



United States Department of Agriculture

# Improving Ecosystem Services from Agricultural Lands; Modern Technologies and Markets Drainage Water Management Opportunities

Natural  
Resources  
Conservation  
Service

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USDA – Natural Resources Conservation Service



In Partnership with:

ECOSYSTEM MARKETS

Making Them Work

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Linking Science, Practice and Decision Making

December 8-12, 2014 | Washington, DC

# Drainage Water Management

## Topics:

- Drainage Intensity in the U.S.
- What is Drainage Water Management (DWM)?
- Potential Impacts – Acres
- Potential Nutrient Reductions
- NRCS Promotion of DWM
- Trends
- Associated Conservation Practices
- Why are Markets Important
- What's Next



More Production



Less Risk

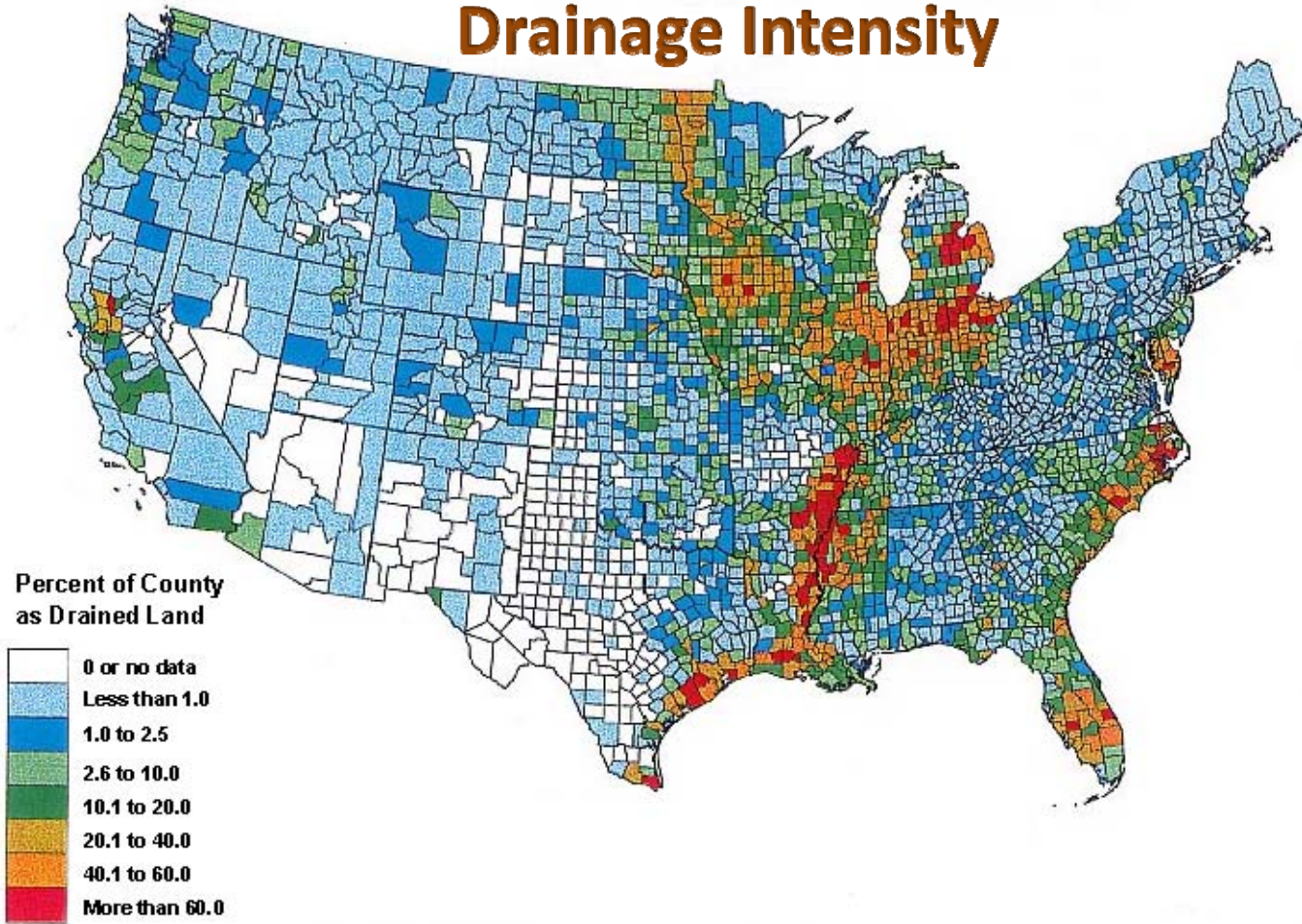


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# Drainage Intensity



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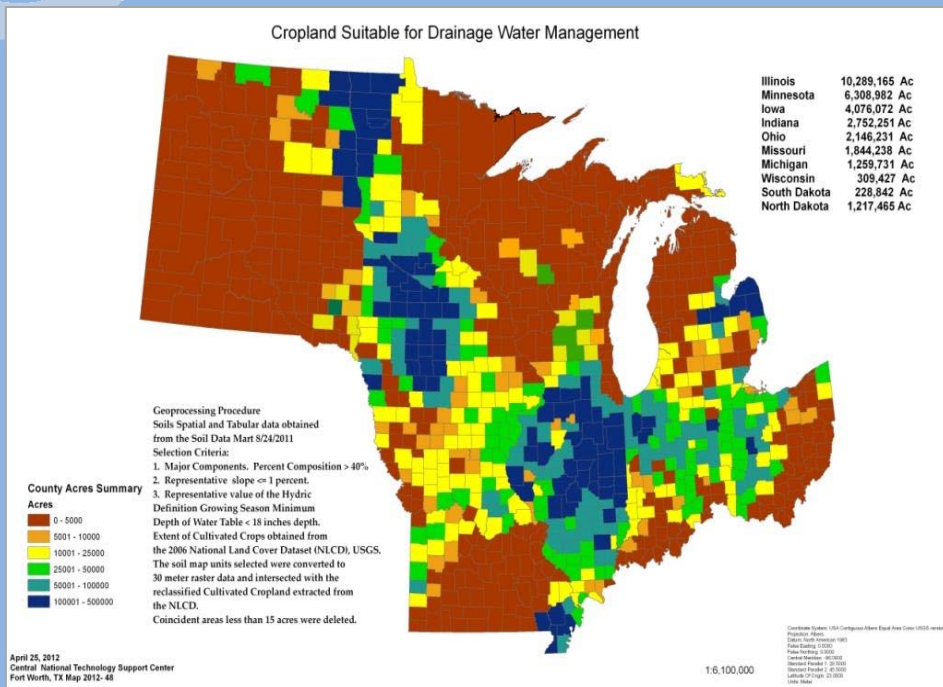


Lower Risk



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# Drainage Intensity



- The drainage infrastructure is extensive, underlying much of the agricultural land in the Midwest.
- Once drained, wet soils are among the most productive in the world.
- More intensive drainage calls for more intensive effort to reduce nutrient losses.



More Production ✓



Less Risk ✓



Cleaner Water ✓

# What is Drainage Water Management (DWM)?



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# Drainage Water Management

DWM is the process of managing timing and amount of water discharges from agricultural drainage systems.

The DWM plan provides the target water table level settings needed at specific dates or seasons. Season long control is the goal.



More Production ✓



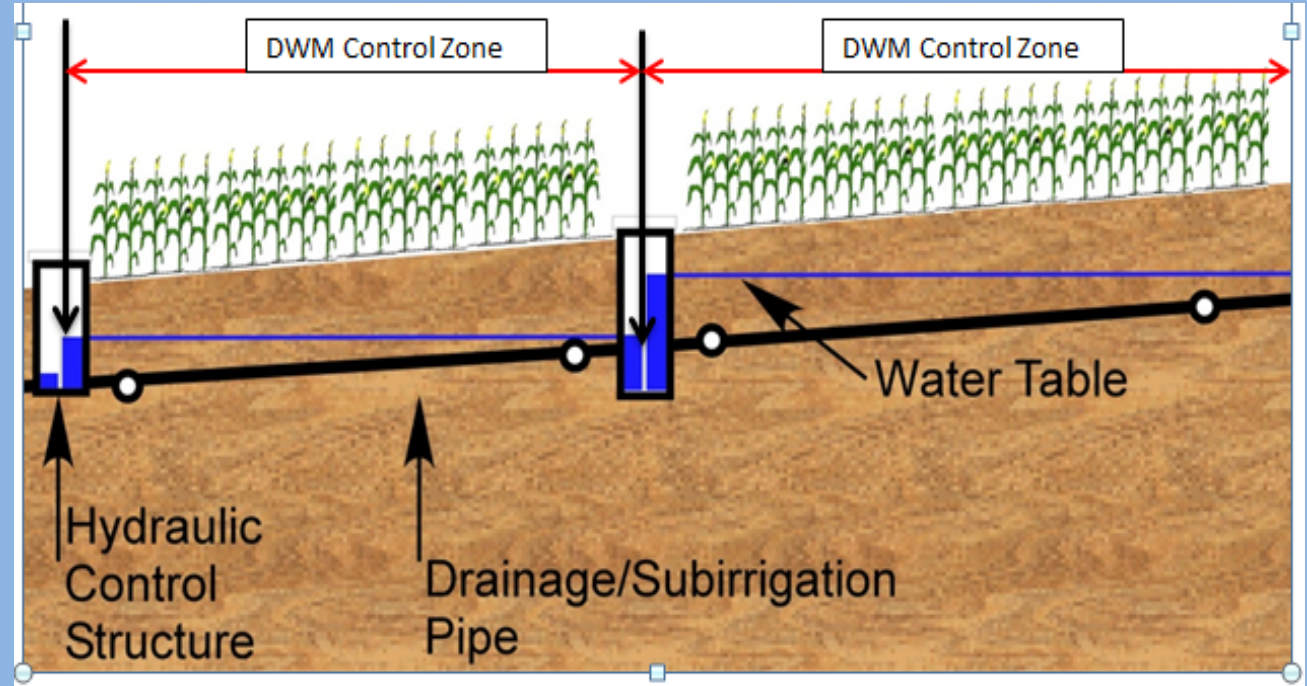
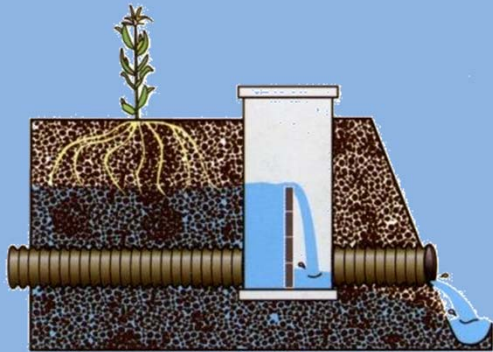
Less Risk ✓



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# Drainage Water Management

DWM is the process of **managing** timing and **amount of water discharges** from agricultural drainage systems. The DWM plan provides the target water table level settings needed at specific dates or seasons. Season long control is the goal.



More Production ✓



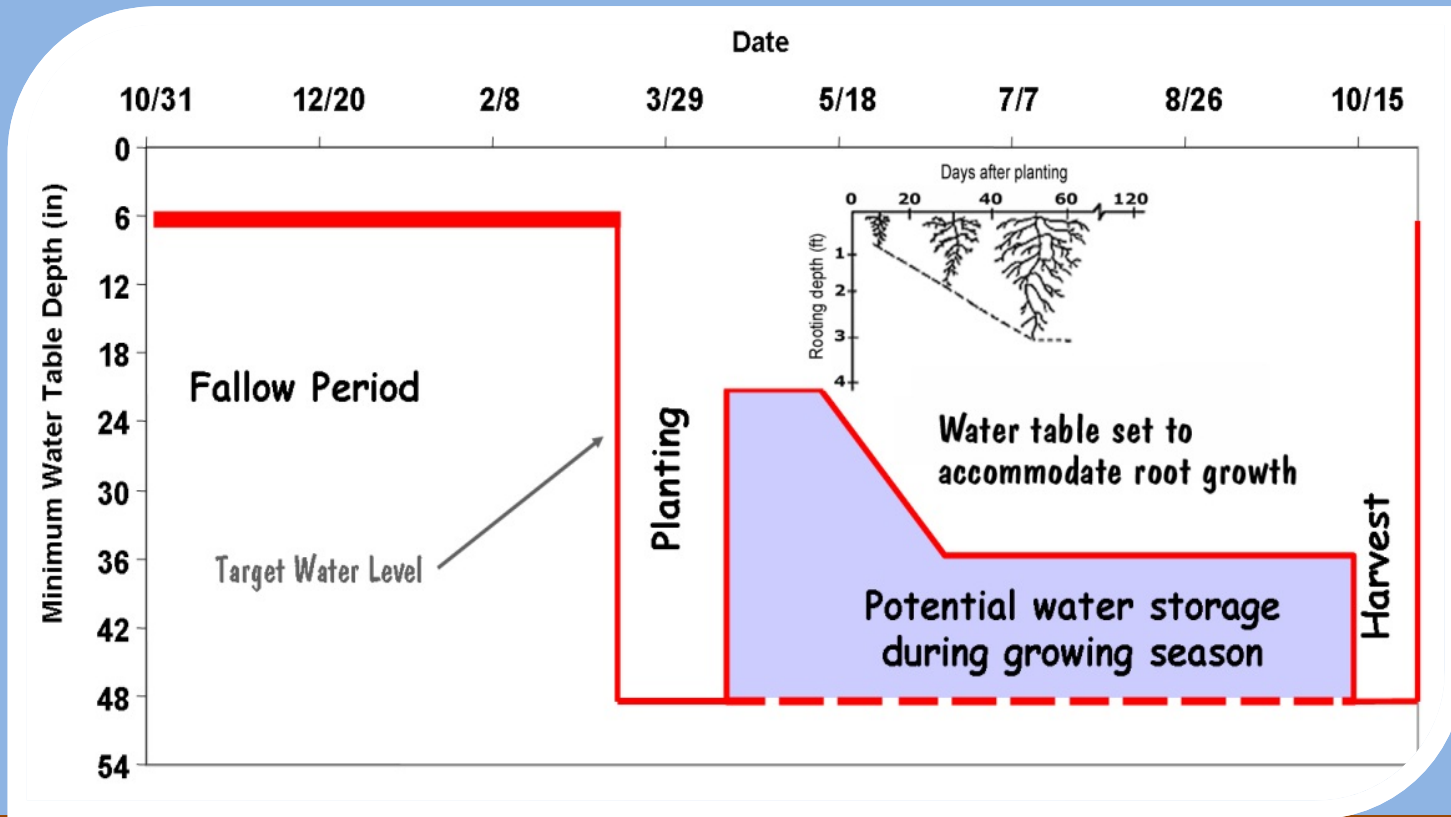
Less Risk ✓



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# Drainage Water Management

DWM is the process of **managing the timing** and amount of water discharges from agricultural drainage systems. The DWM plan provides the target water table level settings needed at specific dates or seasons. Season long control is the goal.



More Production ✓



Less Risk ✓



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# Drainage Water Management

## The Golden Rule of Drainage Water Mgt:

Only release the amount of water necessary to ensure trafficable conditions for field operations and to provide an aerated crop root zone.

Any drainage in excess of this rule likely carries away nutrients and water that is no longer available for crop uptake.



More Production



Less Risk



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# Drainage Water Management

- It is important to understand that for maximum nutrient load reduction a Systems Approach must be employed.
- Drainage Water Management is the **last** opportunity (line of defense) to keep nutrients from reaching surface waters



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Less Risk



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# NRCS does not promote drainage -



Policy and Guidelines for providing both Technical and Financial Assistance related to DWM protect wetland resources from impacts



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# Water Quality Impacts of Drainage Water Management

## Potential Acres



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Less Risk



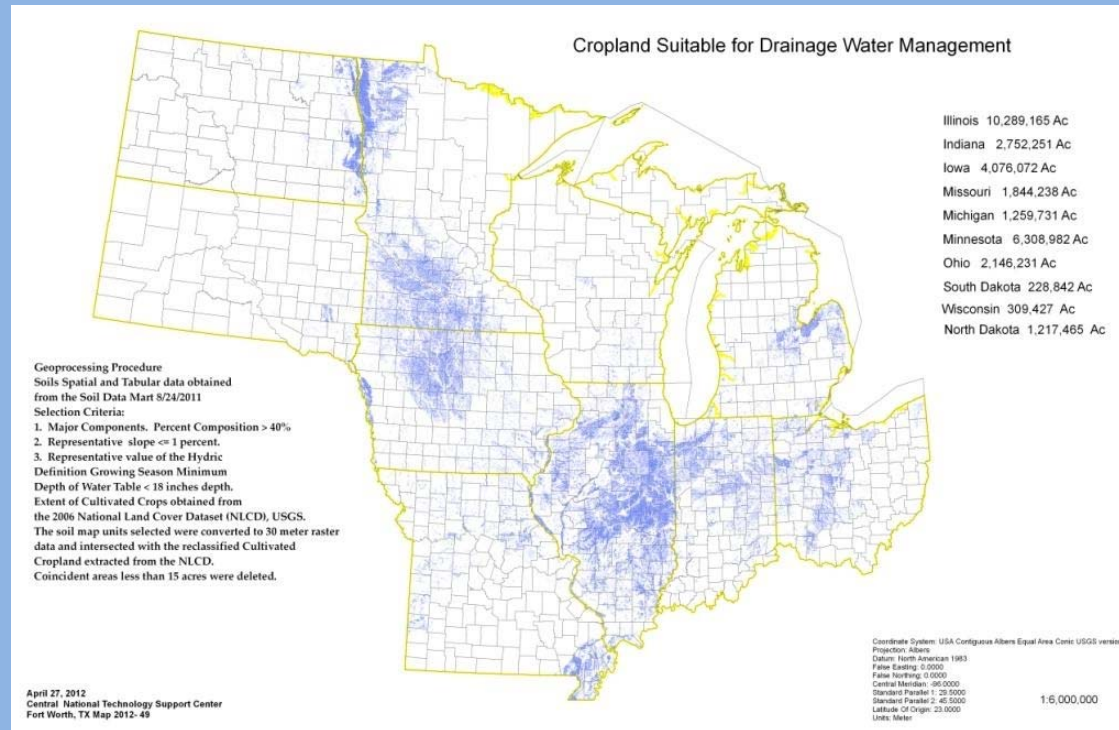
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# Water Quality Impacts of Drainage Water Management

Cropland Acres That Are Likely Drained and are Suitable for Drainage Water Management  
~ 30 million acres in Ag Water Management Team's 10 Focus States




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# Drainage Water Management

## Potential Reductions



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## Summary. Published Results of Effects of DWM on Nitrogen Losses in Drainage Waters

Location	Reference	Number Sites	Site years	% Reduction N Loss
North Carolina	Gilliam et al., 1979	2	6	50-85
	Evans et al., 1989	3	6	18-56
Ontario	Lalonde et al., 1996	2	4	69-82
	Tan et al., 1998	1	2	19
	Drury et al., 2008	1	4	44
Sweden	Wesstrom et al., 2007	1	4	80
Ohio	Fausey, 2005	1	5	46
Iowa	Jaynes et al., 2012	1	4	46
	Helmets et al., 2012	1	4	21
Indiana	Adenya et al., 2012	2	4	18-23
Illinois	Cooke and Verma, 2012	4	8	51-79
<b>Summary</b>		<b>19</b>	<b>51</b>	<b>43 (18-80)</b>

Source: Dr. Wayne Skaggs - NCSU

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Less Risk

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Kevin W. King  
USDA-ARS  
Soil Drainage Research Unit  
Columbus, OH

## EOF research approach

38 fields (19 field pairs)  
representative of Ohio crop  
production agriculture  
Surface runoff and tile  
discharge measurements  
Using a before-after control-  
impact study design



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Less Risk ✓

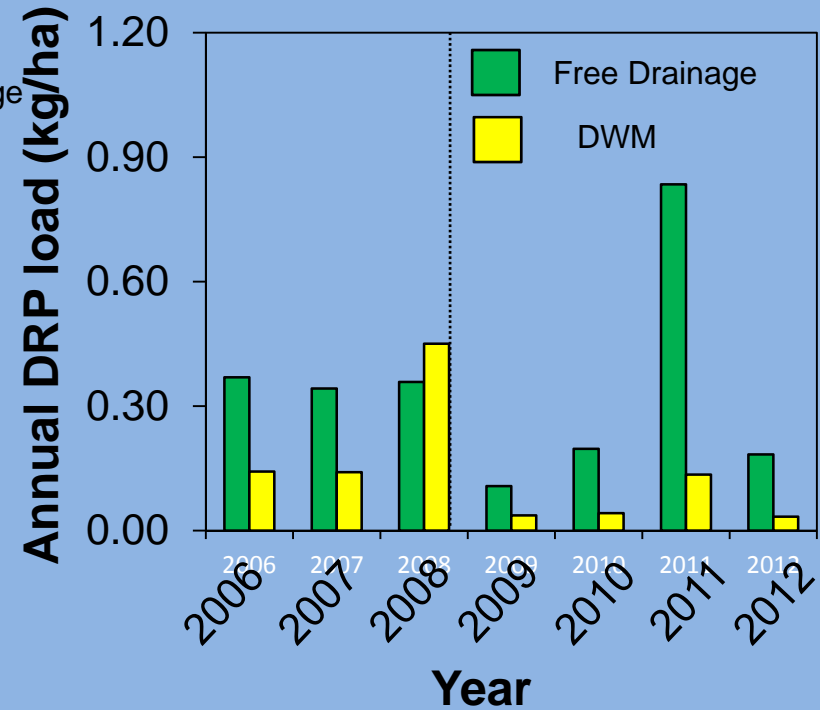
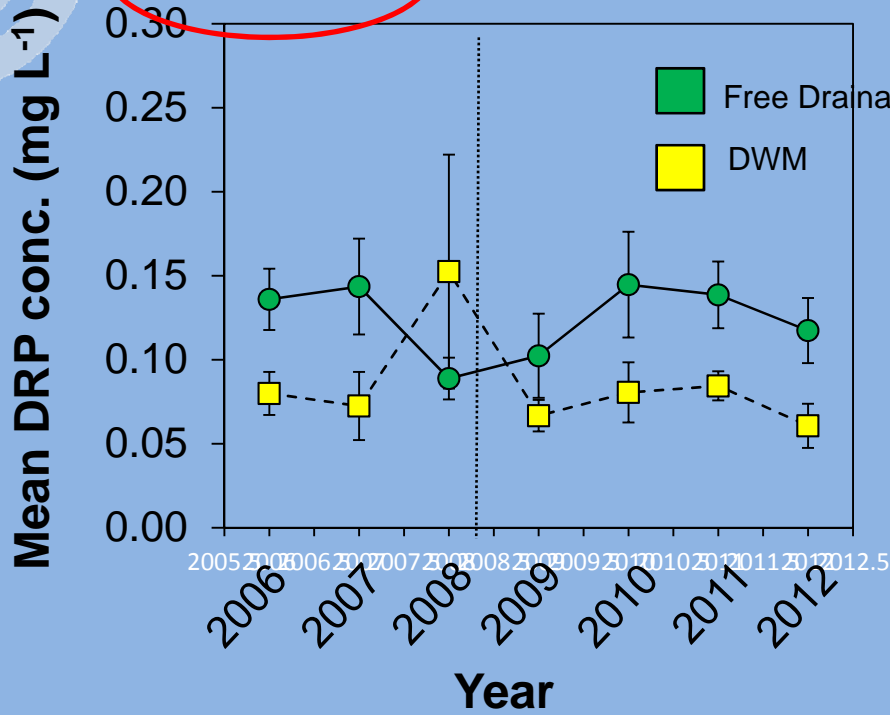


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DWM did not significantly affect dissolved P concentration

40 to 68% reduction in annual dissolved P load with DWM



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# Water Quality Impacts of Drainage Water Management

- DWM does not significantly decrease nutrient concentrations
- DWM reduces the volume of water leaving the tile drainage system
- Reduction is measured in total load reduced and is directly correlated to volume reduced

Volume Reduction X Concentration = Load Reduction



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Less Risk



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# NRCS Promotion of DWM

## Technical Assistance Available:

- National Ag Water Mgt Team since 2011
- Conservation Planning by NRCS staff
- Conservation Activity Plans by Technical Service Providers
- DWM System Design Assistance



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Less Risk



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# NRCS Promotion of DWM

## Financial Assistance Available:

- Funding for Conservation Activity Plans
- Funding for Drainage Water Management Implementation
- Funding for Structures to Implement DWM
  - Structures for Water Control
  - Inline Structures for Water Control
  - Installation of Secondary Mains for DWM
  - Other Associated DWM Practices
- Enhancement Payments under Conservation Stewardship Program for implementation of DWM



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# Water Quality Impacts of Drainage Water Management

## Trends



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Less Risk



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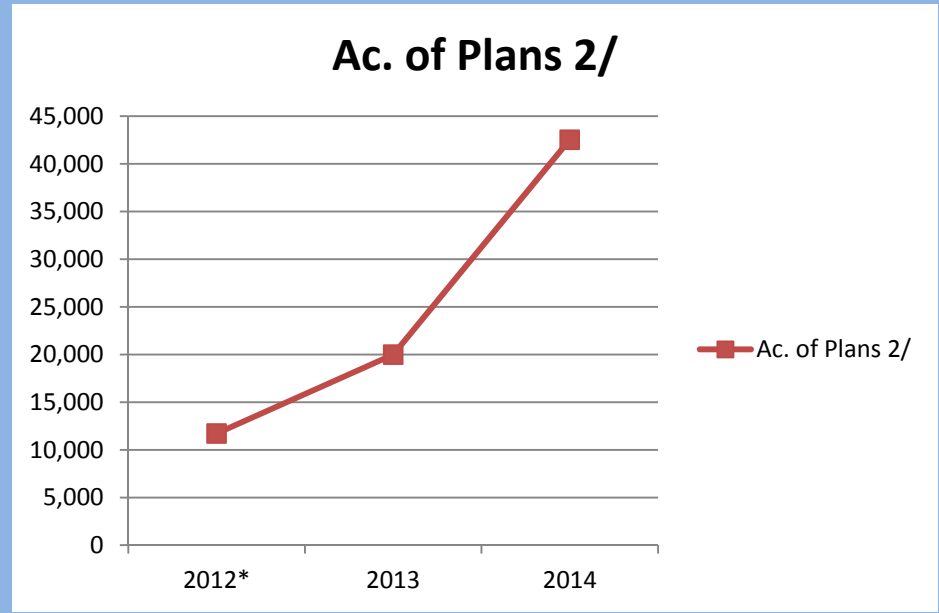
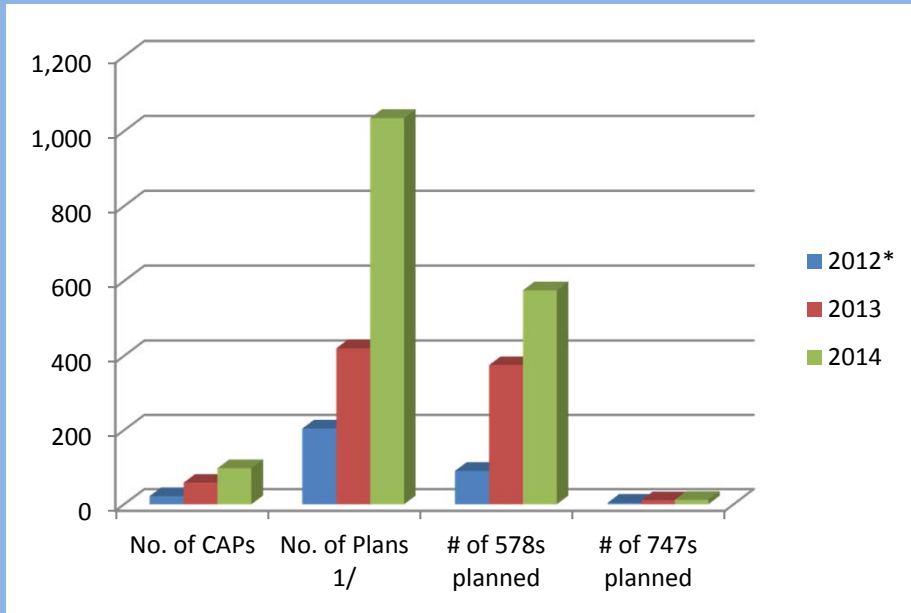
# Drainage Water Management

Trends - FY12 thru FY14\*

\*thru the end of 3<sup>rd</sup> Quarter

No. of Plans and Practices

Acres of Plans



More Production



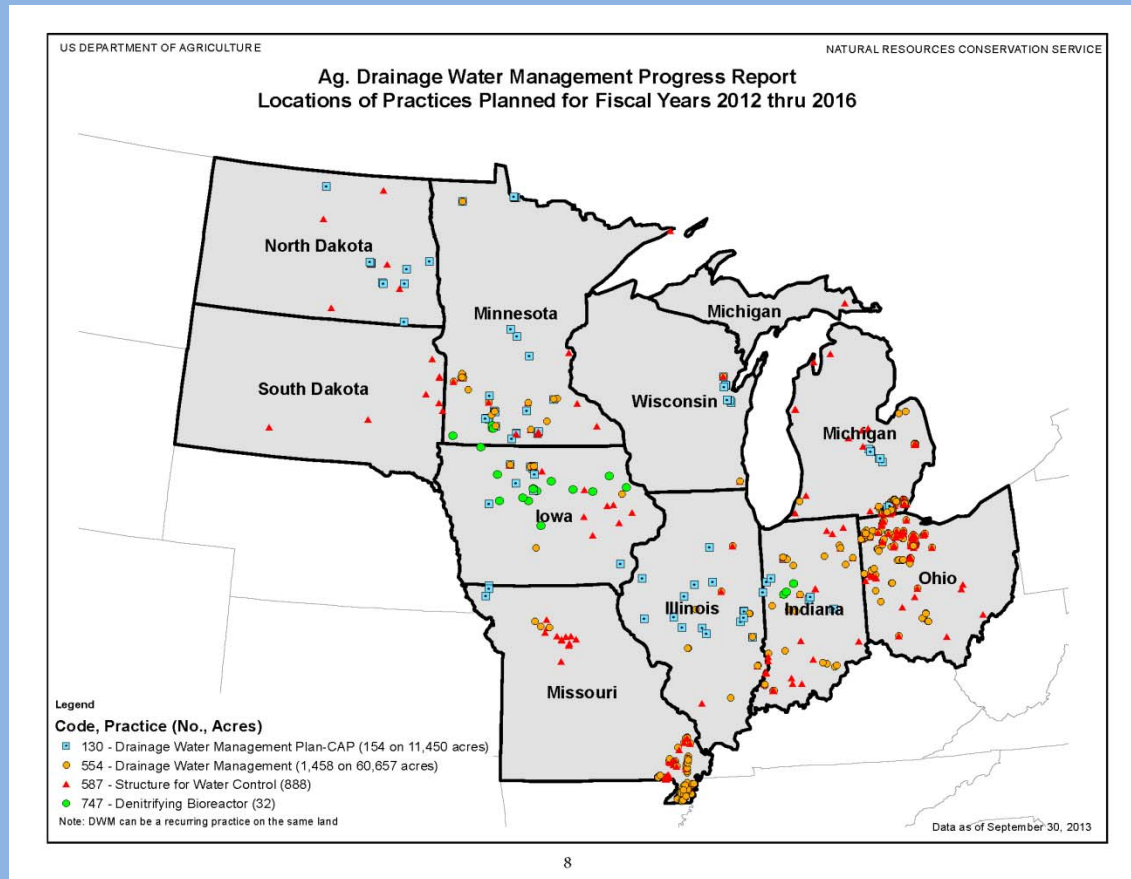
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# Drainage Water Management Practices Planned - FY12 thru FY16



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# Drainage Water Management

## Other Associated Practices to Drainage Water Management

- **Vegetated Subsurface Drain Outlets or “Saturated Buffers”**
- **Denitrifying Bioreactors**
- **Two Stage Ditches**
- **Restored, Enhanced or Created Wetlands**



More Production ✓



Less Risk ✓



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# What are the unique advantages of DWM for Environmental Markets?

- Nutrient reductions are immediate
- Reductions are easily measured
- Significant acres of opportunity (Scale)
- Load reduction is significant
- Producer adoption is increasing
- Modest crop yields for producers – up to 10%



More Production



Less Risk



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# Why are Environmental Markets important?

A viable Market for producers to participate in would greatly increase the adoption of DWM and environmental benefits for society in reducing nutrient loadings into important surface water resources.



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Less Risk



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# What next?

- **Established criteria and methods to quantify nutrient reductions**
- **Establish market values for load reductions**
- **Establish a panel to move forward with the concept of credits for DWM; identify barriers and how to overcome those barriers; identify additional areas/watersheds to pilot the markets**



More Production



Less Risk



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## Improving Ecosystem Services from Agricultural Lands; Modern Technologies and Markets

# QUESTIONS??

Presented by:  
**Paul J. Sweeney**  
*Senior Project Leader*



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