

# Changes in Cropping Patterns Affect Nitrate-N in the Raccoon River Basin

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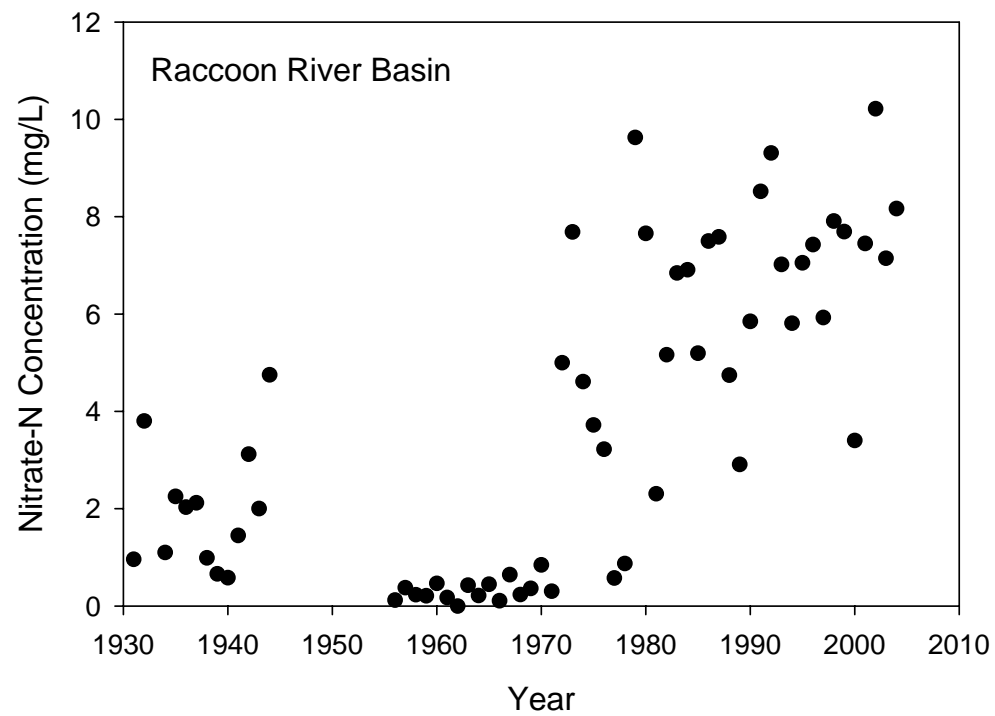
# Background

- Nitrate movement from agricultural lands into creates an environmental concern, e.g., drinking water, hypoxia
- Temporal and spatial trends in nitrate-N have not been fully investigated

# Raccoon River Watershed

- Intensive agricultural area (1,500,000 ha) in central Iowa on the Des Moines Lobe
- Intensive corn-soybean production area
- Source of drinking water for Des Moines and surrounding communities, DSM has the world's largest nitrate removal system
- Area for locally lead Producer Cooperative effort to understand watershed dynamics (ACWA)
- Measurements of nitrate-N since 1930's

# Nitrate Trends



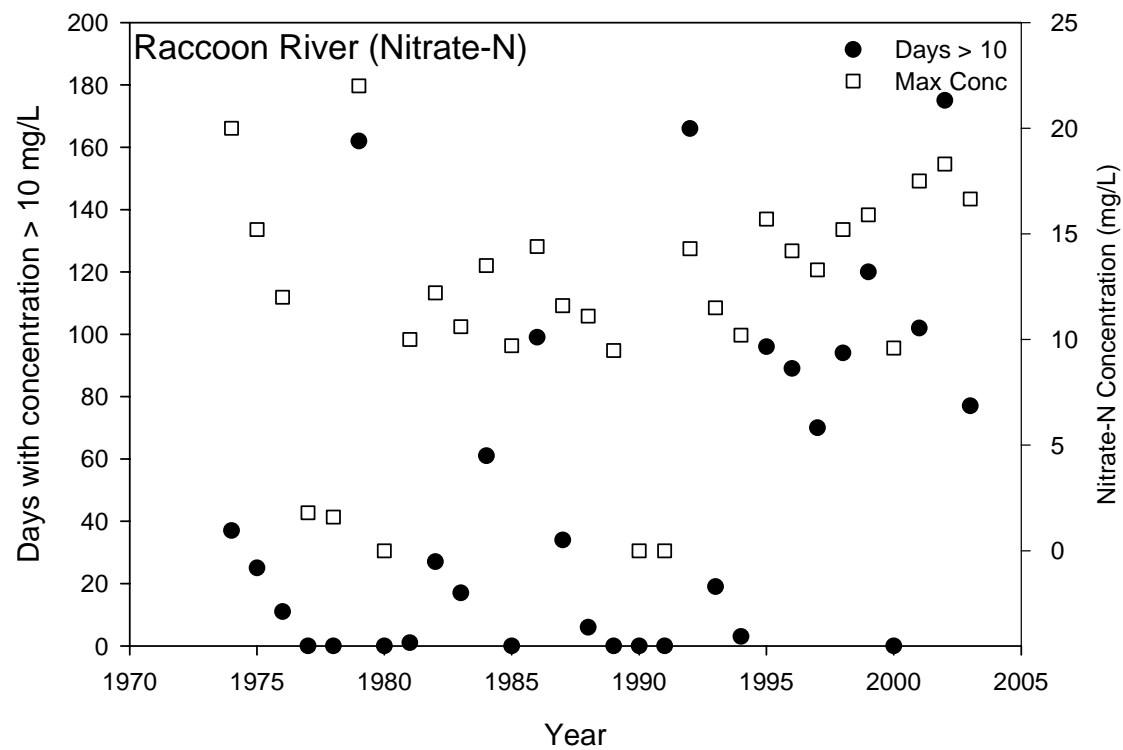
# Concerns

- Increasing trend in nitrate-N concentrations causes concern about future concentrations
- Increasing need to treat water to meet drinking water standards
- What is the role of agricultural practices on nitrate-N concentrations

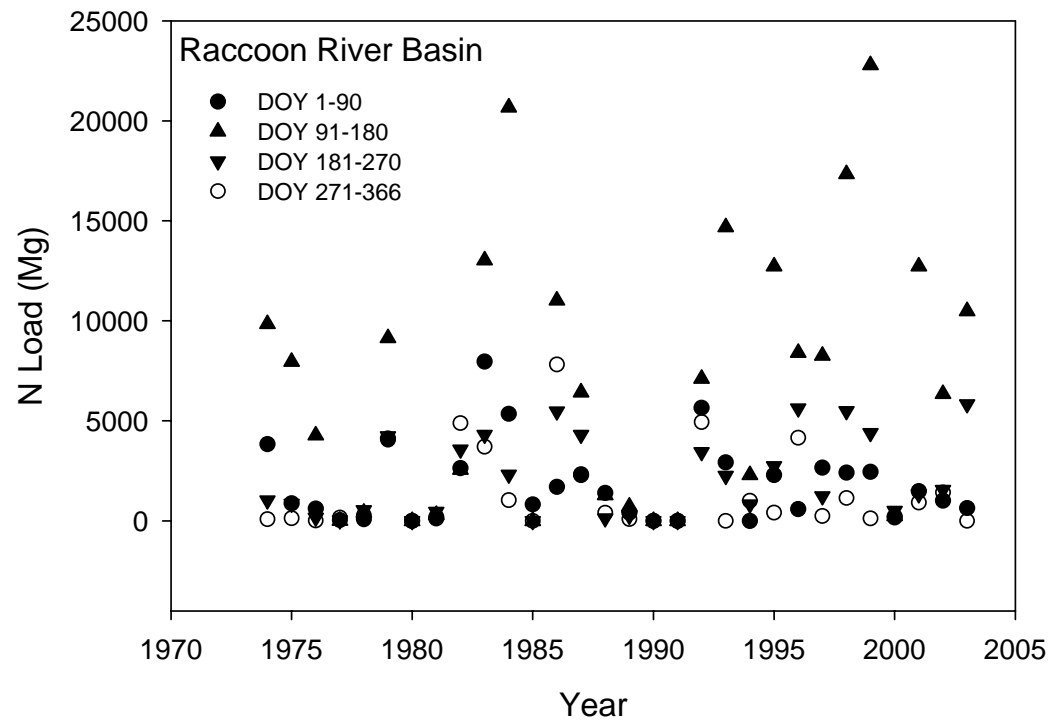
# Questions

- What is the cause of the increasing trends in nitrate-N levels in the Raccoon River?
- What is the impact of changing agricultural practices in the watershed on nitrate-N concentrations?

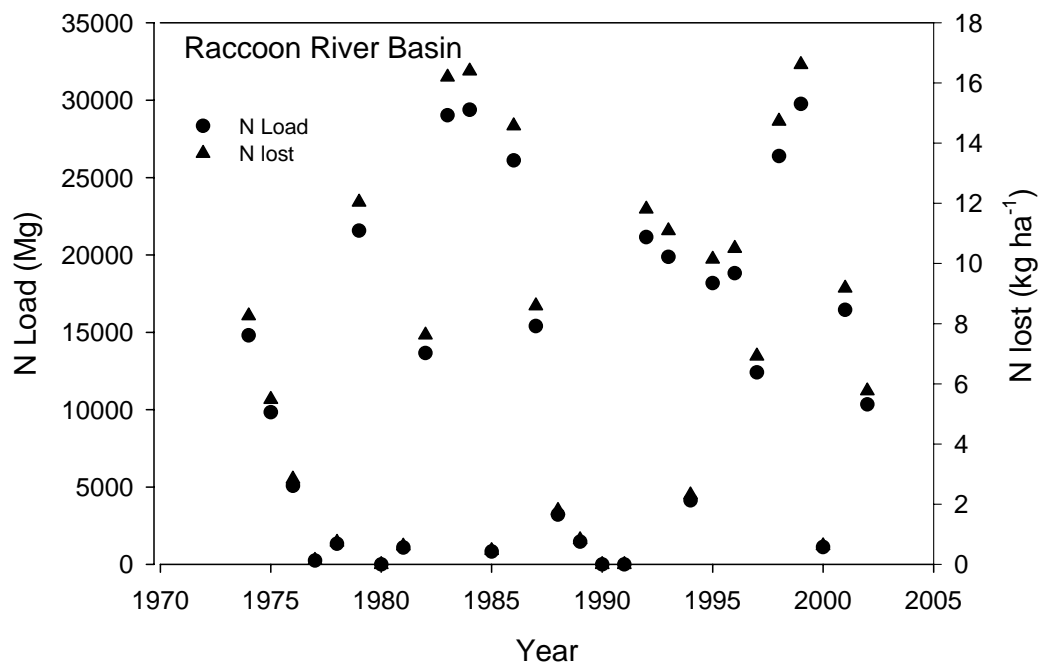
# Nitrate Concentrations



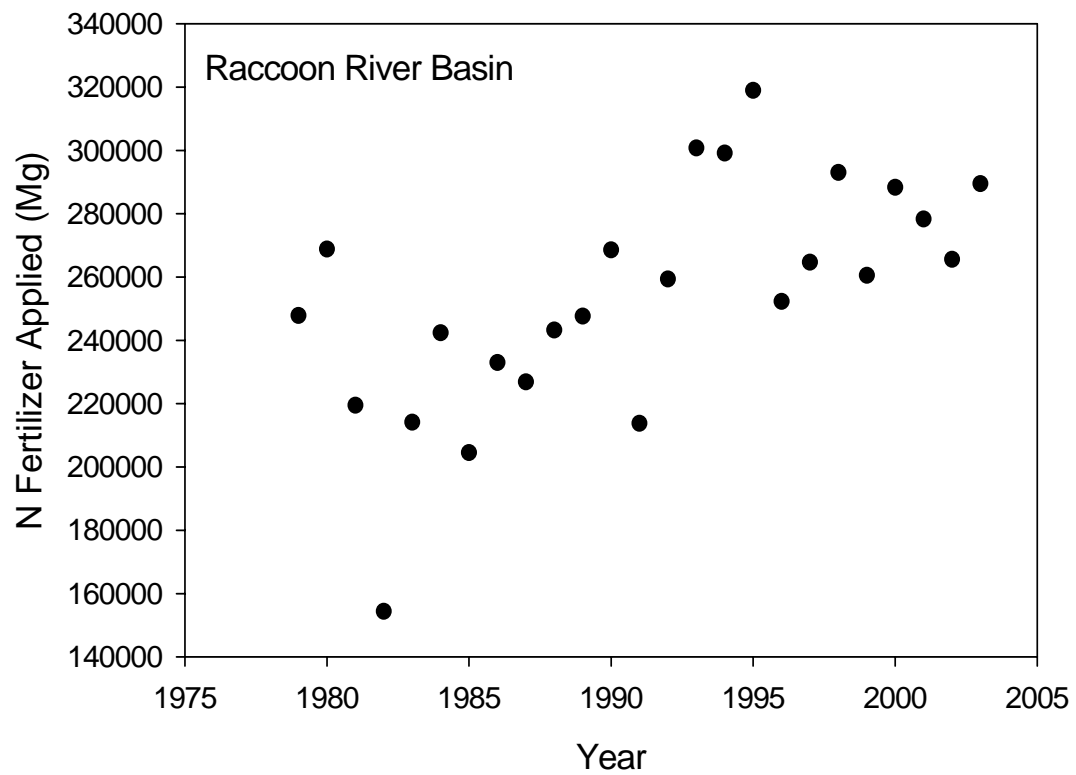
# Nitrate Loads



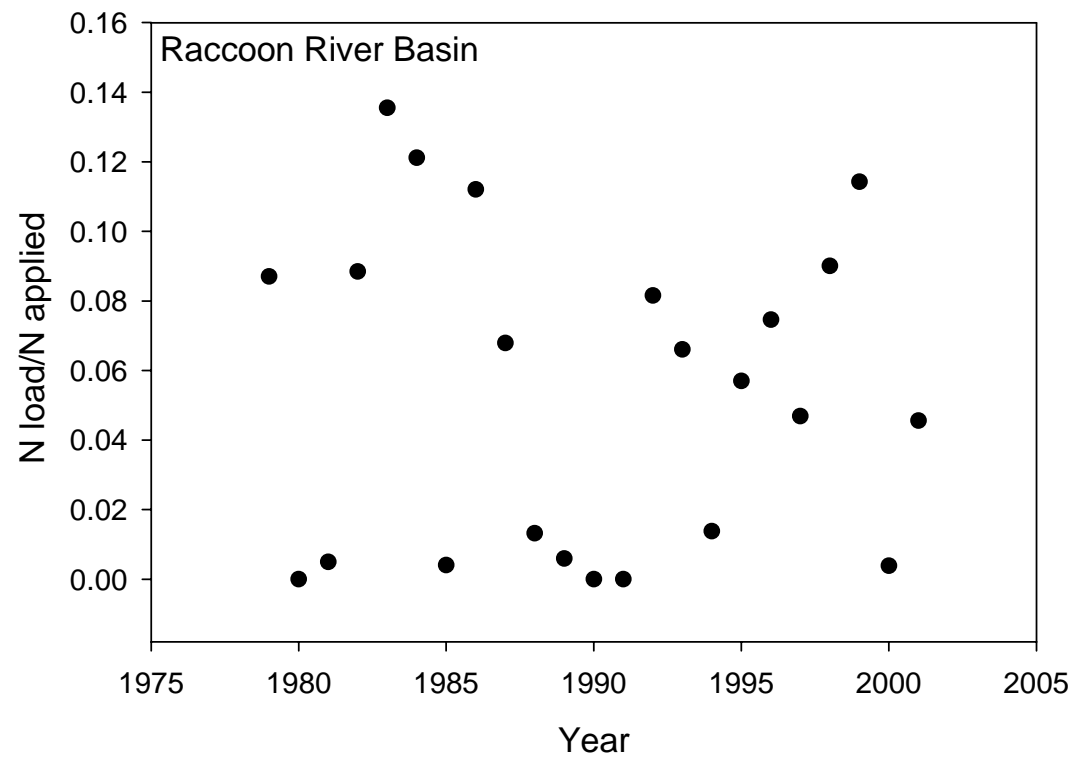
# Nitrate Loads vs Loss



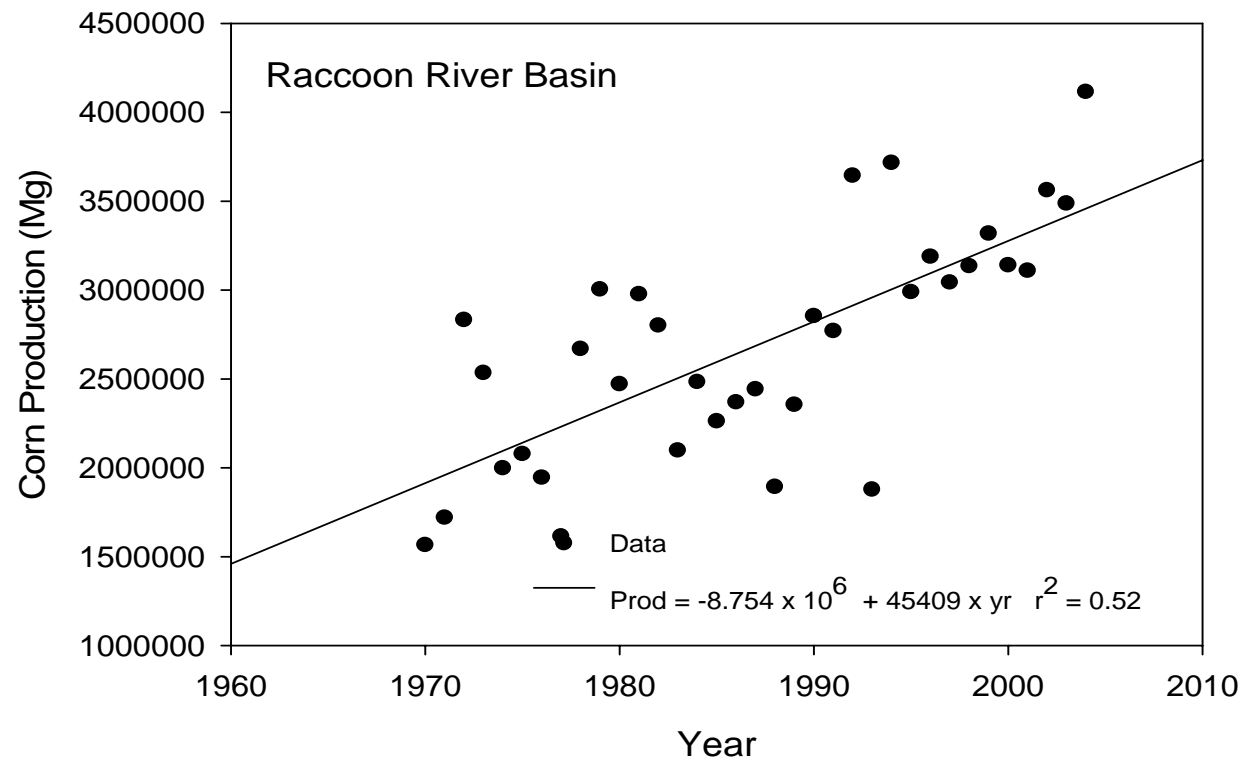
# Fertilizer Application



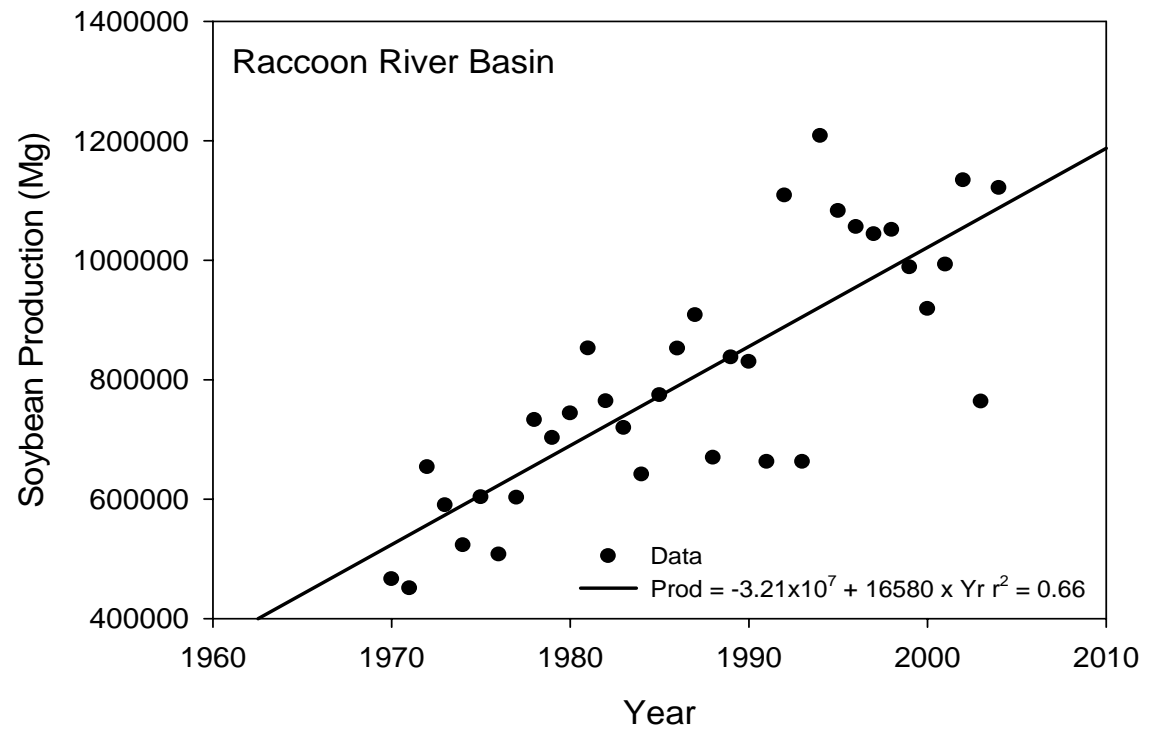
# N Load/N Applied



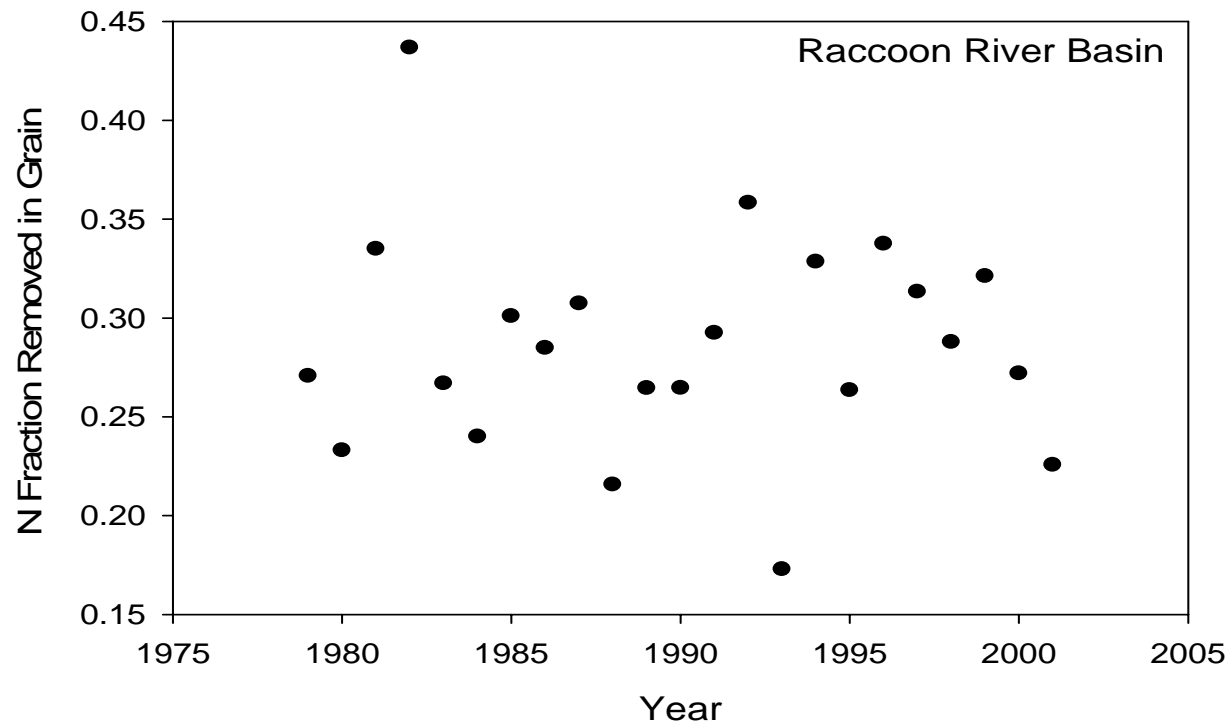
# Corn Production



# Soybean Production



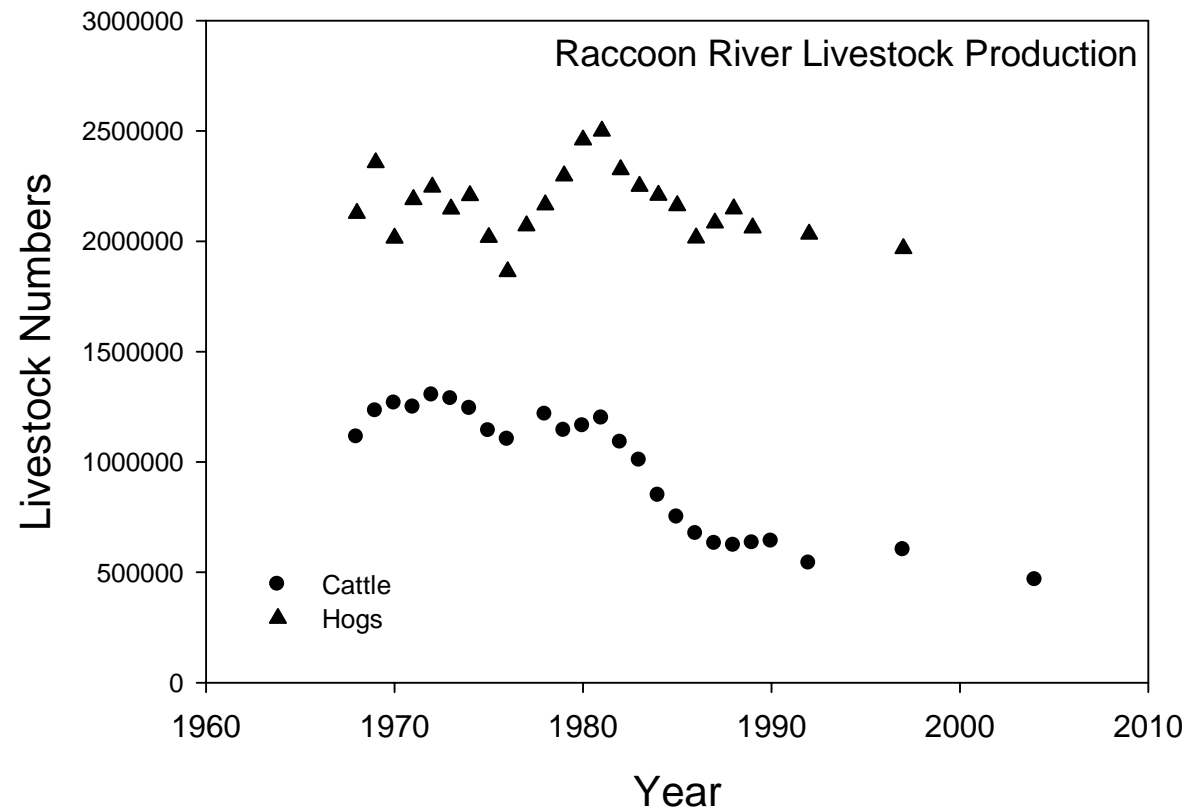
# Nitrogen Removed in Grain



# Observations

- No significant relationship between fertilizer application and nitrate-N trends
- No significant relationship between corn and soybean production and nitrate-N trends
- Concerns about changing animal numbers in the watershed

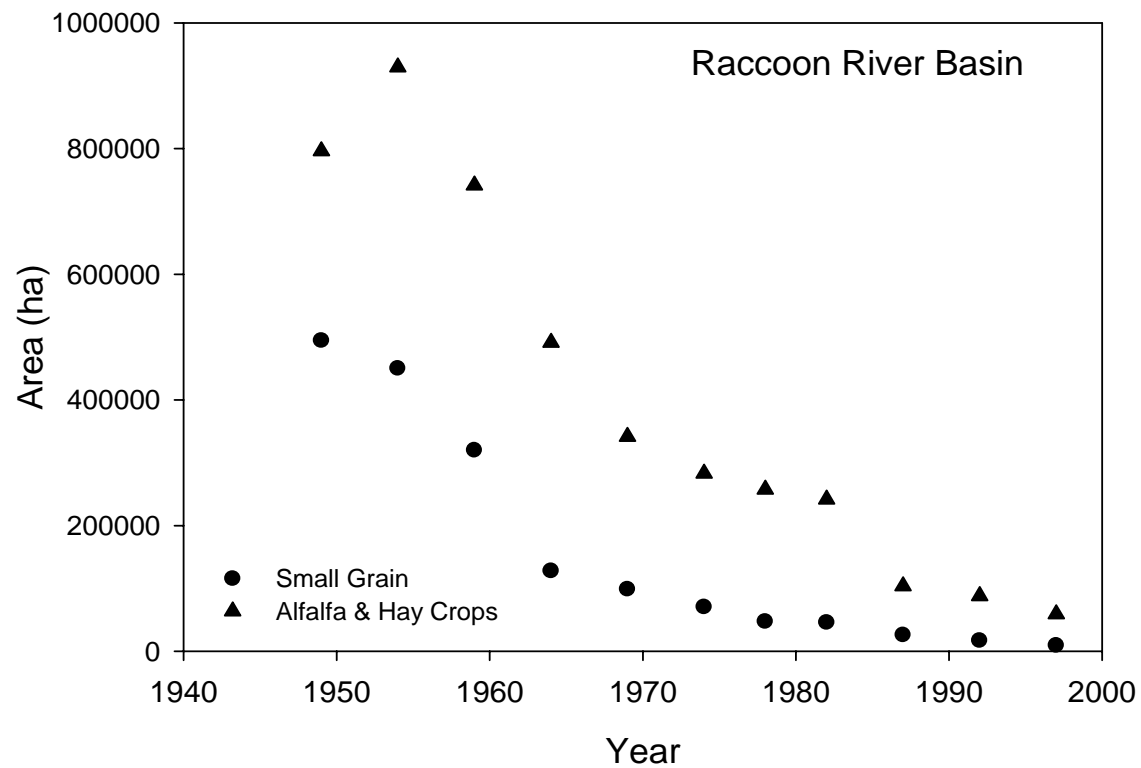
# Change in Animal Production



# Observations

- Reduction in manure application within the watershed
- Reduction of 25% in N applied because of reduced animal numbers

# Change in Land Use



# Observations

Change in small grain and hay area is the most significant factor ( $r=0.75$ )

Change in water balance averages 130-150 mm per year during the early spring (April-mid-June).

Change in water use is nearly the same as the observed change in baseflow of 135 mm (Schilling, 2005)

# Implications

- Changes in cropping practices may be more important than management practices due to affect on seasonal soil water balances
- Reintroduce small grain and hay acres into the watershed to change the water use and nitrate patterns
- Cover crops show a similar effect on N uptake and water use patterns

# Ancillary studies

- Differences among subbasins in nitrate-N concentrations indicate interactions among land use, agronomic management, and water balance
- Management practices that affect water use patterns will have large effect on environmental quality