

Water Quality and Habitat Trends: Does the future reflect the past?

# Making Good long-term Choices

*So, will it be  
bachelor #1,  
bachelor #2 or #3*



Shawn Schottler, St. Croix Watershed Research Station, Science Museum of MN

# What do we want--or not want?

## What makes my baby blue?



Oxygen

No Oxygen



- Safe drinking water
- Fewer/smaller noxious algal blooms
- Reduced hypoxia
- Good habitat for fish and aquatic life

**Less Nitrate, Phosphorus,  
Turbidity (soil loss),  
Bacteria**



- Game species
- Non-game species
- Pollinators---bees, butterflies
- Quality of life, wildlife, songbirds, monarchs...



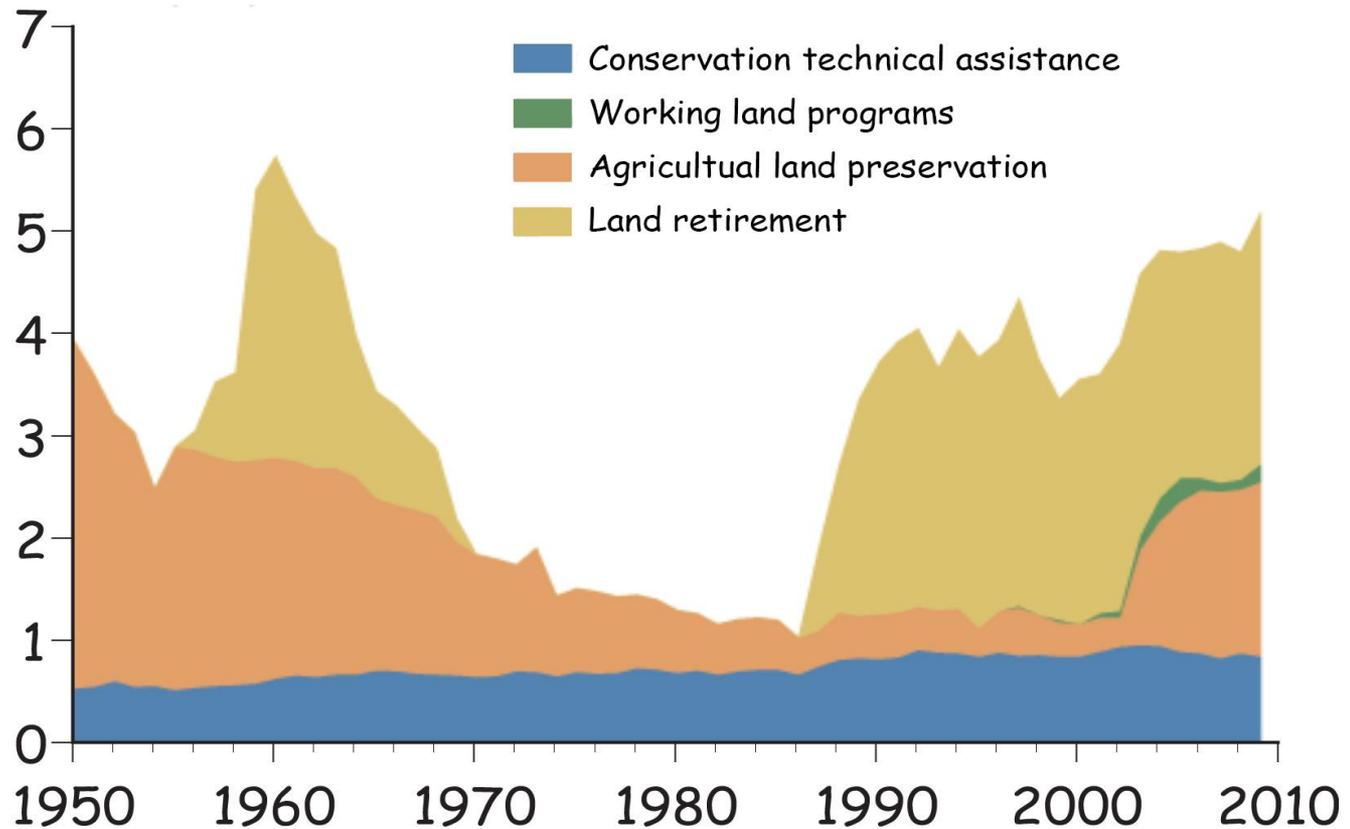
**More and Better Habitat**

# Our Commitment to Agricultural Conservation Efforts

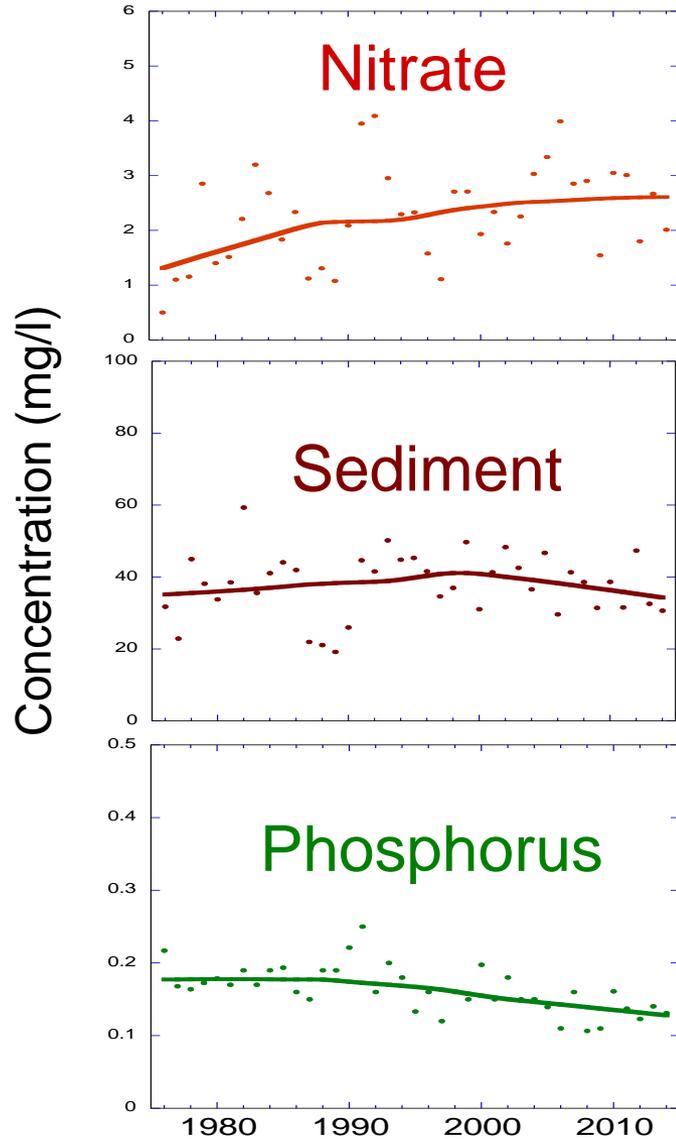
(we've spent a lot of money on clean water and habitat)

\$ billions (2010)

USDA Conservation Expenditures



# Water Quality Trends Mississippi River at Prescott 1975-2015

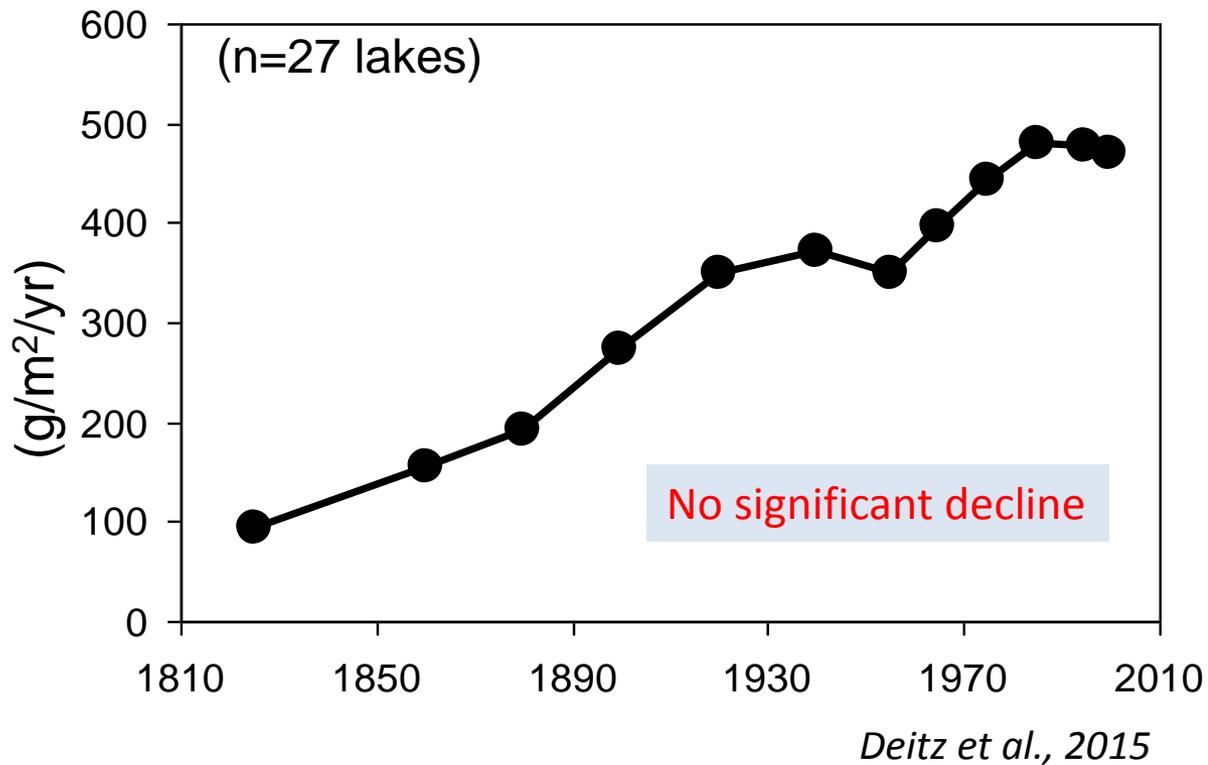


No decline  
in non-point sources

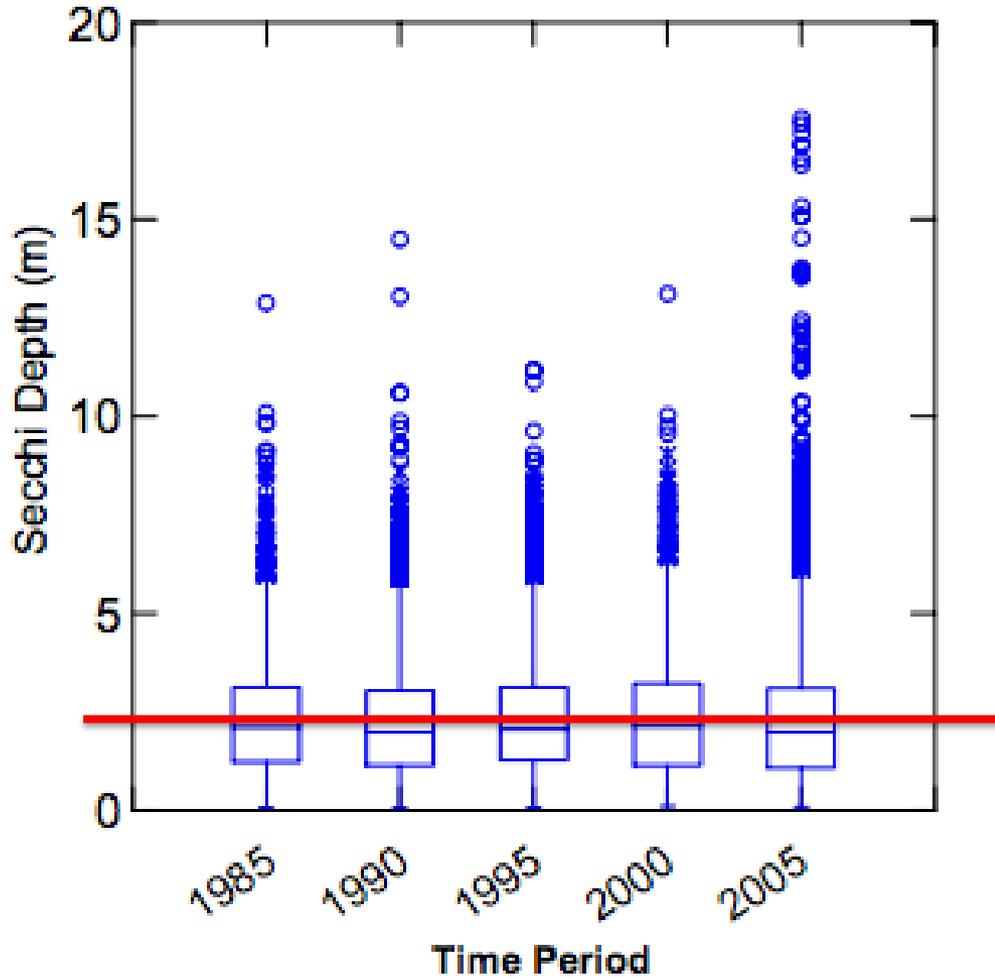


# Long-term Erosion Trends from Lake Cores

## Average Sediment Input to Lakes in Agricultural Watersheds



# Water Clarity Trends-Minnesota Lakes

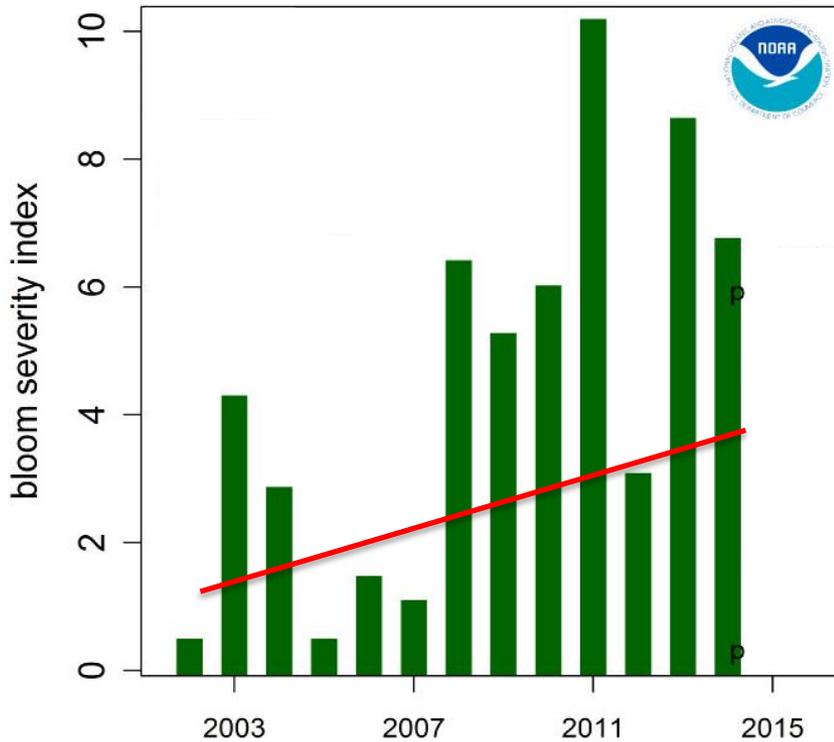


**Little to no improvement**

# Trends in Harmful Algal Blooms (blue-greens)

Lake Erie

*Hashtag,  
#better them than us ??*

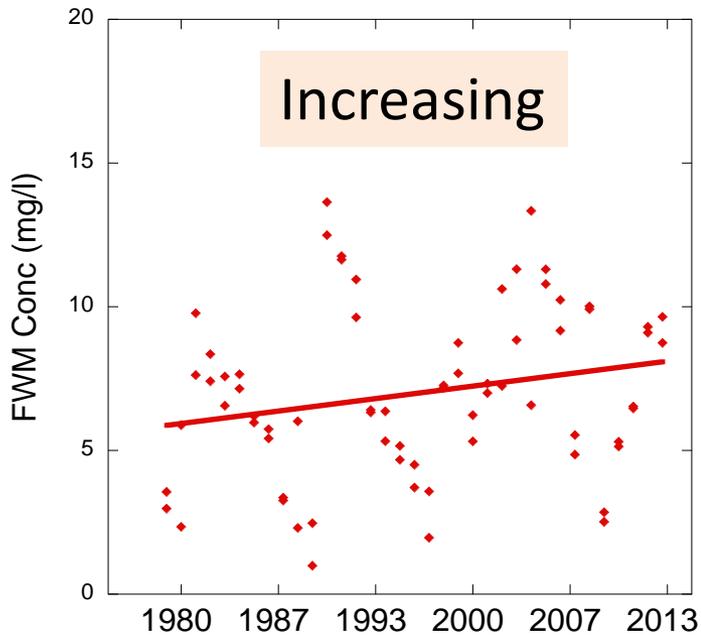


# Nitrates in Surface and Groundwaters

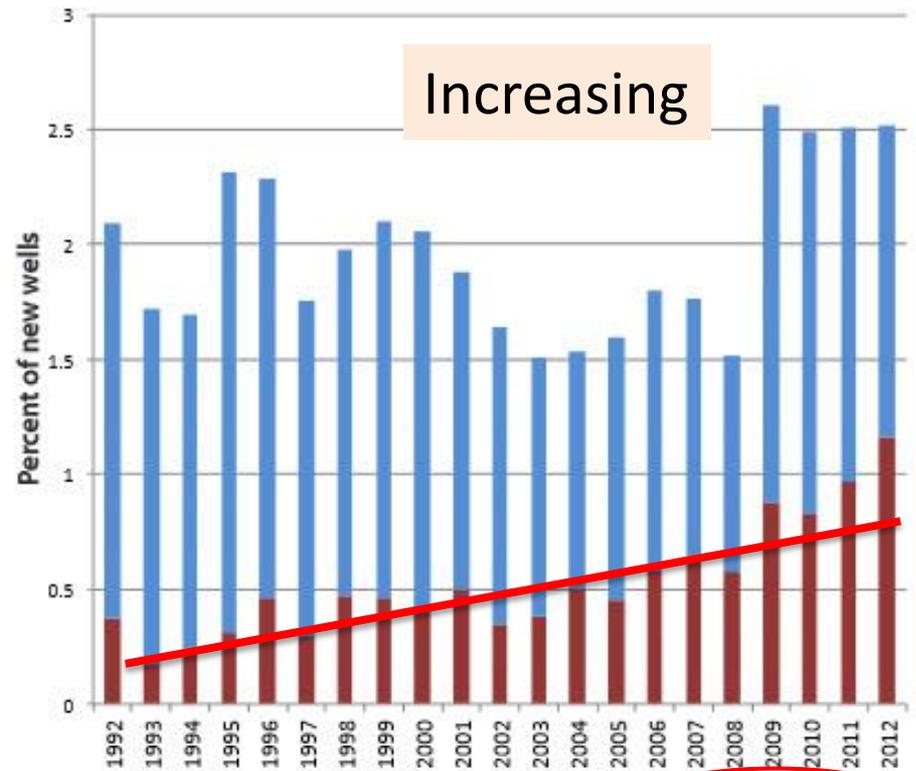


*The goal is a 45% reduction....*

## Spring Nitrate Conc. Minnesota River at Jordan



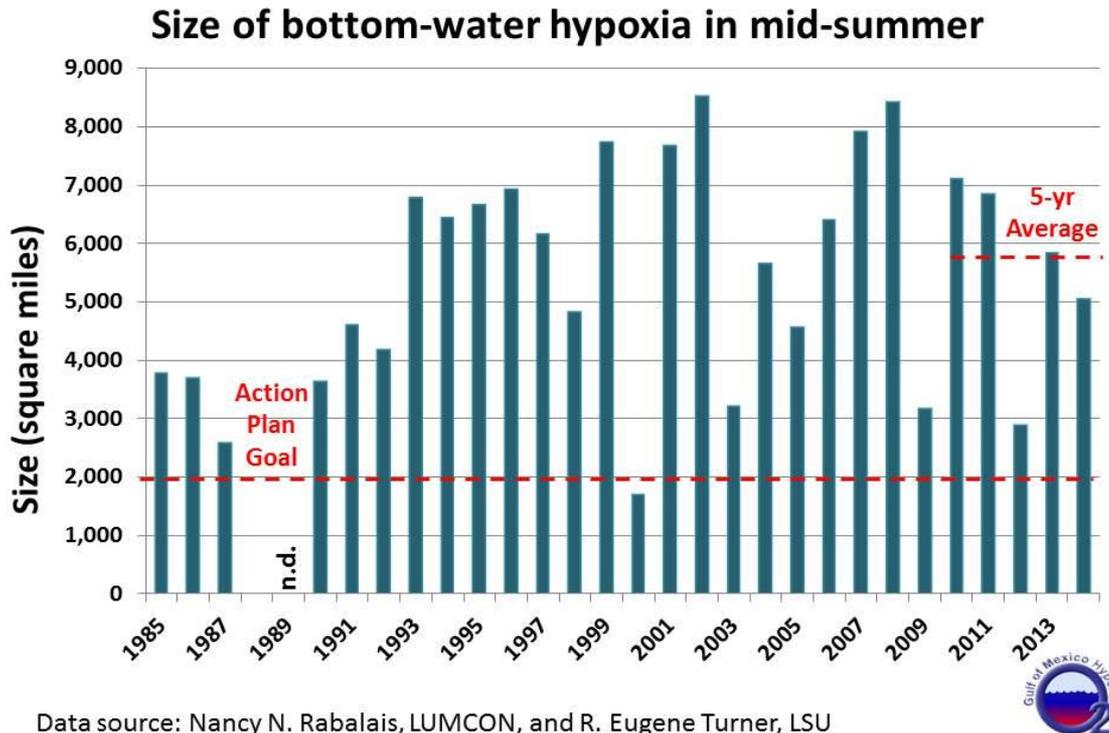
## Percent of New Wells with High Nitrate



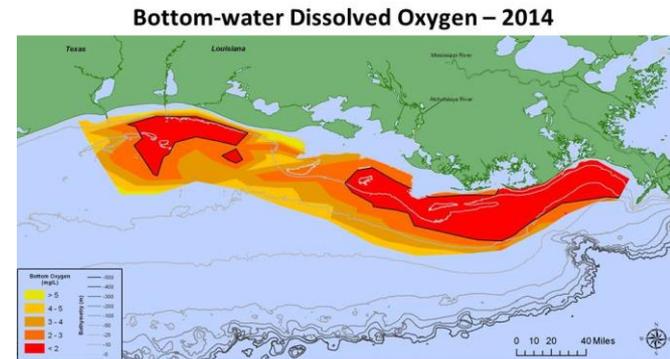
-  > 10 mg/l
-  5 - 10 mg/l

# Trends in the Hypoxia Zone in Gulf of Mexico

**No significant decrease**



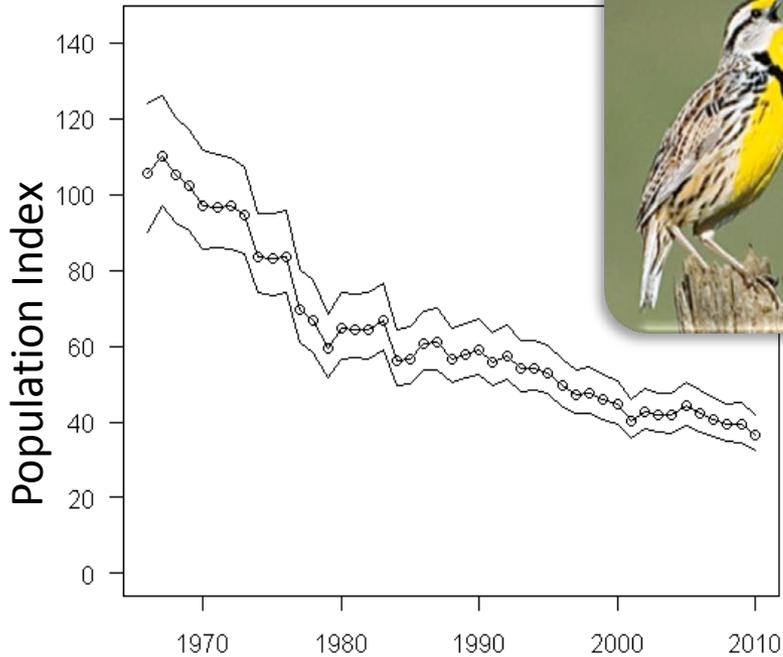
Data source: Nancy N. Rabalais, LUMCON, and R. Eugene Turner, LSU  
 Funding sources: NOAA Center for Sponsored Coastal Ocean Research and U.S. EPA Gulf of Mexico Program



# Habitat: Trends in Grassland Species

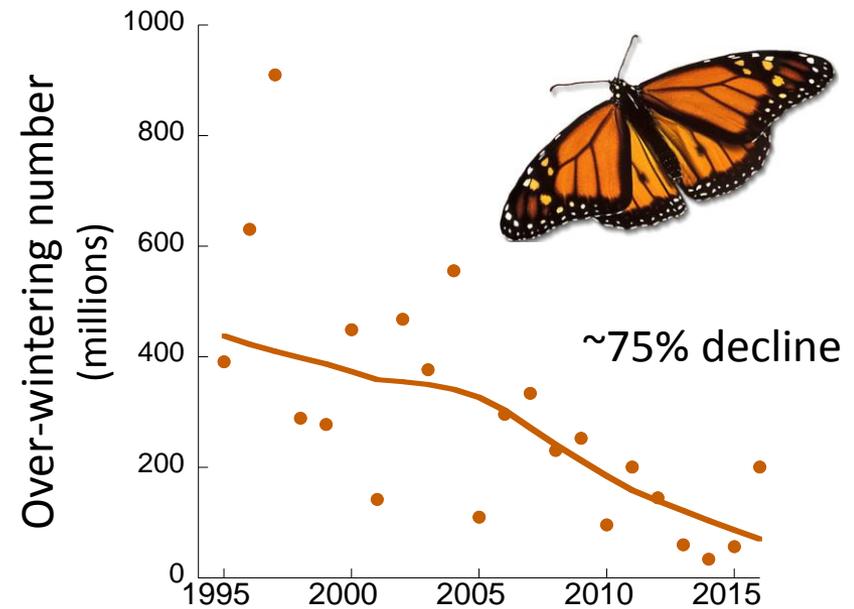
## Eastern Meadowlark

Tallgrass Prairie Region



USGS Breeding Bird Survey, 2012

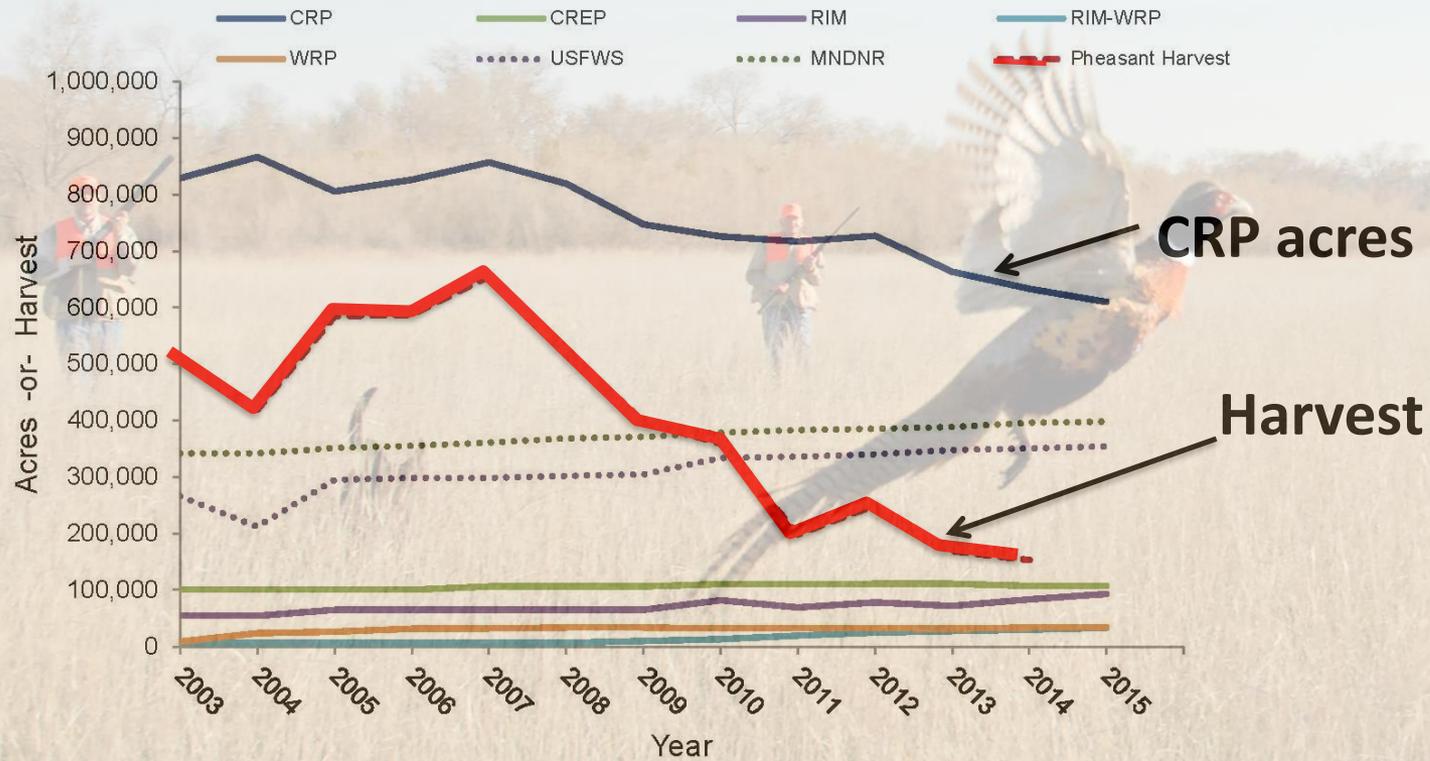
## Midwest Monarch Population



Data from WWF-Mexico and Monarch Watch, 2016

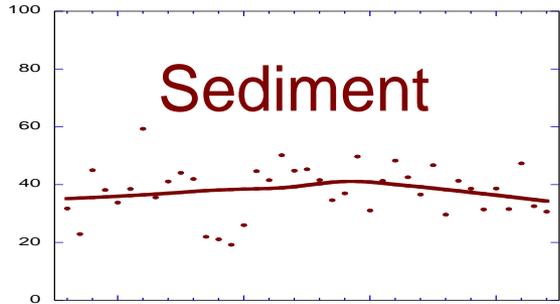
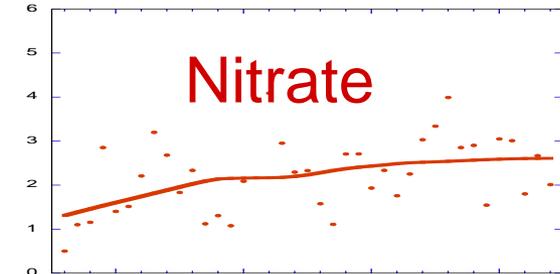
# Habitat: Gamebird Trends

## Minnesota Pheasant Harvest

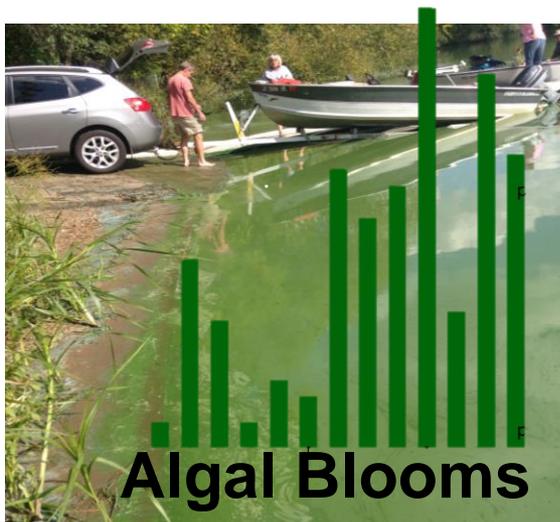
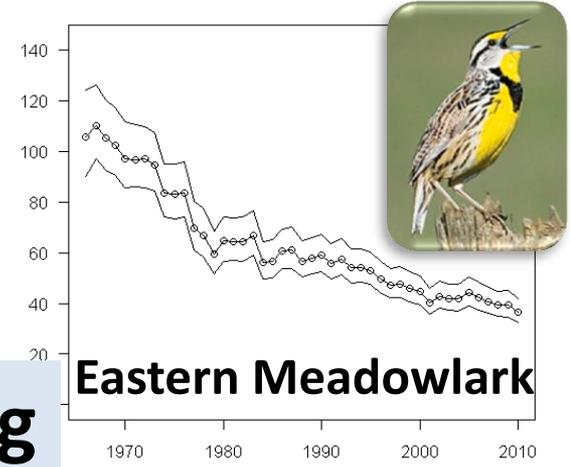


# Trends—After Much Effort and \$

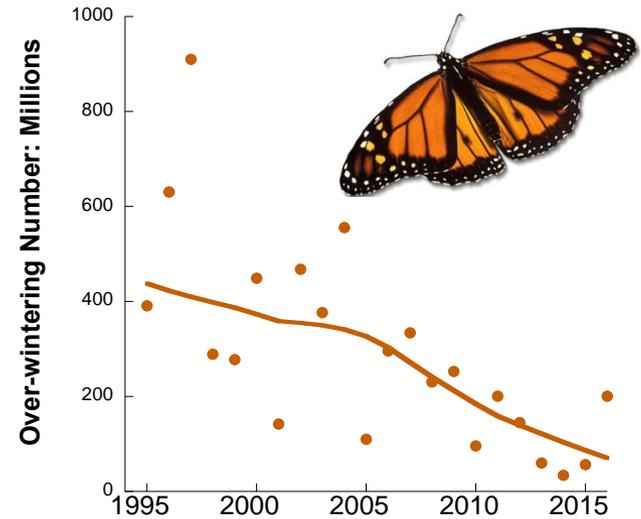
## Mississippi River at Prescott 1975-2015



**Not improving**



## Midwest Monarch Population



*Data from WWF-Mexico and Monarch Watch, 2016*

So BMPs/Conservation Practices Don't Work?

# Minnesota River: 1975-2015 Commitment to Our Goals

**Conservation:**

460,000 acres added

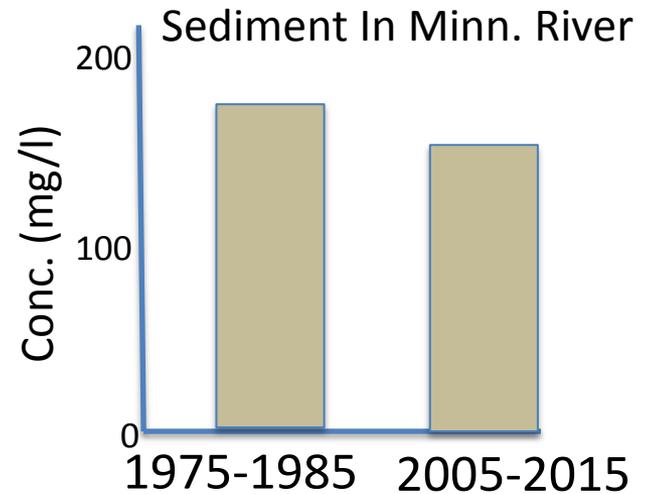
**Corn:**

425,000 acres added



*The payoff*

What the heck—  
that's it???



So BMPs/Conservation Practices Don't Work?

**Individually effective—Collectively not enough**

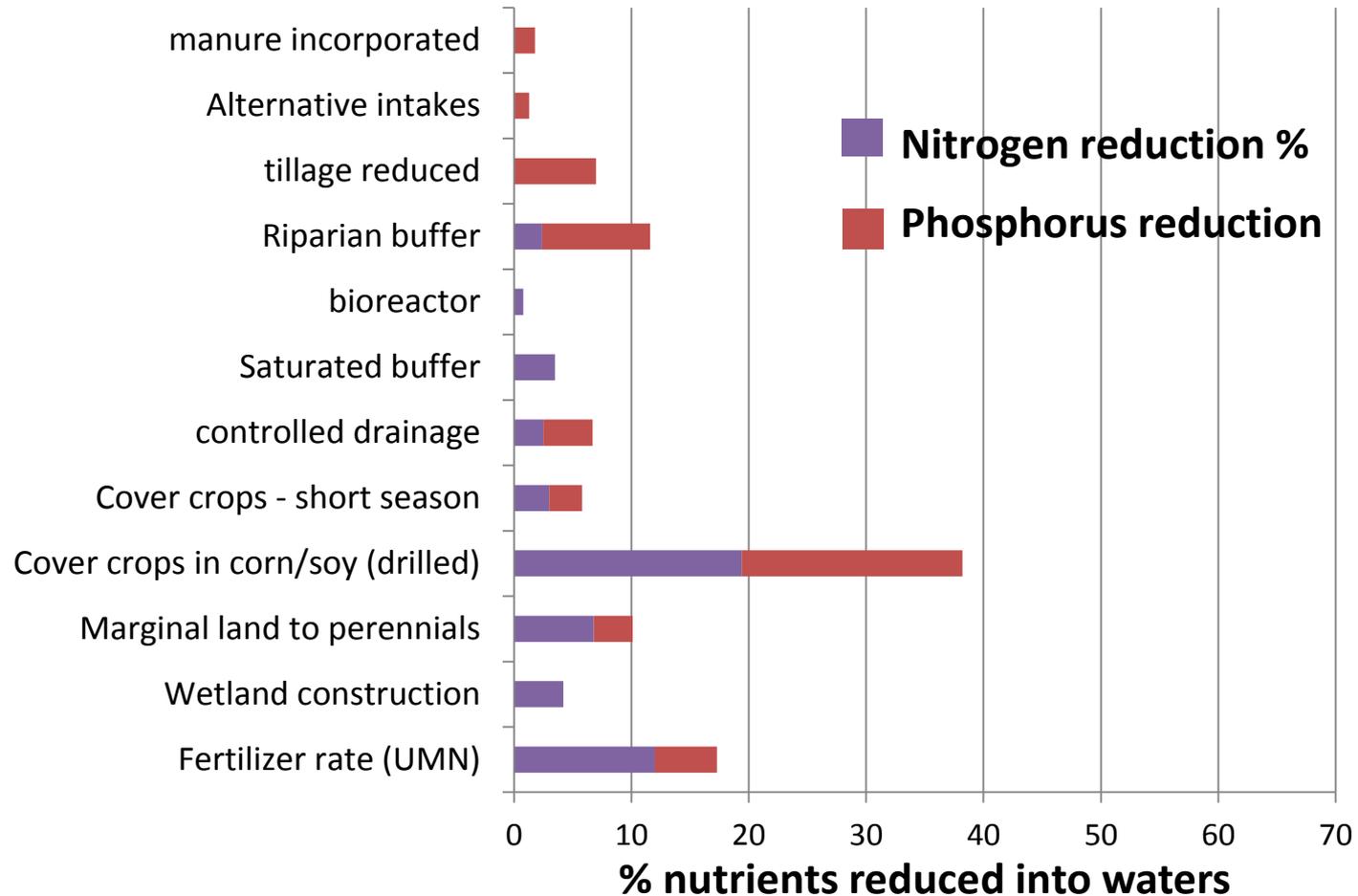
And

**We are doing other practices that 'negate' conservation**

# MNPCA– Nutrient Reduction Strategy

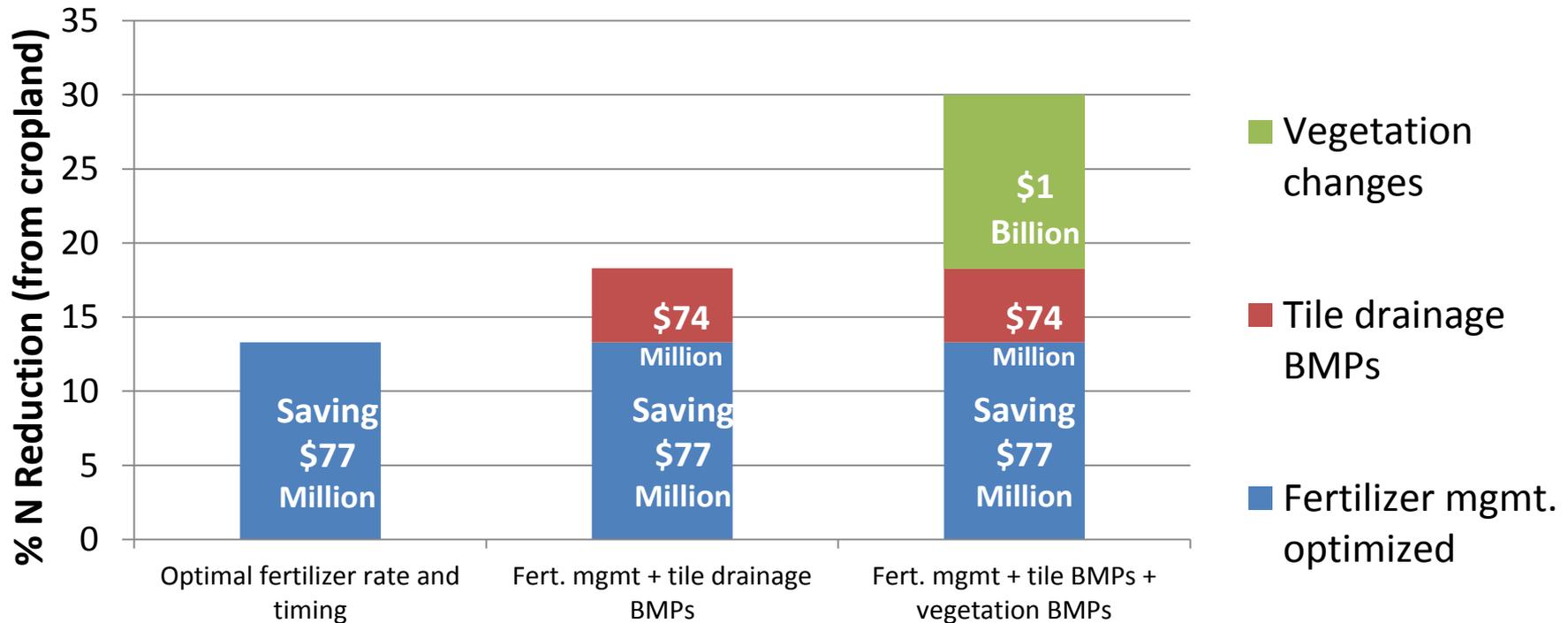
How many and of what type necessary to reach WQ objectives

## Conservation Practice Estimated N & P Reduction

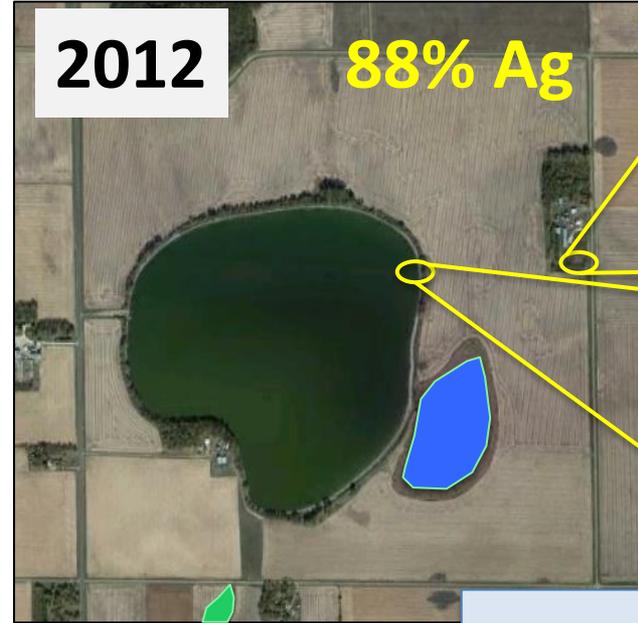
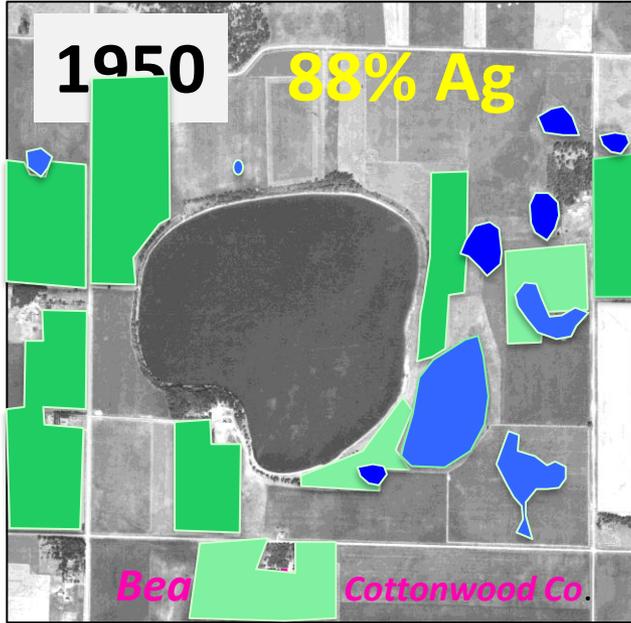


# Cost Estimate of Nitrate Reduction

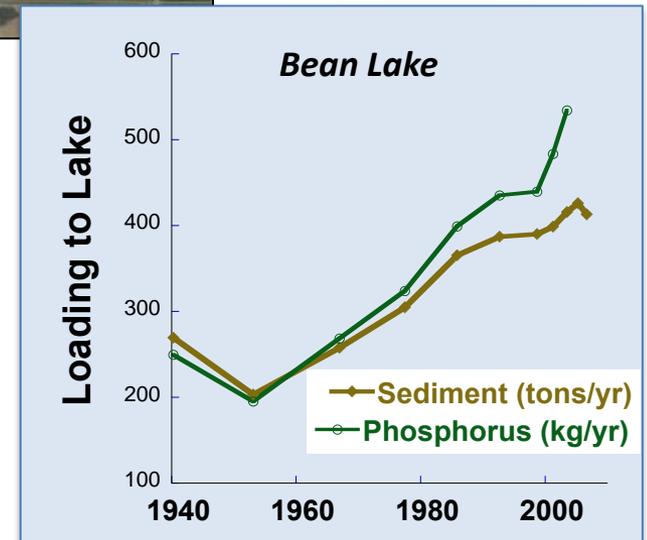
30% Reduction > **1.5 \$Billion per year**



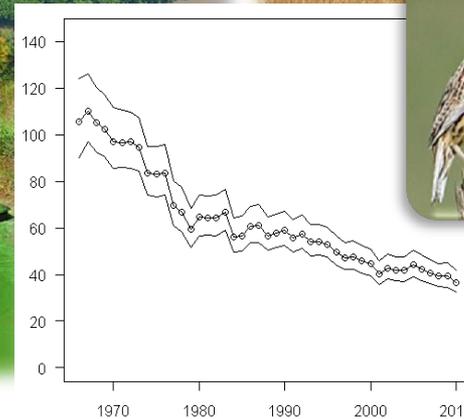
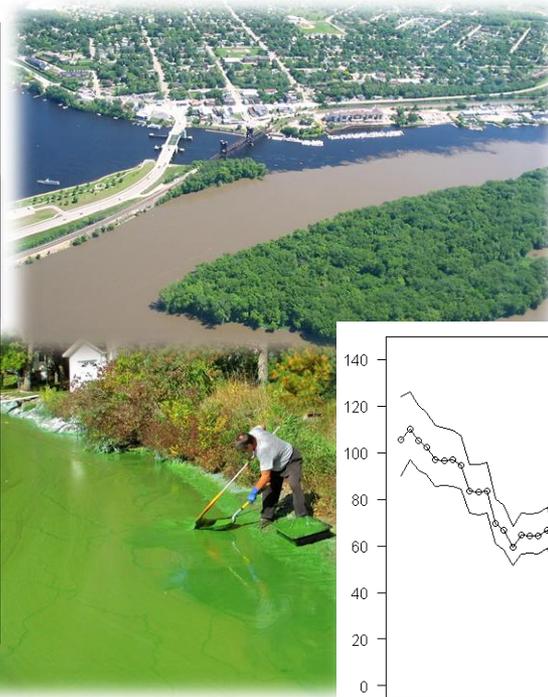
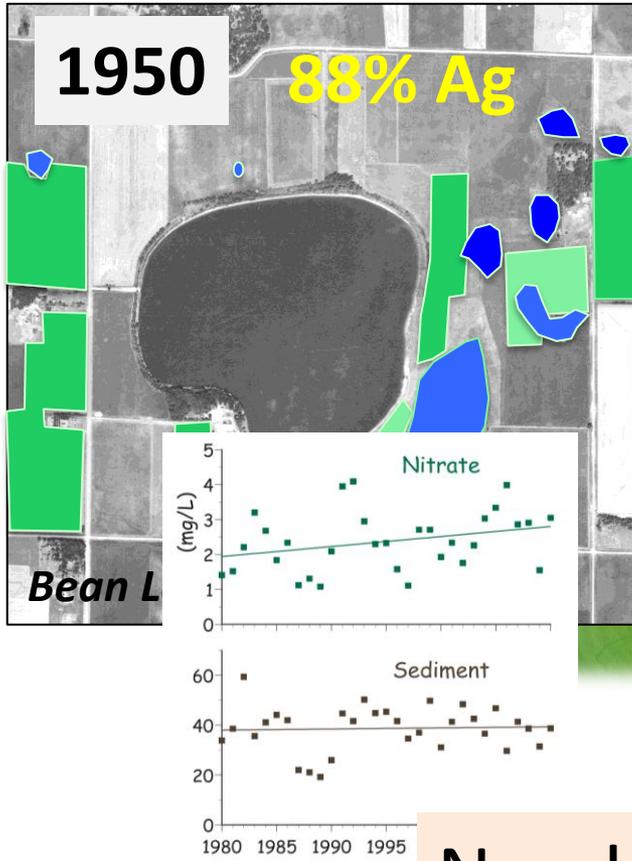
# Decades of Changes: Ag then, ag now...but very different



- Loss of wetlands and depressions
- Addition of artificial drainage-  
*routing water, sed and nutrients to SW*
- Loss of alfalfa, hay, pasture
- Addition of row-crops..  
...and associated addition of nutrients

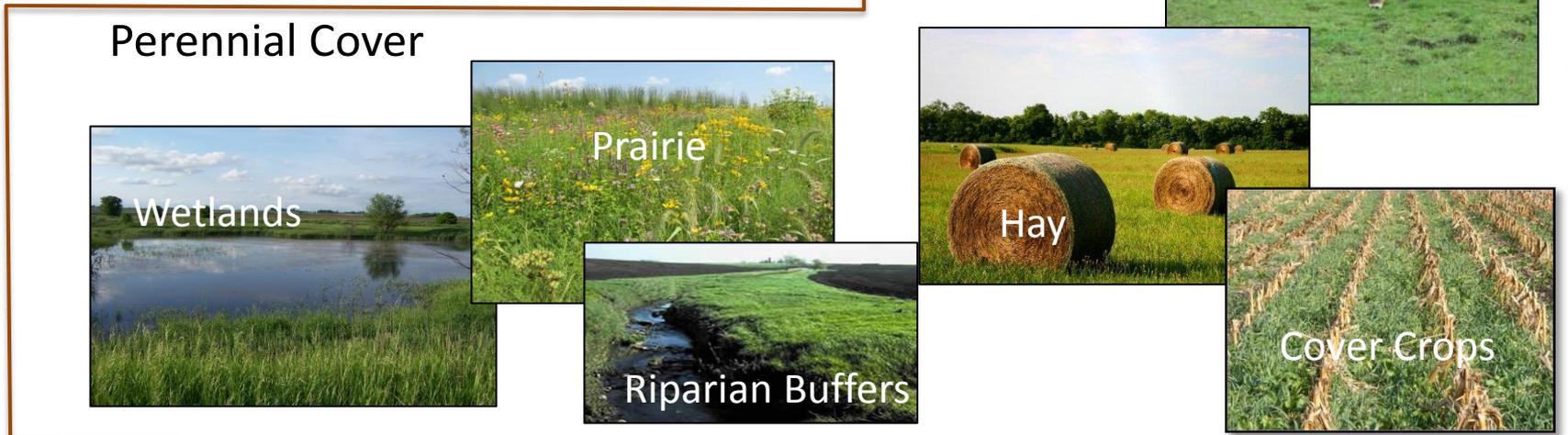
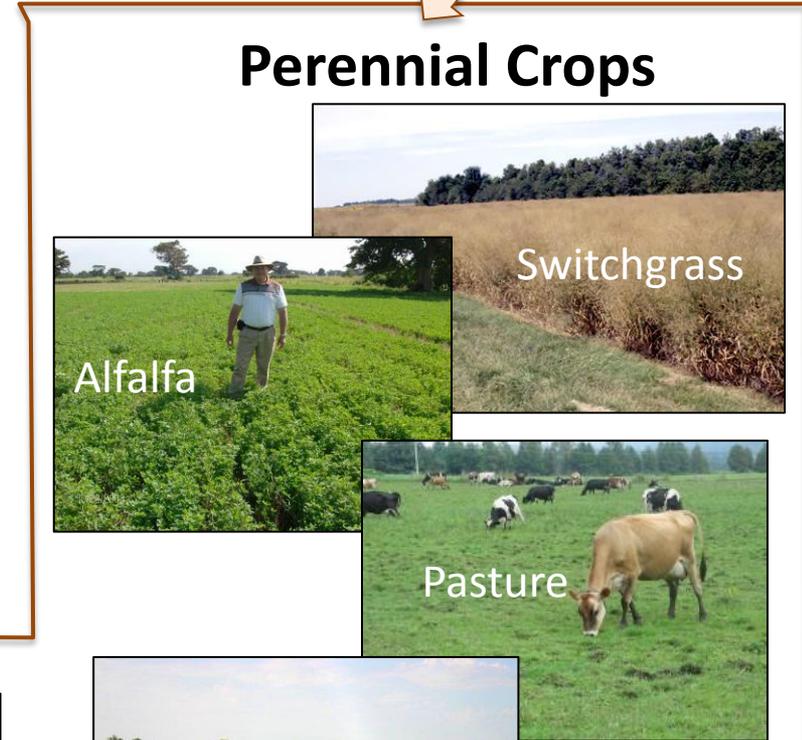
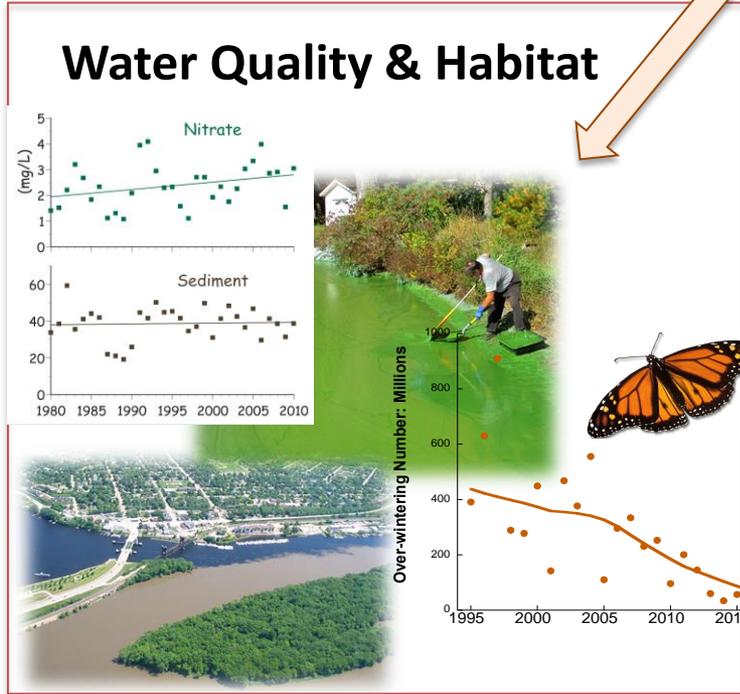


# Linked by a Common Denominator



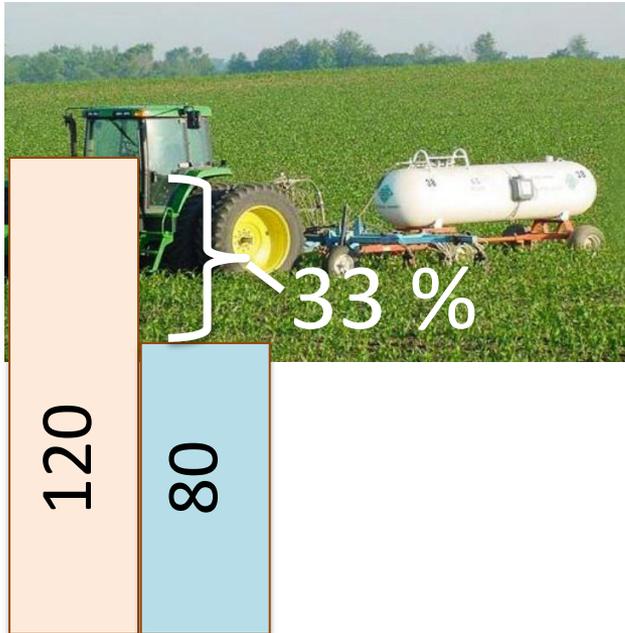
Need more perennials /crop diversity  
on a landscape scale

# If we want to change these --we need lots of these



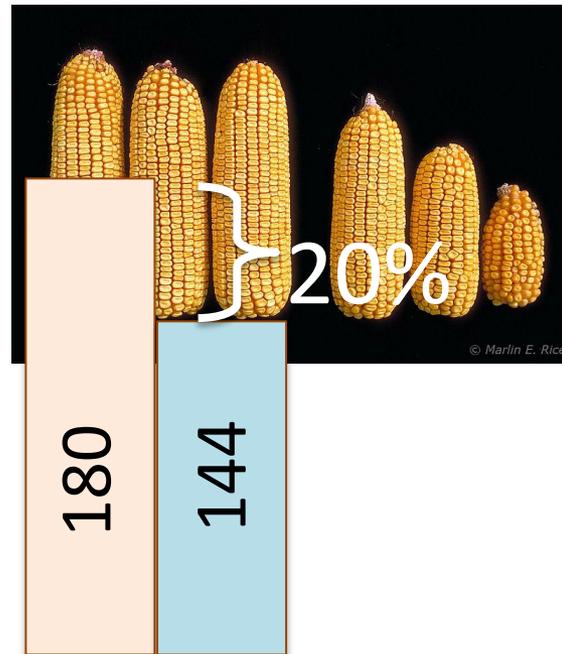
## N-Application Rate

(lbs/acre)



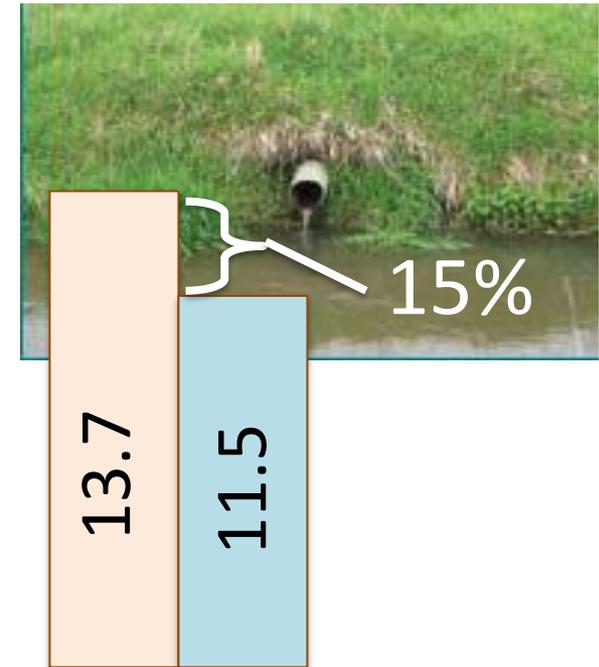
A large  
reduction in  
fertilizer

## Corn Yield (bu/acre)



Creates a big  
reduction in  
yield

## Nitrates in Water (mg/l)



But only a **small**  
improvement in  
Nitrates

*The problem*

***The solution***

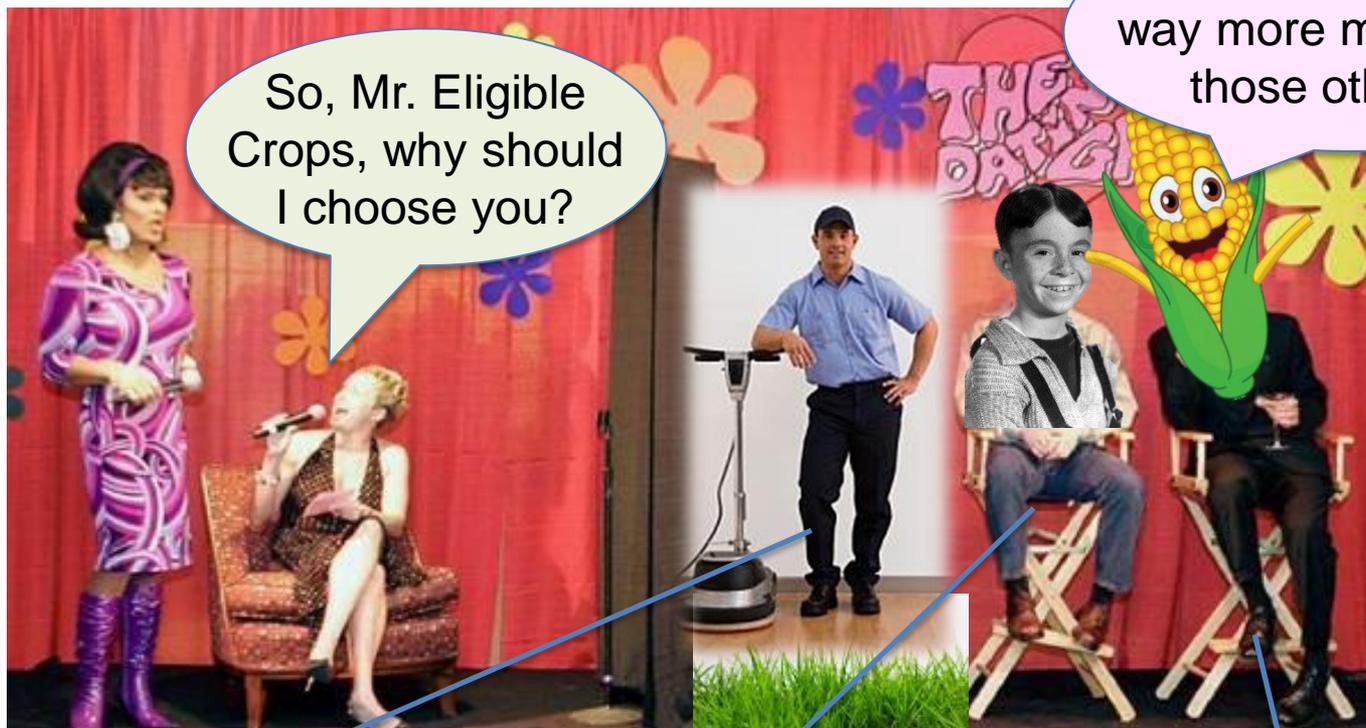
“ In the end, our current cropping systems leak N and only perennial vegetation has been shown to be effective at scouring N from the soil profile. It needs to be noted, though, that while the environmental benefits of this practice are clear, an economic system to support these perennial crops does not exist...”

***Our challenge***

So we need perennial vegetation/crops on the landscape

Why is this so hard?

# Making Choices: Why is the landscape the way it is?



## Grass Buffer

- ♥ I clean up water
- ♥ Don't take up much space
- ♥ Government supported
- ♥ Chicks dig me



## Alfalfa

- ✓ Make good food
- ✓ 15 million calories/acre
- ✓ Can make Ethanol
- ✓ Fix Nitrogen
- ✓ Good at holding soil
- ✓ Smells good

## Corn

- ♥ Make good food
- ♥ 15 million calories/acre
- ♥ Can make Ethanol
- ♥ Well developed markets

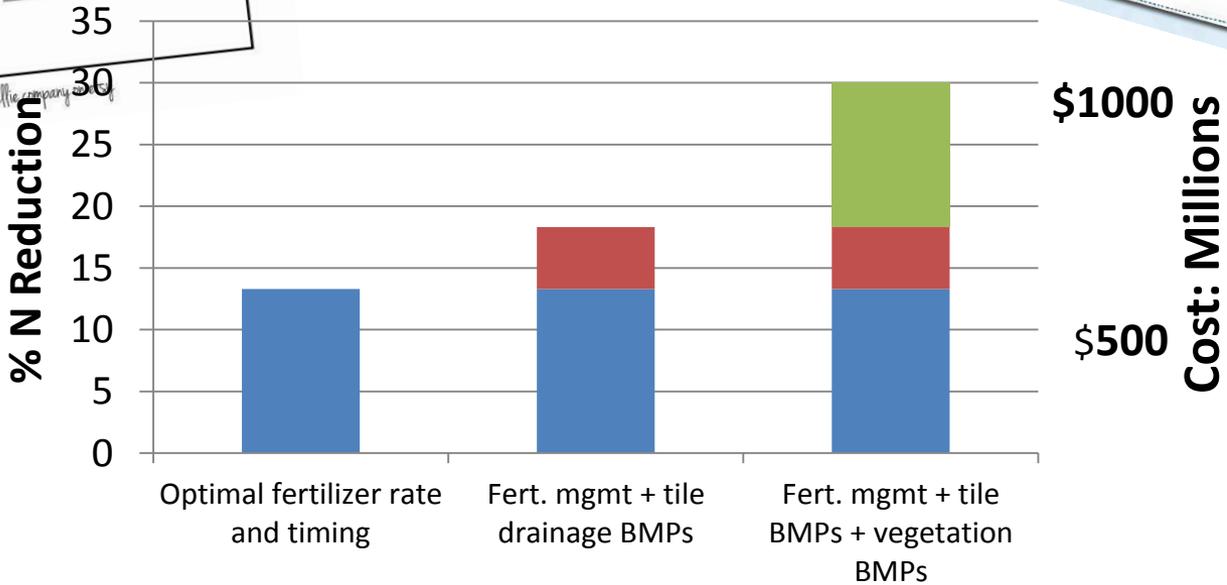
# Goals and Cost– A Dilemma



**\$1 billion**  
per year

## Honey Do List

- 40% N reduction
- More Ducks
- Stop Algae Blooms
- Cut back on Phosp.
- Help the Bees
- Say no to Erosion
- End Hypoxia



# Water Quality and Habitat Improvement Strategies

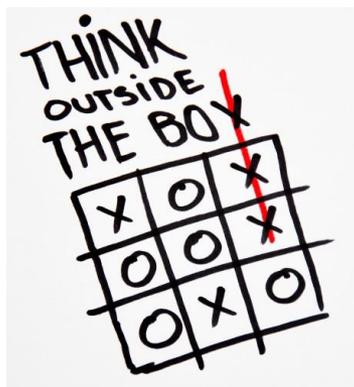
## So, how are we going to pay for it?

Show me  
the money!



- The land is used for corn/soy because there are markets and mandates for corn/soy

Corn/Soy Make Money--- BMPs/Conservation cost Money



- So, let's create markets for perennial vegetation/crops (i.e. make perennials profitable)

# Ethanol as a Market for Perennial Crops

*a.k.a.*

*Ethanol as a Nutrient and Sediment Reduction Strategy*

*Ethanol as a Habitat Program*

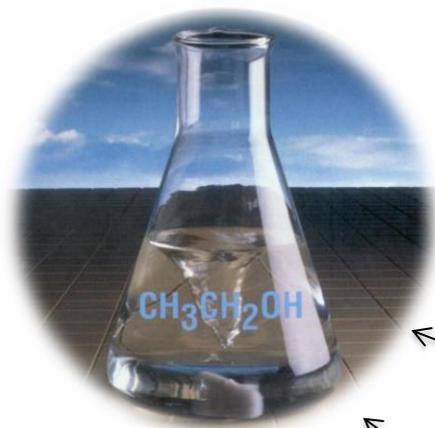
Energy Independence and Security Act of 2007 established the

## Renewable Fuels Standard (*aka Ethanol Mandate*)

- Mandates that Americans consume 13-15 billion gallons of ethanol in our gasoline (~10% of auto fuel)

And

- Mandates increased use of cellulosic sources



**Ethanol**



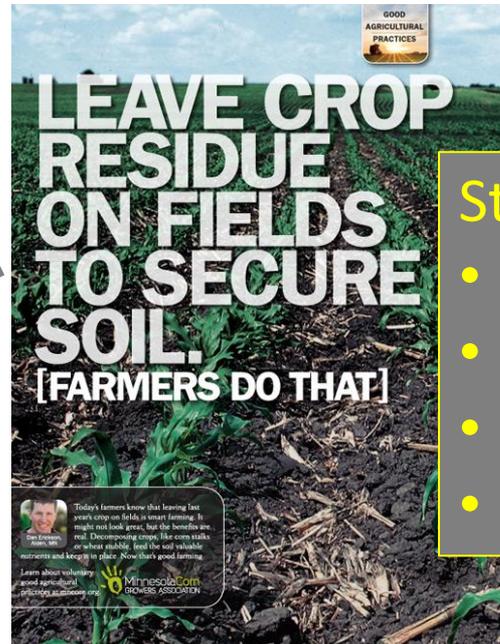
— Currently ~13 billion gallons from corn



By 2022:  
Additional 16 billion gallons from cellulose

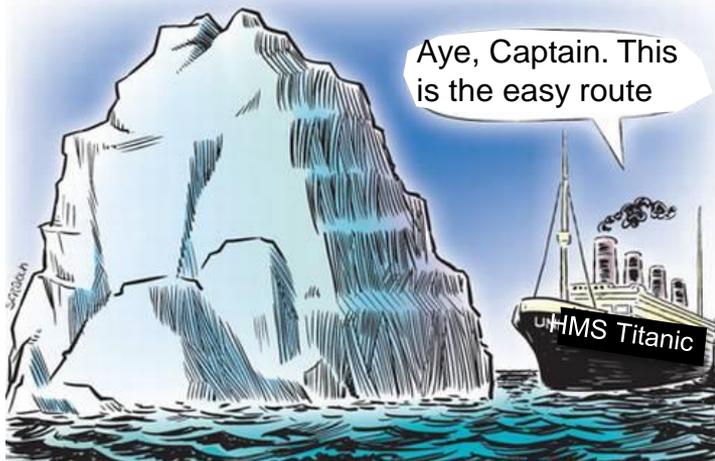
Corn stover (waste) is the “easy” source to meet the mandate..

~90 Million Acres of unused, **wasted** corn stalks, leaves and cobs



Stover:

- Organic Matter
- Prevents Erosion
- Store Nutrients
- Nourish Soil



Excessive Stover Harvest:  
Negative Implications for  
Water Quality and Habitat

Mandate other sources to meet the Mandate

## Perennials and alfalfa are a viable source of cellulosic ethanol

- Similar or more Net Energy
- Negligible soil loss
- Less water/nutrient runoff
- Build Organic Matter
- Store Carbon
- Provide Habitat



### **If:**

- **Required ~50% of cellulosic ethanol from perennials**

### **Then**

- **~30% reduction in Nitrate, Phosphorus and Sediment**

# Electricity as a Market for Perennials

*i.e.*

*Electricity as a Water Quality/Habitat BMP*

# Switchgrass can be co-fired with coal for electricity

- If replace 10% of BTUs from Coal with Grass  
= 410,000 acres of perennials in Minnesota



**Could replace all Coal with  
4 million acres of grass**



**200 ft wide grass buffer,  
along 17,000 miles of waterways  
= 10% of BTUs from coal**

# The Technology Exists....



*Alliant Energy's Ottumwa (Iowa) Coal Plant*



*Biomass Heating Facility. Fort Pickett, VA*

- We need a “mandate” to make it happen
- We can't make the power companies do that.. right?



# Perennial Grains as Livestock Feed

## Intermediate Wheat Grass Grain

- High feed value: ~95% net nutritional energy of corn
- Currently ~30 bushel/acre

~12 bushels to  
finish 1 hog



## Intermediate Wheatgrass



Minnesota finishes ~ 8million hogs/year

Thus if replace just 10% of corn ration with IWG.  
**= 330,000 acres of perennial vegetation**  
added to landscape

**200 ft wide buffer strip 13,000 miles long**

## Crop Insurance as an Incentive for Perennials

Taxpayer subsidized crop insurance doesn't reward farmers for leaving habitat...

...maybe it should



## Currently

- The public pays 63 % of a Farmer's Crop Insurance
- Crop Insurance rewards increased yield
- **No Incentive for Conservation**

What if we rewarded both yield and conservation

### Crop Insurance as a BMP: **Reward Farmers for Conservation**

- **No conservation—farm as you want = Public pays 51% of premium**
- **Implement 4% perennial vegetation = Public pays 63%**
- **Implement more than 8% perennial vegetation = Public pays 75%**

- Voluntary
- Will get us to our water quality/habitat goals
- Doesn't cost taxpayers additional money!



## A Market Driven, Water Quality/Habitat Improvement Strategy

Market Driven BMPs: How many acres of **perennials** from each

Practice	Acres in MN
• 50% Cellulosic Ethanol from Alfalfa/Grass	2 million
• 10% of Coal BTU's from Grass	410,000
• 100% of Coal BTU's from Grass	4 million
• Eating Premium Fed Beef	~350,000
• Crop Insurance Incentives	> 2 million

No additional cost to taxpayers,  
"Simple": does not require infrastructure/consumer changes

What we have been doing is not enough...

Following current path is mucho expensive \$\$\$

## Let's Make Grass Profitable

Changing crop insurance or mandating a grass market is easier than implementing 1000's BMPs one at a time

## Nutrient and Sediment Reduction Strategies

—**Thinking** differently about choices that can change water quality and habitat

*So Girl, better ask a different question, I don't think any of them have a billion \$s*

*Ok, So bachelors, if you were my date, how would you clean up the water*

*Require BTUs from grass*

*Use Markets As BMPs*

*Change Crop Insurance*

