



# Effects of Agricultural Land Retirement of the Minnesota River Basin

Victoria Christensen and Kathy Lee  
USGS, Mounds View, MN

Prepared in cooperation with the Minnesota Board of Water and Soil Resources with partial funding from the Minnesota Environment and Natural Resources Trust Fund

U.S. Department of the Interior  
U.S. Geological Survey

## Reason for Study

- RIM, CREP, and CRP were all designed to improve water quality.
- Agricultural land commonly is retired on the basis of field-scale research that shows improved water quality
- Currently no Minnesota or Federal programs exist to evaluate the effectiveness on water quality and aquatic biology on a watershed scale
- This study evaluates the effectiveness of agricultural land retirement programs for 3 streams in the Minnesota River Basin and try to answer the question:
  - Does the amount and proximity of retired lands improve biological integrity?

## Reason for Study



## The Minnesota River Basin

- **Primarily agricultural**
- **Concern over soil erosion**
- **Sediment and nutrient loads are high**

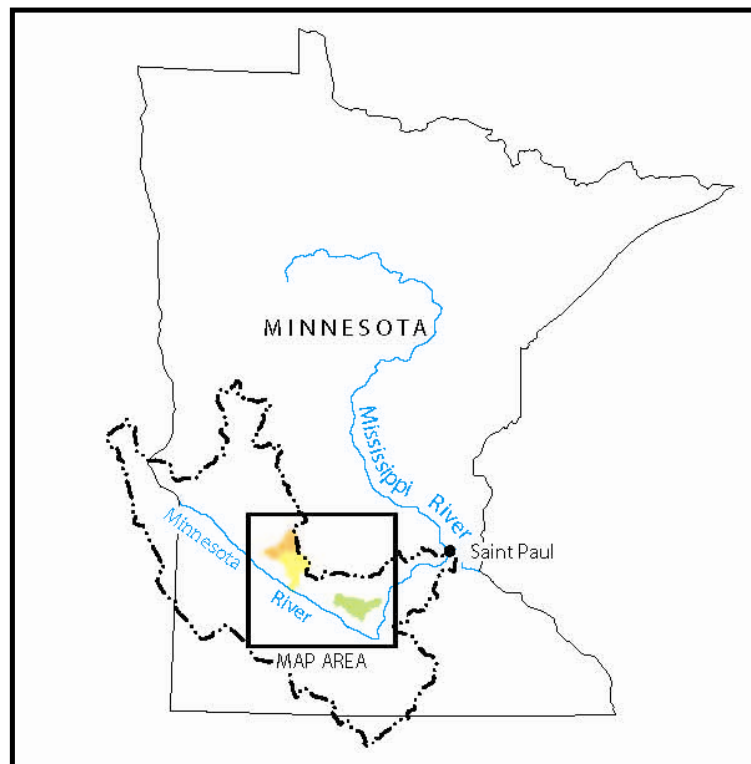
## Objectives

- **Characterize and compare streamflow, water quality, and biological conditions in the Minnesota River Basin**
- **Compare spatial and temporal variability in water quality and biological conditions to the amount and location of land retirement**

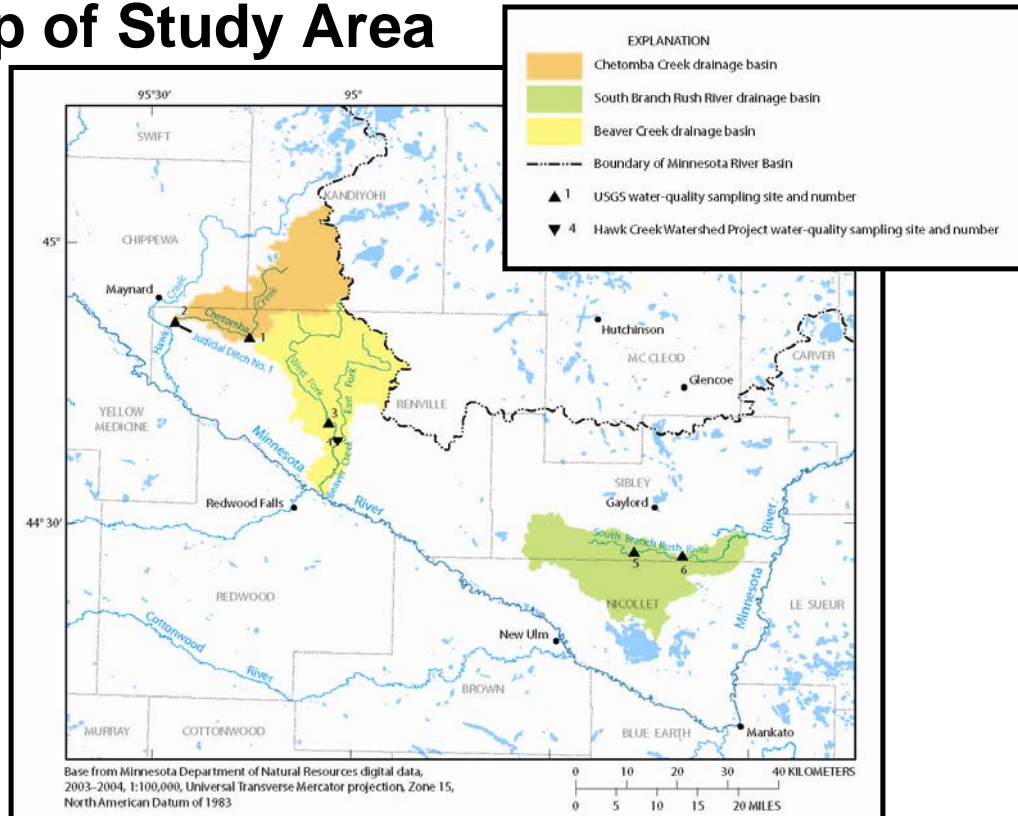
# Today's Presentation

- **Nutrient and chlorophyll-a concentrations in Chetomba Creek, West Fork Beaver Creek, and South Branch Rush River, 2005-2007**
- **Biological conditions in 2006 and 2007**

## Map of Study Area



# Map of Study Area



## Site selection

- **17 site selection parameters included:**
  - Slope
  - Basin size
  - No in-line lakes
  - Climate
  - Basin drainage and sinuosity
  - Soil type (cluster analysis)
  - Range of land retirement conditions

## Land use



Photo by Loren Engleby, Kandiyohi County

## Land use



Photo by Loren Engleby, Kandiyohi County



# Land use



South Branch Rush River at Bernadotte



South Branch Rush River at Norseland

# Land use

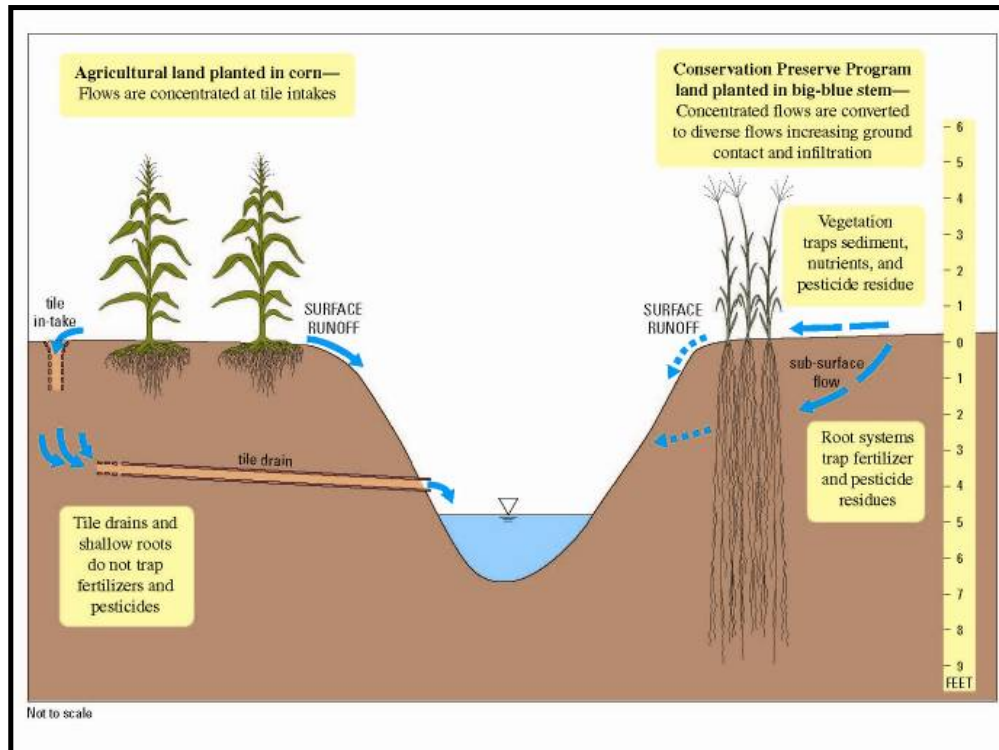


West Fork Beaver Creek



Photo by Stephanie Klamm, Hawk Creek Watershed Project

# Land use

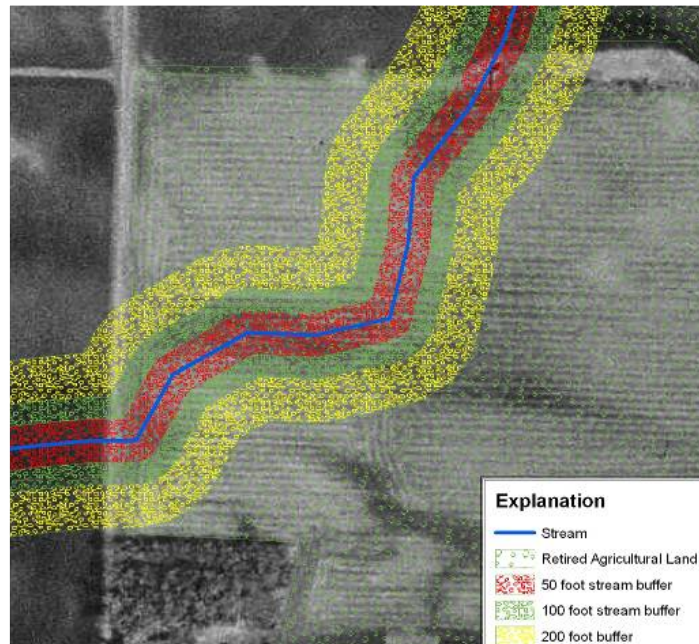


## Methods: GIS land retirement data

- Land retirement data included:
  - Conservation Reserve Program (CRP)
  - Conservation Reserve Enhancement Program (CREP)
  - Reinvest in Minnesota (RIM)
  - Pheasants Forever
  - Wildlife Management Areas
  - USFWS Waterfowl Production Areas

# Intensity of Retired Lands

- Calculated for 50ft, 100ft, 200ft, and 300ft buffers
- Most retired land in these basins is riparian
- Intensity of retired lands is greatest in the 50ft buffer

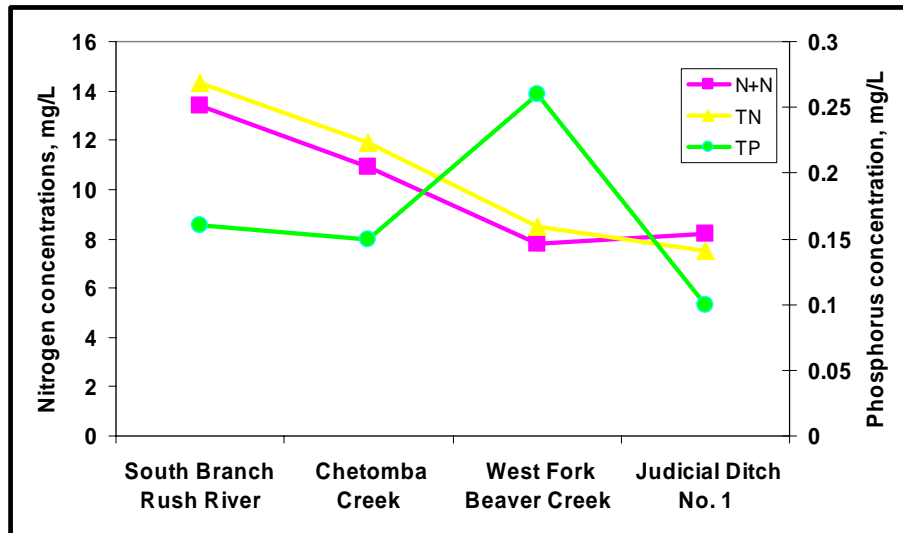


# Percentage of Land Retirement

	Basin	300-ft Buffer	200-ft Buffer	100-ft Buffer	50-ft Buffer
Chetomba Creek	3.1	3.9	4.3	5.1	5.7
Judicial Ditch No. 1	6.3	9.4	11.3	15.3	18.7
West Fork Beaver Creek	3.7	6.2	7.5	9.5	10.4
South Branch Rush River	1.5	2.7	3.2	5.1	7.6

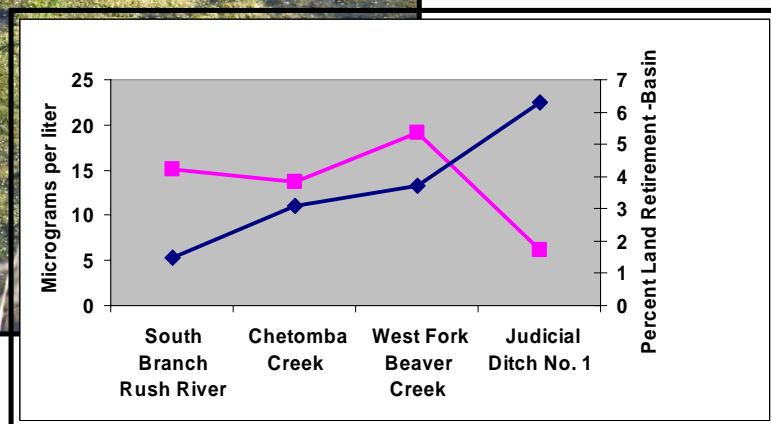
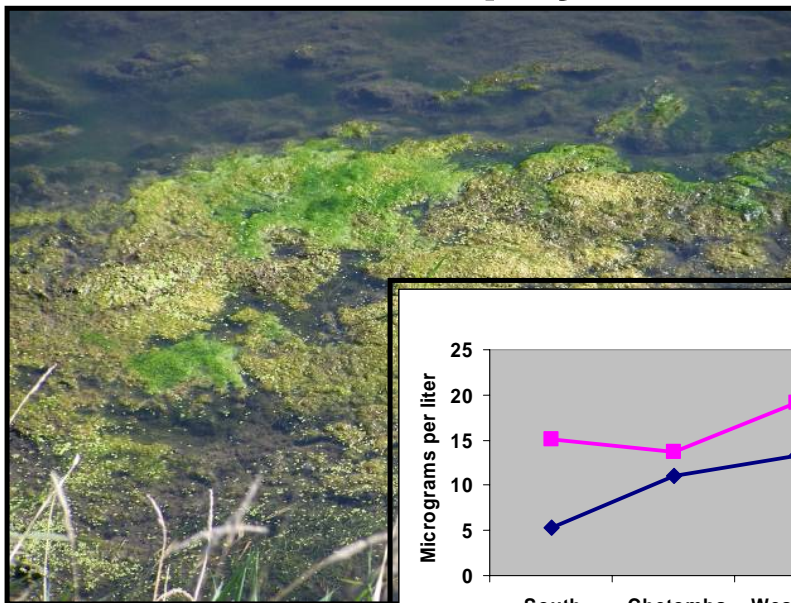


# Results: Nutrients



→  
Increasing land retirement percent (basin)

# Results: Chlorophyll-a



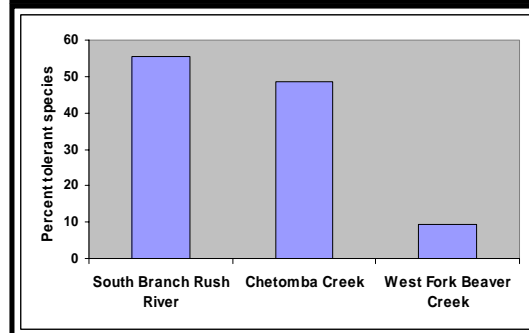
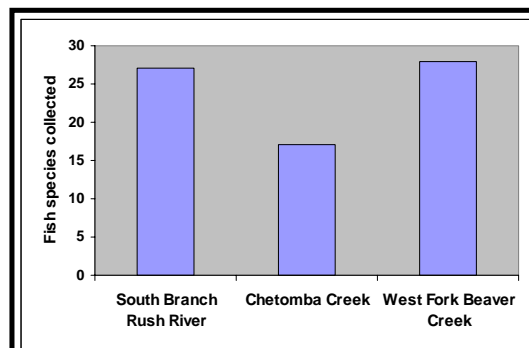
→  
Increasing land retirement percent (basin)

## Results: Fish

- 21 species of fish from 5 families collected
- Majority of fish were from Cyprinidae family
- Five taxa were classified as tolerant fish
- West Fork Beaver and South Branch Rush similar numbers of fish collected, but South Branch Rush had more tolerant species



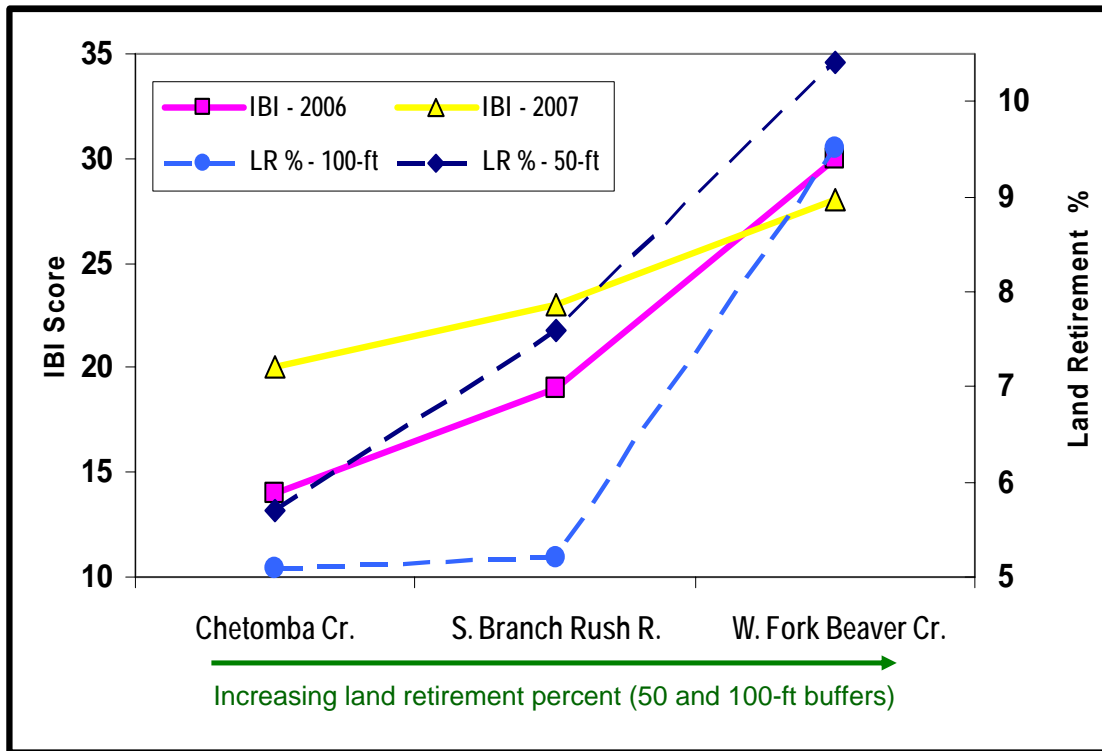
## Fish Collection 2006 and 2007



- Number of species collected at West Fork Beaver Creek indicates better resource quality

Increasing land retirement percent (basin)

## Results: IBI Scores



## Conclusions

- Total nitrogen decreased with increasing retired land percentage
- Most tolerant fish species were found at the sites with the least land retirement
- IBI scores increased as local land retirement percentages (50-ft and 100-ft buffers) increased



West Fork Beaver Creek

# Acknowledgments

- Eric Mohring, Minnesota Board of Water and Soil Resources
- Konrad Schmidt, Minnesota Department of Natural Resources
- Minnesota Environment and Natural Resources Trust Fund
- USGS Personnel:



## For More Information:

- [vglenn@usgs.gov](mailto:vglenn@usgs.gov)
- <http://mn.water.usgs.gov>