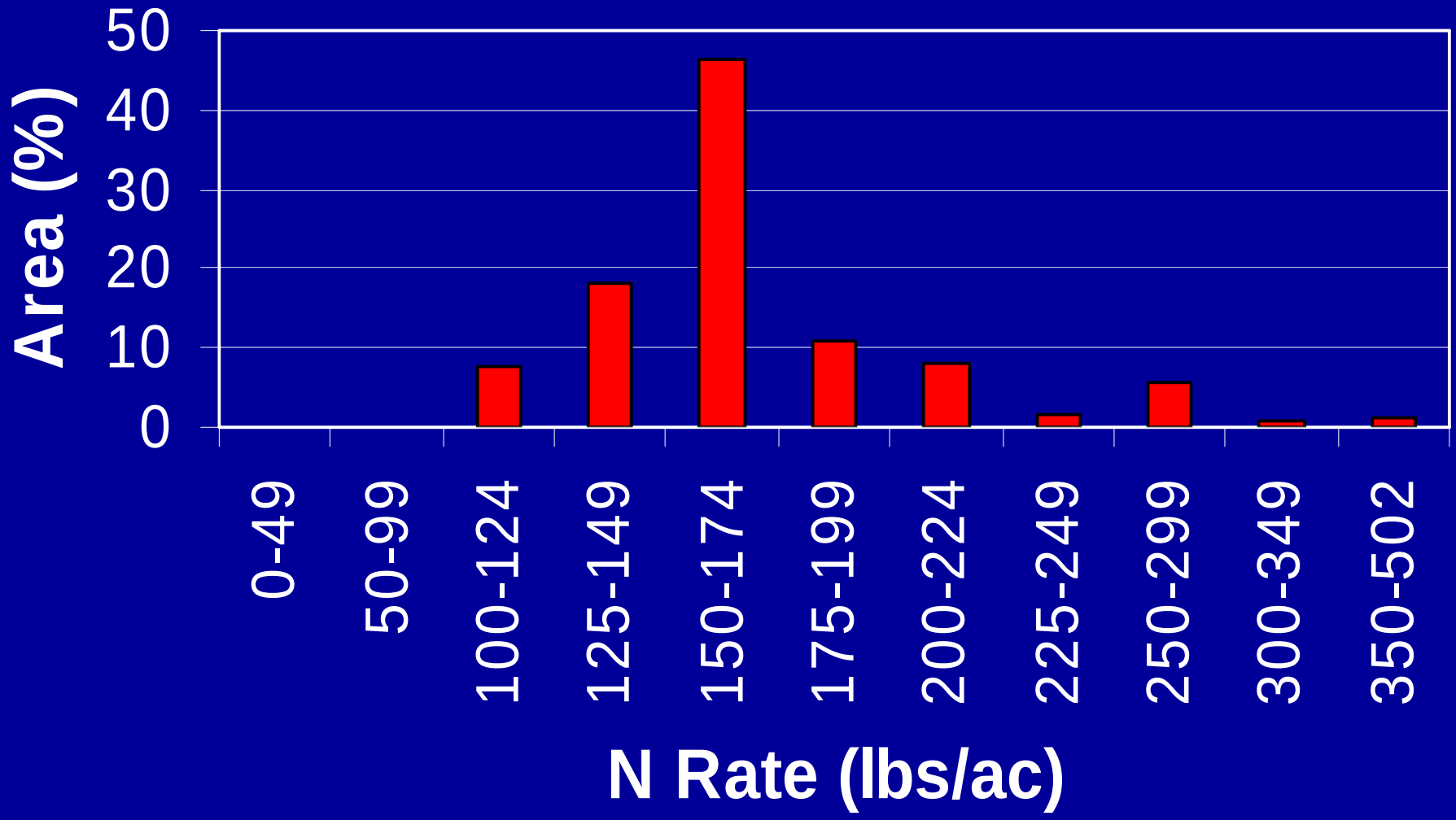


Survey Results

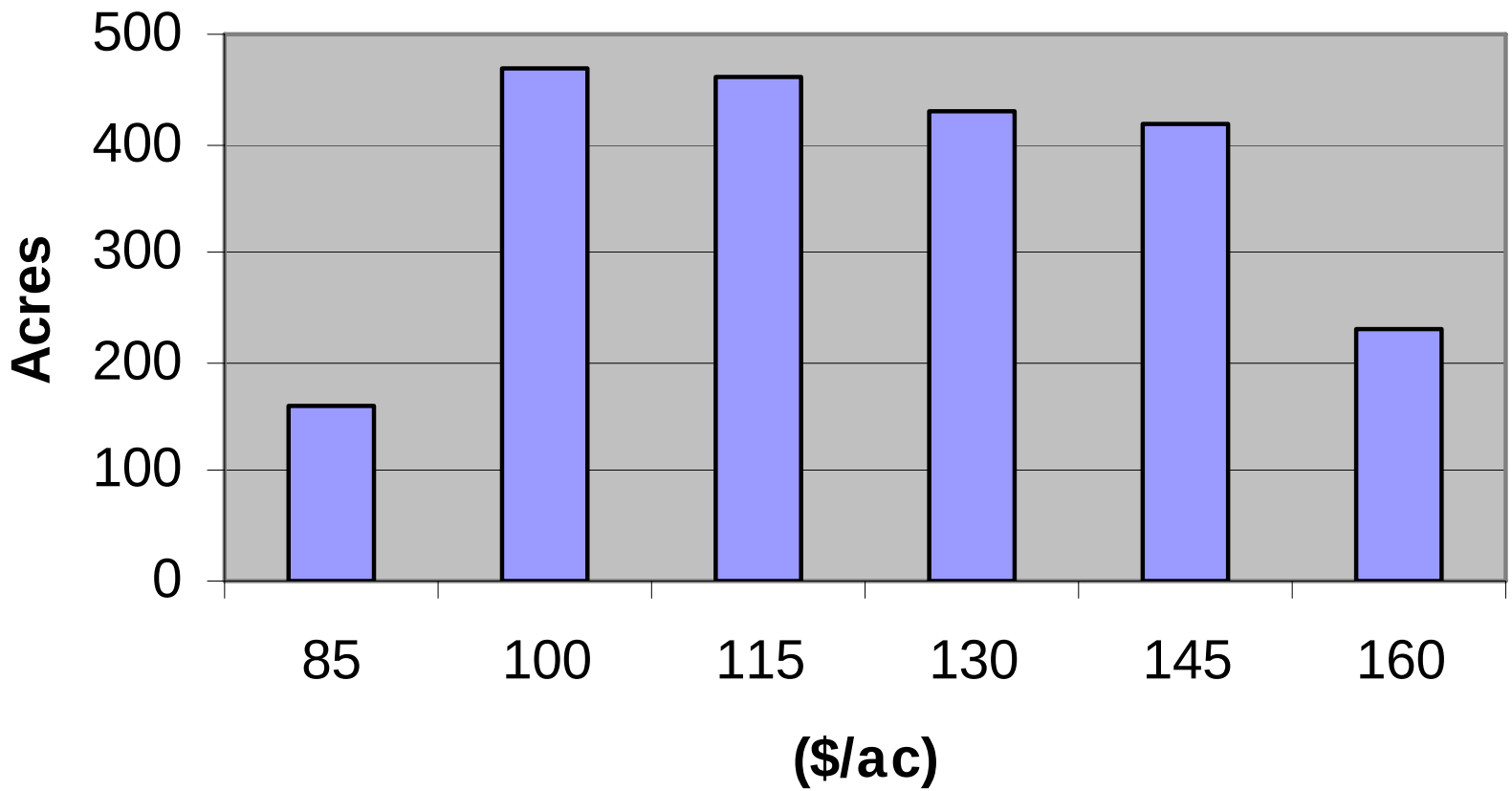
- Surprised by:
  - Extent of moldboard plowing on corn residue
  - High rates of nutrient applications to corn



Nitrogen Rates on Corn



Input Costs-Corn



BMP Implementation Phase

- We didn’t tell farmers what to do
- We met with them individually and reviewed their current practices
- Then asked them what do you think you could do differently to improve water quality?
- Many would then ask us to make recommendations

Implementing BMPs

- Success in implementing BMPs was based on trust
- Tried implementing practices suggested by farmers, even though we didn't think they'd be effective
- Nutrient BMPs and buffer strips were difficult to sell, tillage and drainage BMPs easier
- Many farmers said they would be willing to adopt whatever the rest of the group was doing
- Once the first farmer changed to CRP many others followed

Best Management Practice Implementation

- For the 2003, 2004, and 2005 crop years a BMP was implemented on 49%, 63%, and 56% of the cultivated acres in the treatment watershed, respectively
- ~41% of the cultivated acres have been grid soil sampled using a 2-acre grid spacing since the beginning of the project
- ~33% of the open intakes replaced by rock inlets
- ~20% of the open intakes modified with hickenbottom risers
- 11 fields have buffer strips

Best Management Practice Implementation

- Tillage BMPs
  - Multi-tool used on corn residue that would have been plowed
    - 2003 crop year – 68%
    - 2004 crop year – 73%
  - No-till on soybean residue that fall tillage would have occurred
    - 2003 crop year – 12%
    - 2004 crop year – 11%

Maintaining Collaboration

- Graduate student presence and continuity as main point of contact
  - Regular travel to watershed
  - Regular phone communication
- Relationships
  - Trust
  - Respect
  - Two way communication
  - Follow through on actions

Project Management

- Regular meetings of team
- Progress reports with farmers
- Fiscal matters decided at beginning of project
  - $244,687 in salaries and fringe benefits
  - $45,000 for water quality monitoring
  - $5,100 for travel to sites
  - $141,826 for farmer participation/surveys
  - $102,387 for overhead
- Getting farmers paid in a timely fashion through the University was a challenge

Challenges

- More time needed to
  - Build relationships
  - Sell nutrient BMPs
  - Get BMPs implemented and measure their impacts
- Climatic variability
  - Large storm in washed crop residue away in treated watershed
  - But, farmers more convinced about effectiveness of residue management after seeing lack of gullying on high residue fields
- Beavers
  - Built dams downstream of water quality monitoring station, reduced accuracy of flow measurements in first year

Gas Pipeline Project

- Pipeline project in study area
  - Unexpected
  - Took a lot of time to mitigate effects
  - Luckily the weather and timing of the construction was ideal and pipeline had minimal impacts on results
  - Farmers more informed about pipeline project and had access to governmental checks and balances as a result of our influence
  - Ongoing litigation for compensation to farmers

Challenges

- Dealing with different personalities and social aspects of project
  - Family member pressure
  - Age and income differences
  - Availability of time to implement new practices
- Co-op uses different philosophies for nutrient management than the university (no zero rate for variable P)

Integrating Research and Extension

- One-on-one contacts were very effective at getting changes on the ground
  - Used opportunity to summarize research
  - Discussed strengths and weaknesses of existing management practices
- Resistance to N BMPs
  - University has abundant data to show benefits of reduced N rates
  - Farmers receive most of their information from local agronomist who helps determine nutrient management practices

Extension

- Farmers generally unfamiliar with extension bulletins and information outlets
- Reorganization of Extension impacted the project negatively (reassignment of project member)
- Unexpected synergy developed with a separately funded phosphorus index outreach project
- County helped farmers buy tillage equipment

Project Accomplishments

- Successful team building
- High survey participation rates (84% of area)
- Documented existing tillage, nutrient management practices
- Documented water quality impacts of farming
  - 472 lb/ac TSS
  - 0.8 lb/ac TP
  - 24.9 lb/ac NO3-N
  - 5.5 inches drainage and runoff (out of 22” precipitation)
- This information will be useful in addressing Total Maximum Daily Loads in similar soils and landscapes of the Minnesota River Basin

Project Accomplishments

- Implementation of BMPs
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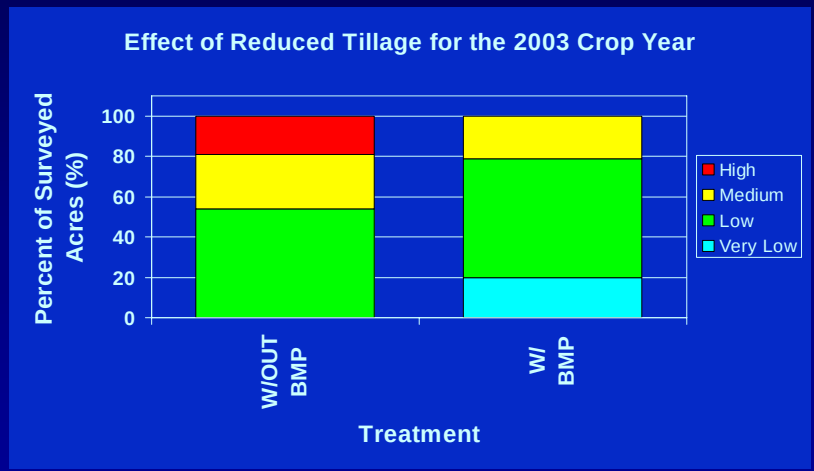
Project Accomplishments

- Tested phosphorus index model
  - Reduced phosphorus transport significantly on 20 fields representing 20% of the area through tillage BMPs
  - Reduced phosphorus transport significantly on 11 fields through filter strips
  - Model will be used extensively in Minnesota



Water Quality Impacts

- Water quality patterns
  - Most sediment and P carried in large storms
  - 41% reduction in sediment delivered from fields targeted for conservation tillage
  - Reductions in sediment (20%) and phosphorus (15%) delivery to the watershed estimated as a result of implementing BMPs
  - No improvements in water quality measured at mouth

Factors Affecting Willingness to Adopt BMPs

- Age of farmer
- Size of farm and time required for BMP
- Amount of capital available
- Type of equipment available
- Likelihood that adoption will increase yields or profitability
- What the neighbors or relatives think
- Awareness of water quality impacts
- Influence of the local agronomist

Lessons Learned

- Pre-existing farmer-agency-university relationships critical to project
- Project coalesced after team building and farmer surveys
- Farmer participation is dependent on support from local agronomists and county personnel
- The types of BMPs implemented are best developed in one-on-one conversations with farmers and discussions about their specific management systems
- It takes a long time to see effects of BMPs on water quality

Acknowledgement

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