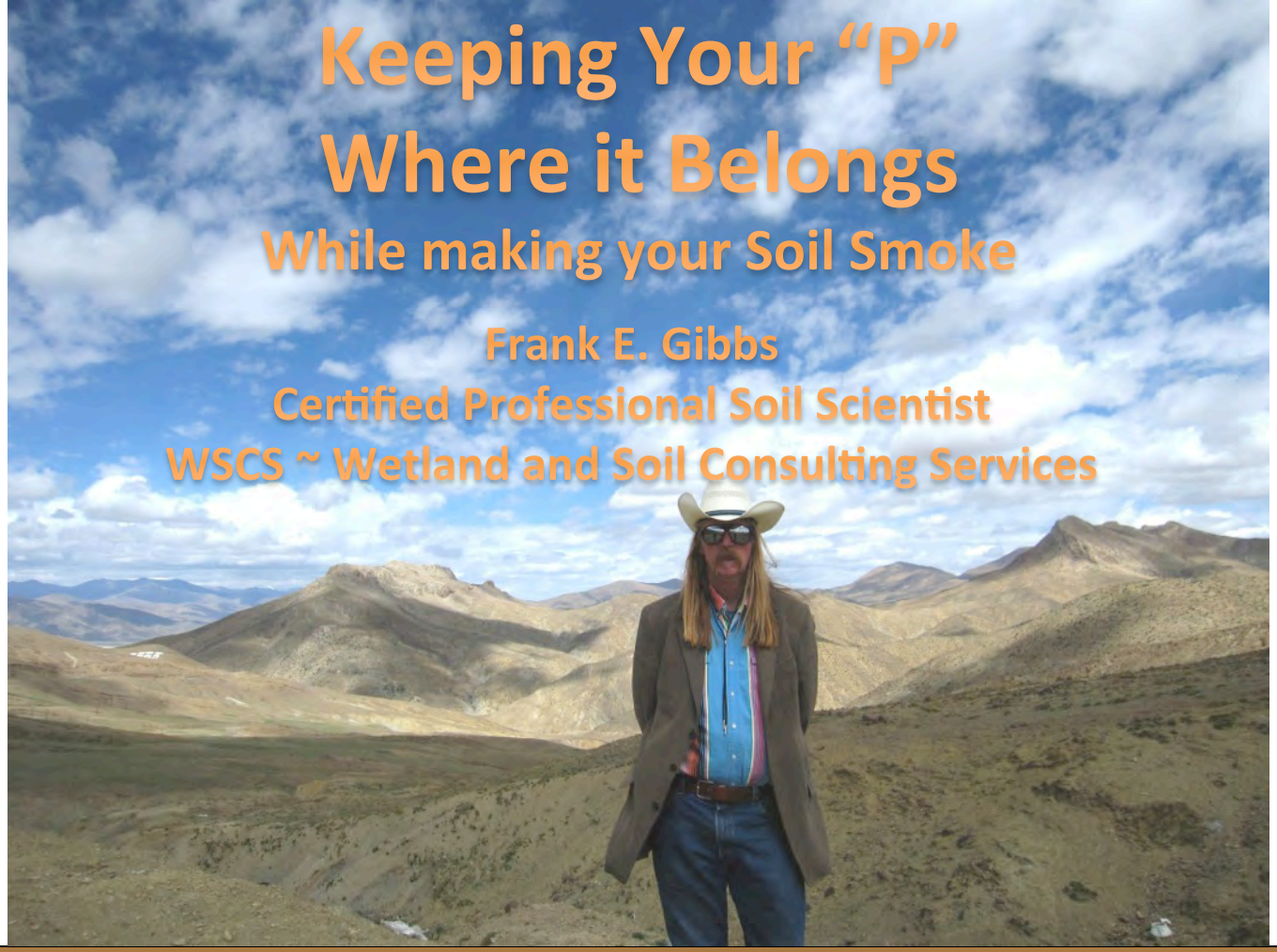
Keeping Your "P" Where it Belongs

While making your Soil Smoke

Frank E. Gibbs
Certified Professional Soil Scientist
WSCS ~ Wetland and Soil Consulting Services



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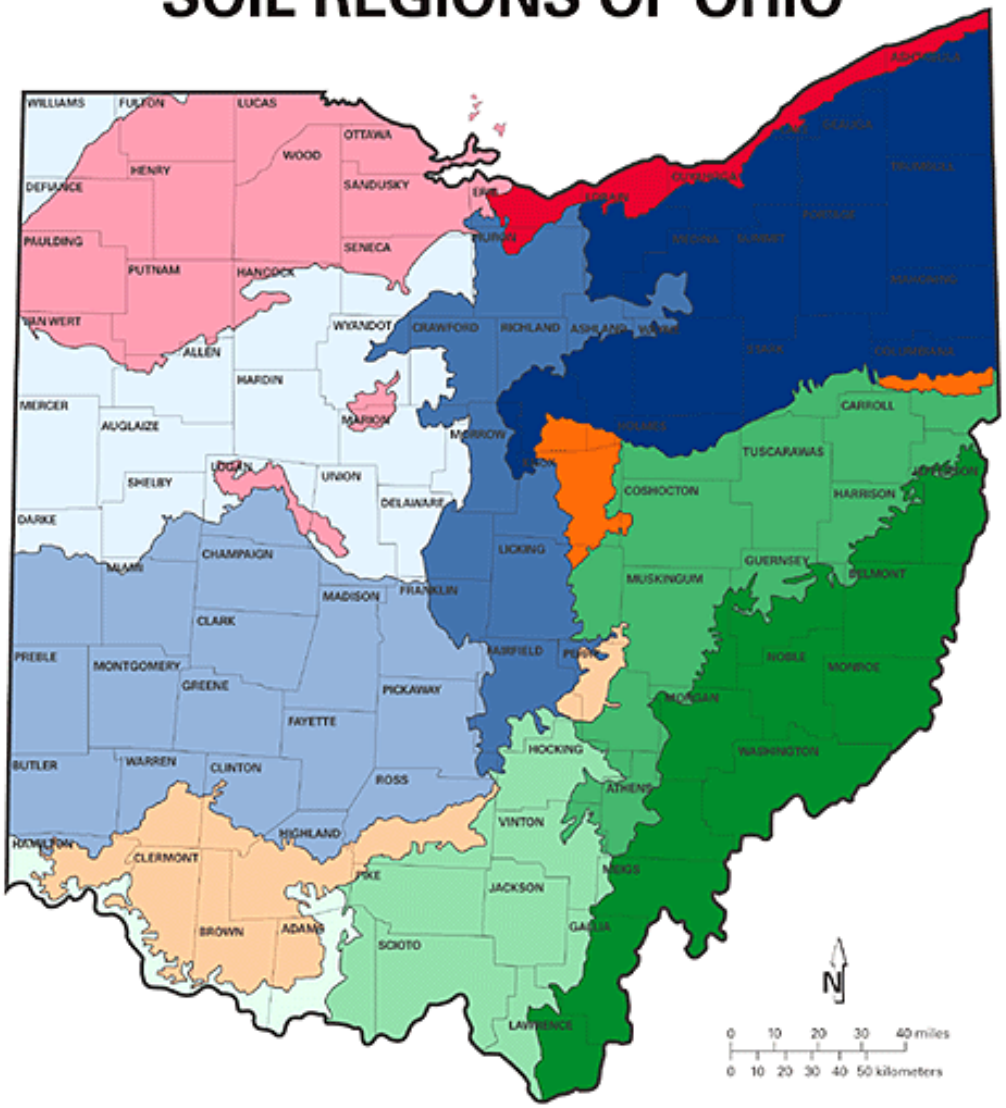
SOIL REGIONS OF OHIO



LEGEND*

1 Hoytville-Nappanee-Paulding-Toledo

2 Conotton-Conneaut-Allis

3 Blount-Pewamo-Glynwood

4 Miamian-Kokomo-Eldean

5 Bennington-Cardington-Centerburg

6 Mahoning-Canfield-Rittman-Chili

7 Clermont-Rossmoyne-Avonburg-Cincinnati

8 Westmoreland-Homewood-Loudonville

9 Eden-Bratton-Brushcreek

10 Shelocta-Brownsville-Latham-Steinsburg

11 Coshocton-Westmoreland-Berks

12 Gilpin-Upshur-Lowell-Guernsey

*Soil regions are identified by the names of the soil series that are common in that region

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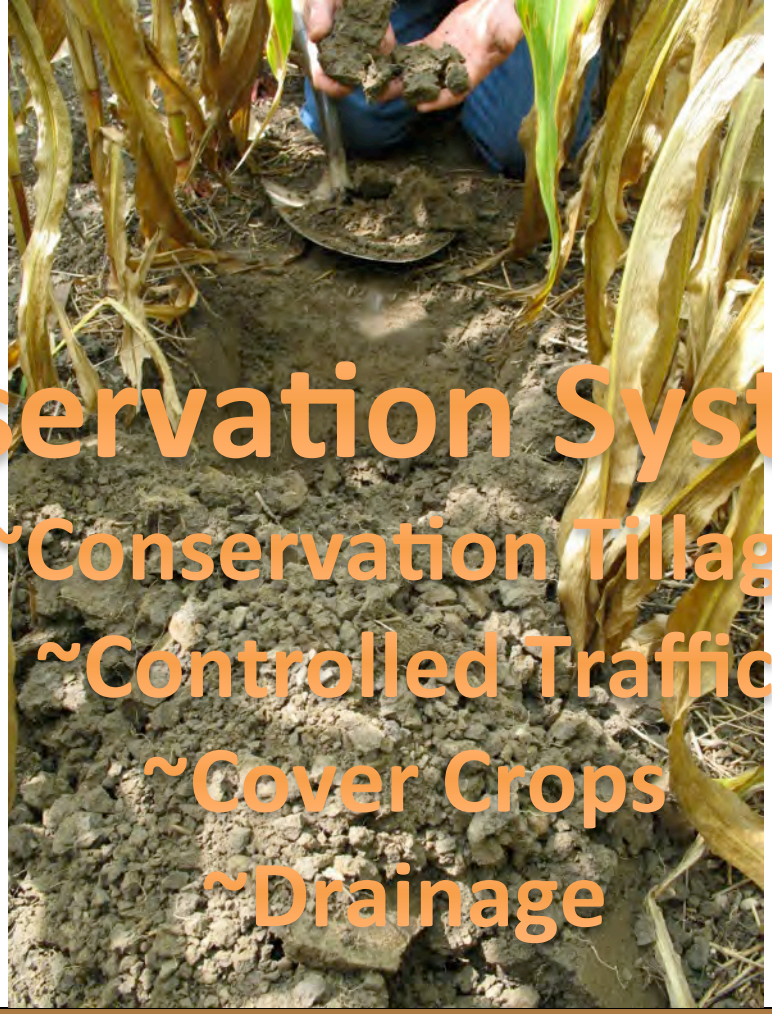

Conservation Systems:

~Conservation Tillage

~Controlled Traffic

~Cover Crops

~Drainage

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09/03/2011 (DOY=246)

~Dr. David Baker
Heidelberg University

~Joe Nester
Nester Ag

~Kevin King
USDA-ARS Drainage Unit

~Rick Wilson
OEPA

~Mark Sunderman
Deshler Farmers Elevator

~Allen Dean
AD Farms

~Jerry and Les Seiler
Seiler Farms

08/30/2012 (DOY=243)

Rainfall Comparison in inches

Month	2011		2010	1972
January	1.62	0.84	1.12	
February	4.41		1.67	0.78
March	3.14		2.40	2.55
April	6.22		2.83	5.95
May	7.42		8.14	4.16
June	2.24		6.67	3.37
July	2.35		1.90	4.30
August	6.03		2.80	3.04
September	7.66		1.19	8.26
October	4.26	1.37	1.85	
November	5.03		4.28	4.54
December	4.48		0.66	3.07
Total	54.86		34.75	38.99

Past rainfall record year 1950 = 50.39 inches

Average Annual Rainfall = 34.50 inches

Provided by Guy Verhoff, Pandora Weather Observer

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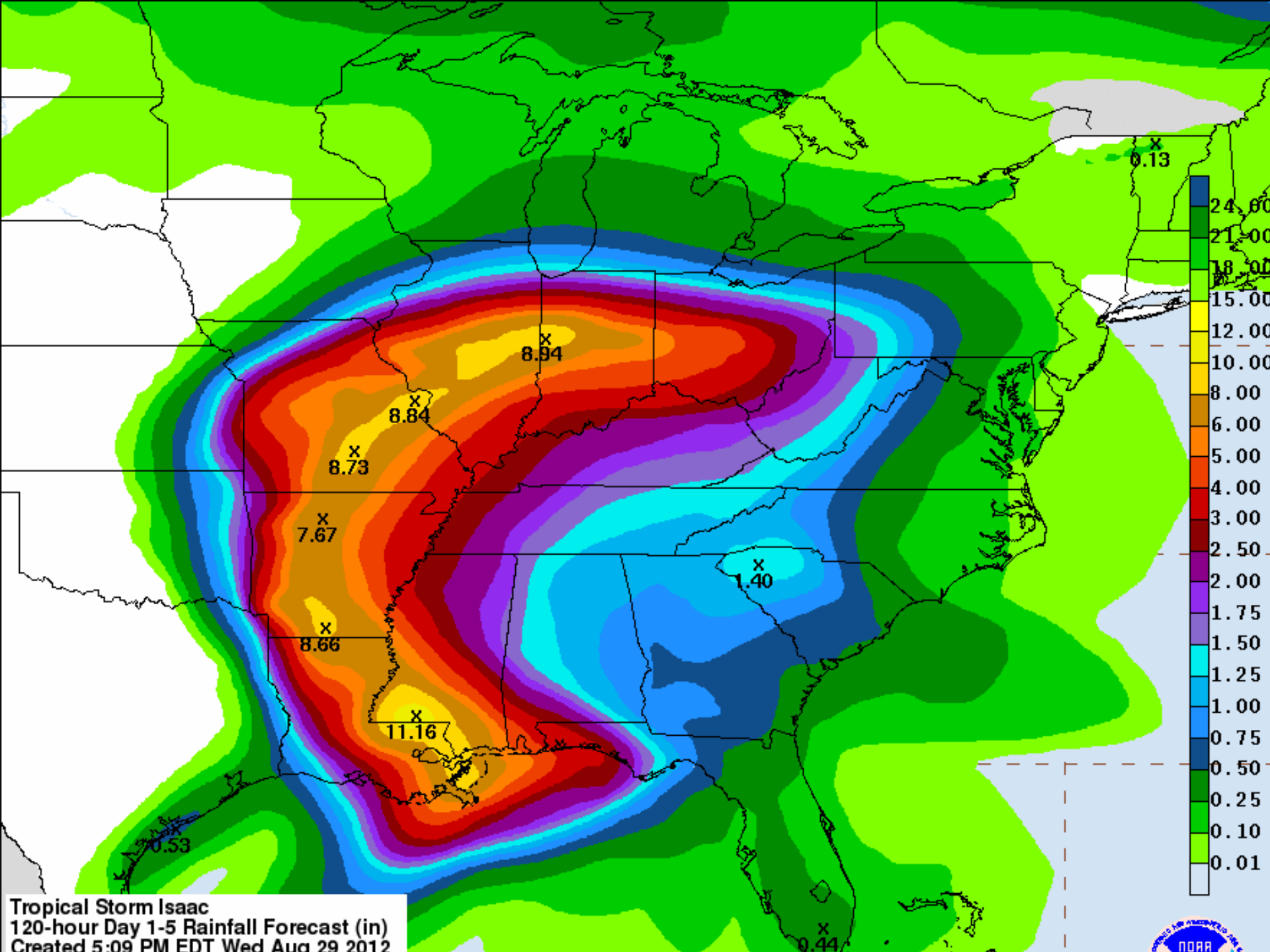
0.13
8.94
8.84
8.73
7.67
1.40
8.66
11.16
0.53
0.44
24.00
21.00
18.00
15.00
12.00
10.00
8.00
6.00
5.00
4.00
3.00
2.50
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.10
0.01
Tropical Storm Isaac
120-hour Day 1-5 Rainfall Forecast (in)
Created 5:09 PM EDT Wed Aug 29 2012

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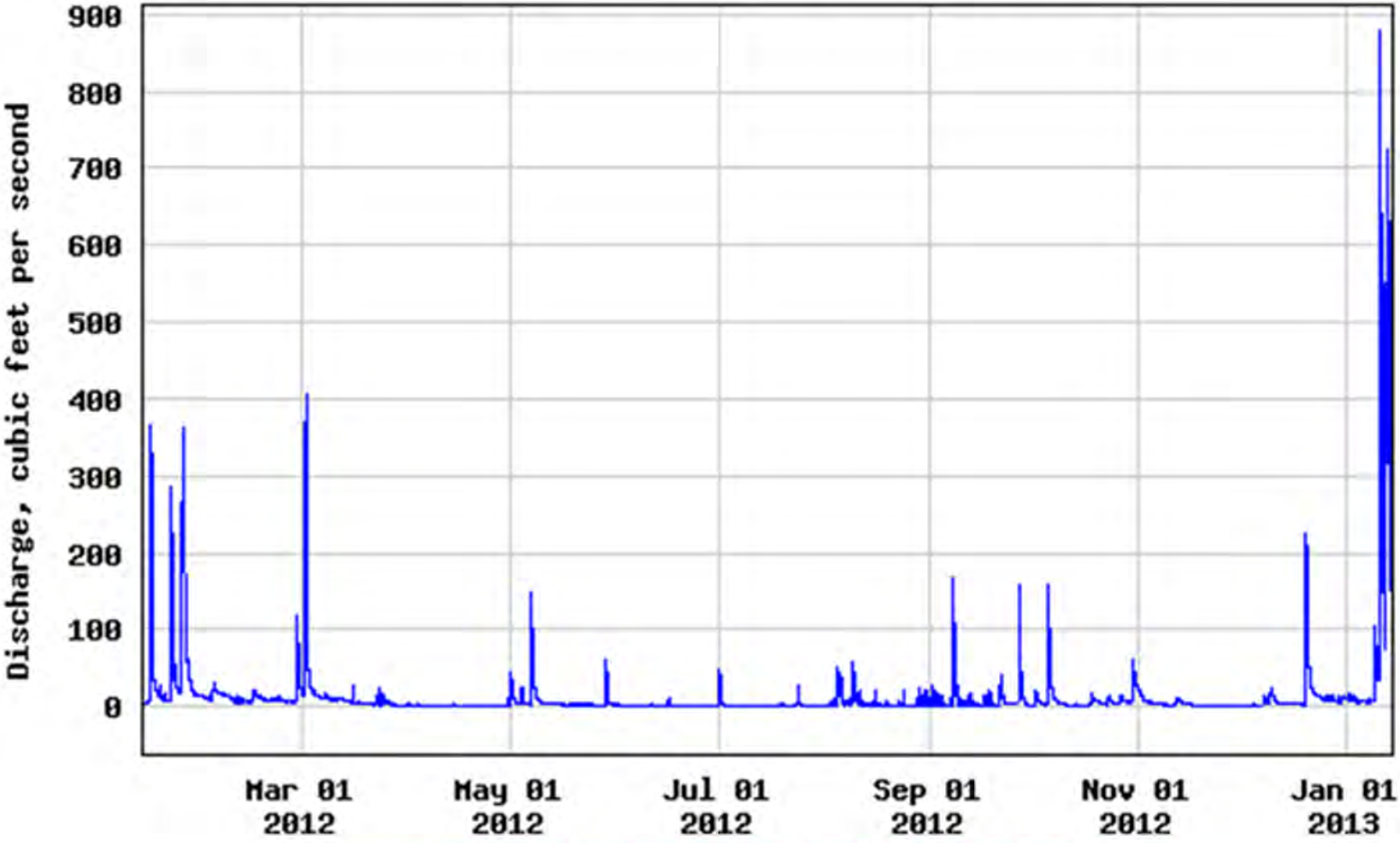
USGS

USGS 402913084285400 Chickasaw Creek at St. Marys OH



---- Provisional Data Subject to Revision ----

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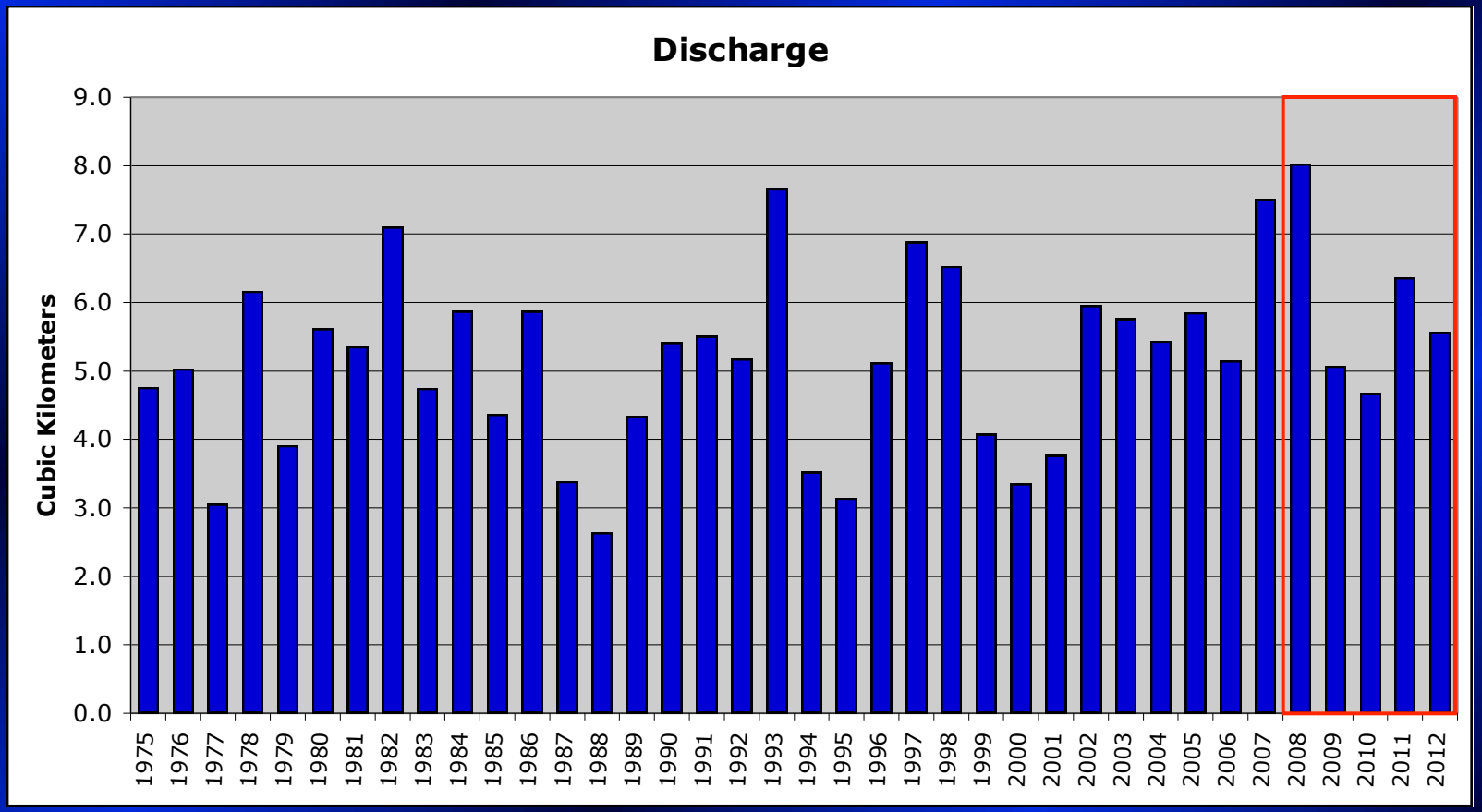
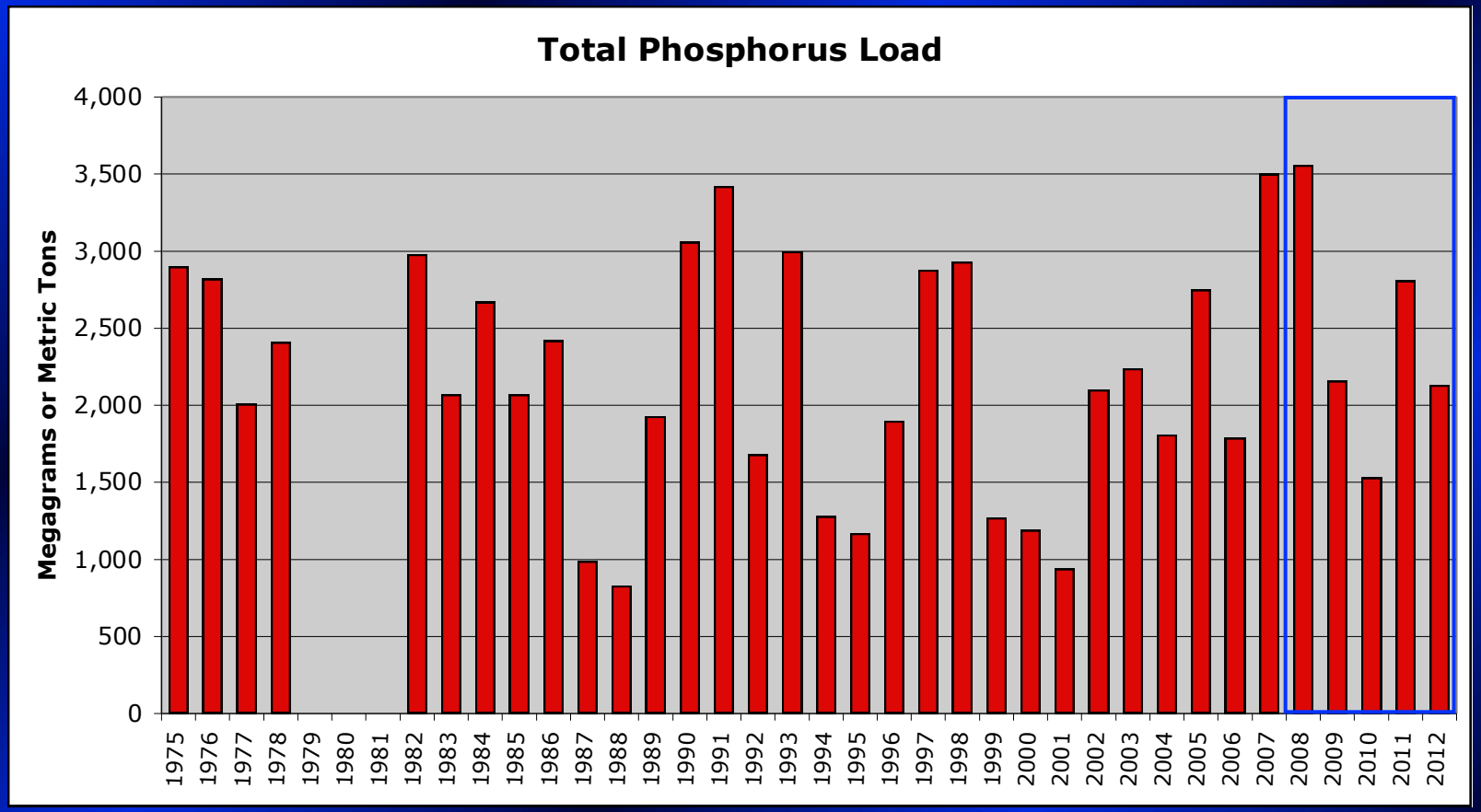
Maumee Water Year Discharge



2011 and 2012 sort of medium, not too different

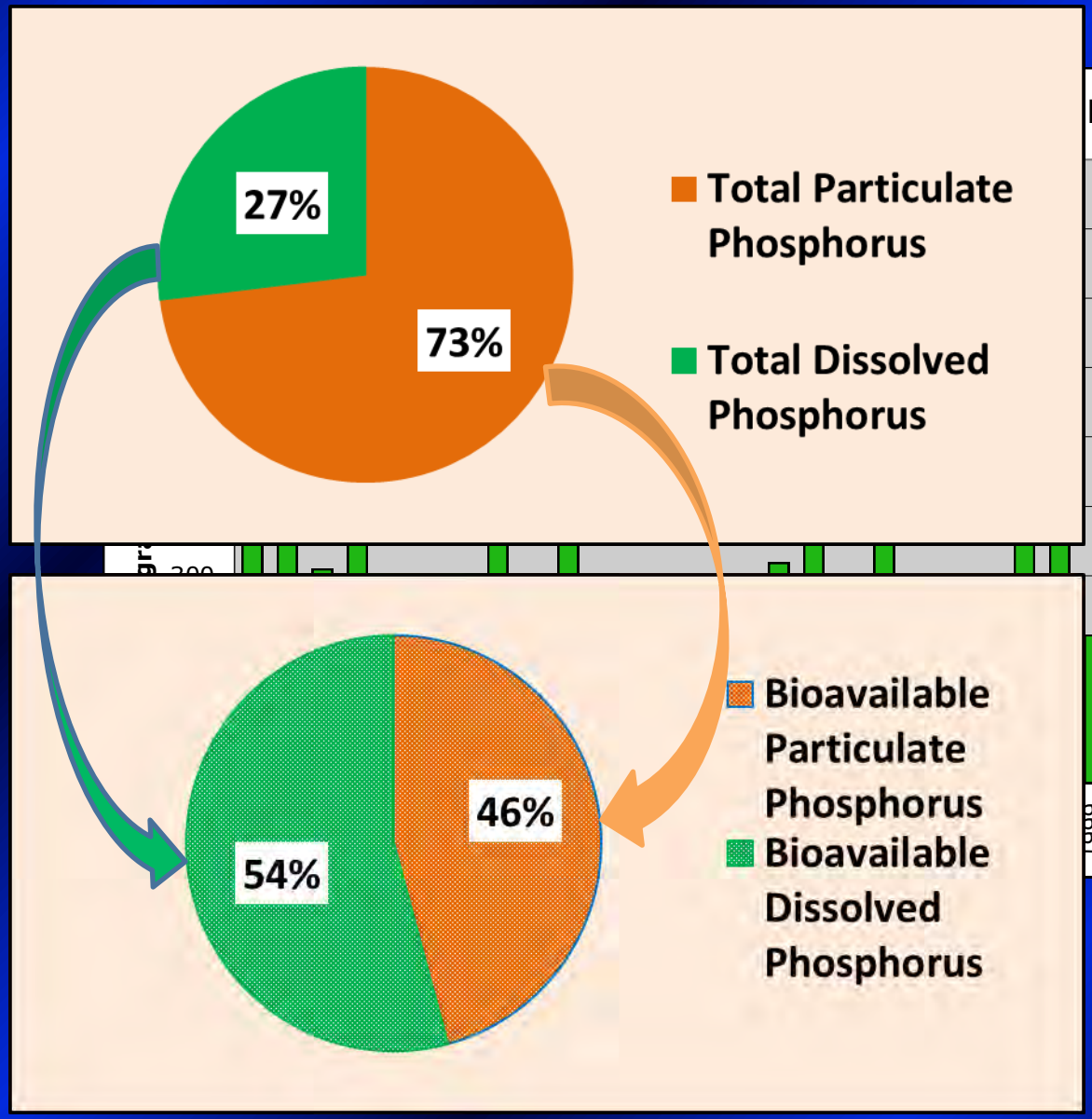
Water Year TP Load

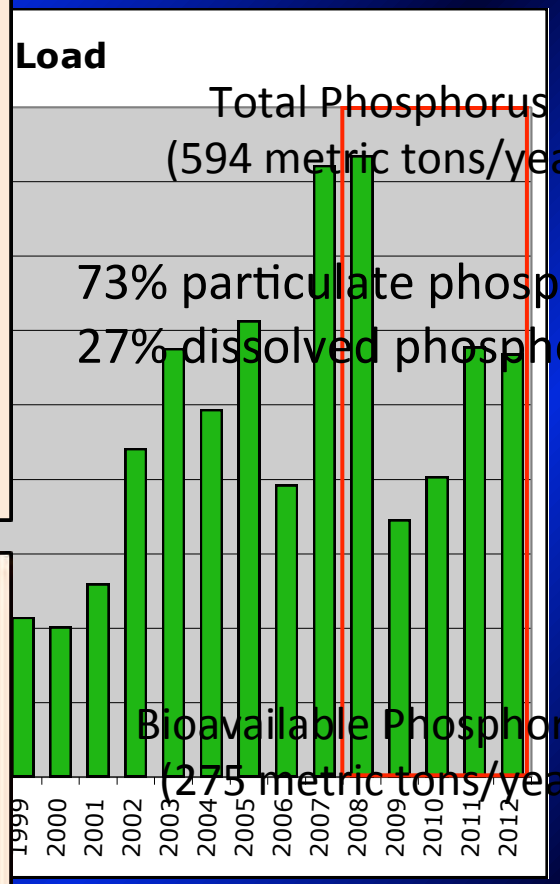


2011 high medium, 2012 low medium

Characteristics of average annual export of phosphorus from the Sandusky River, 2002-2011

Water Year DRP Load





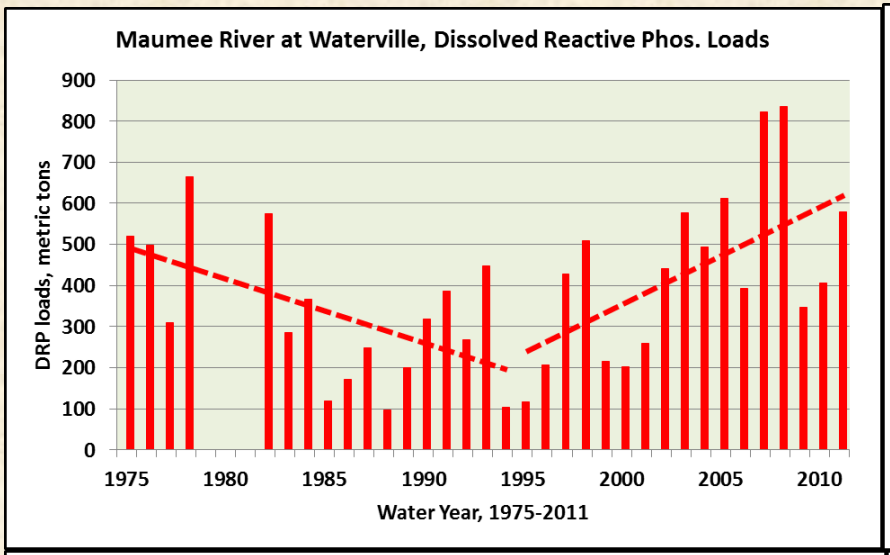
Total Phosphorus
(594 metric tons/year)

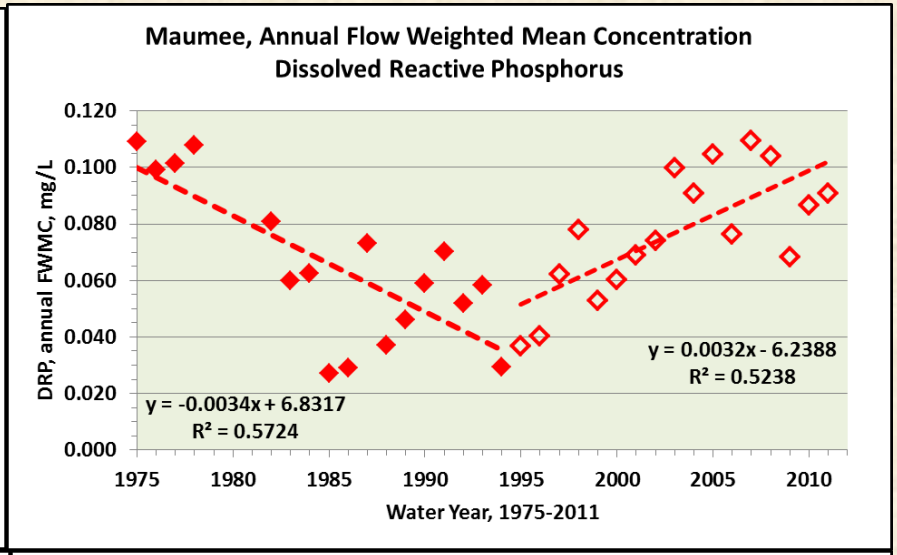
73% particulate phosphorus
27% dissolved phosphorus

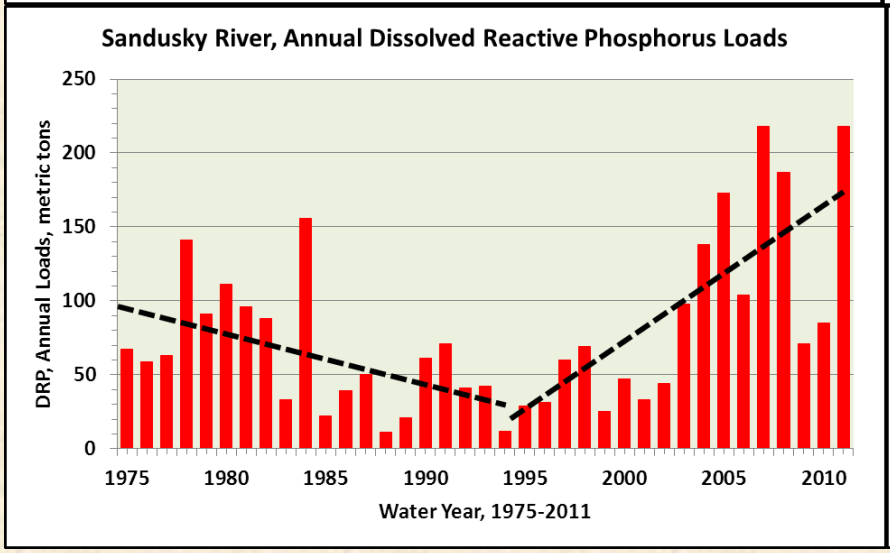
Bioavailable Phosphorus
(275 metric tons/year)

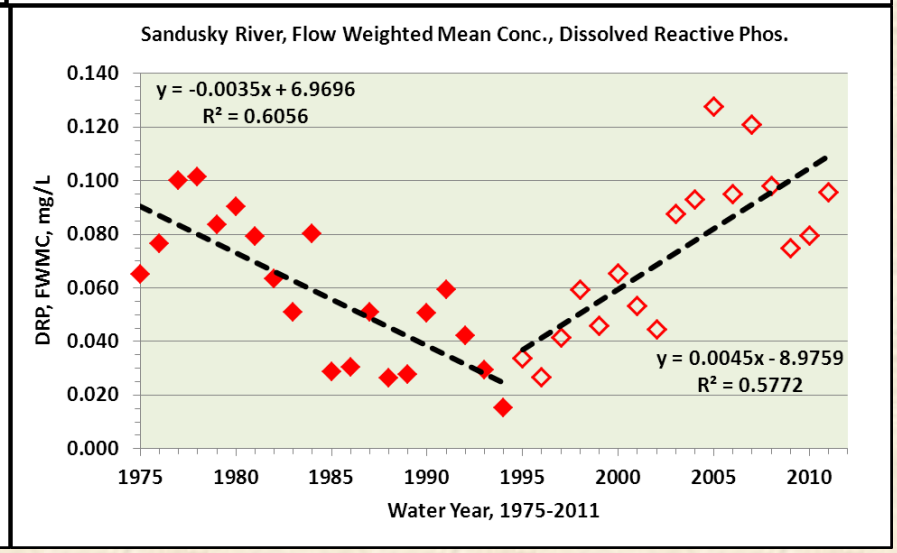
46% particulate phosphorus
54% dissolved phosphorus

Trends in annual loads and flow weighted mean concentrations of dissolved reactive phosphorus in the Maumee and Sandusky rivers

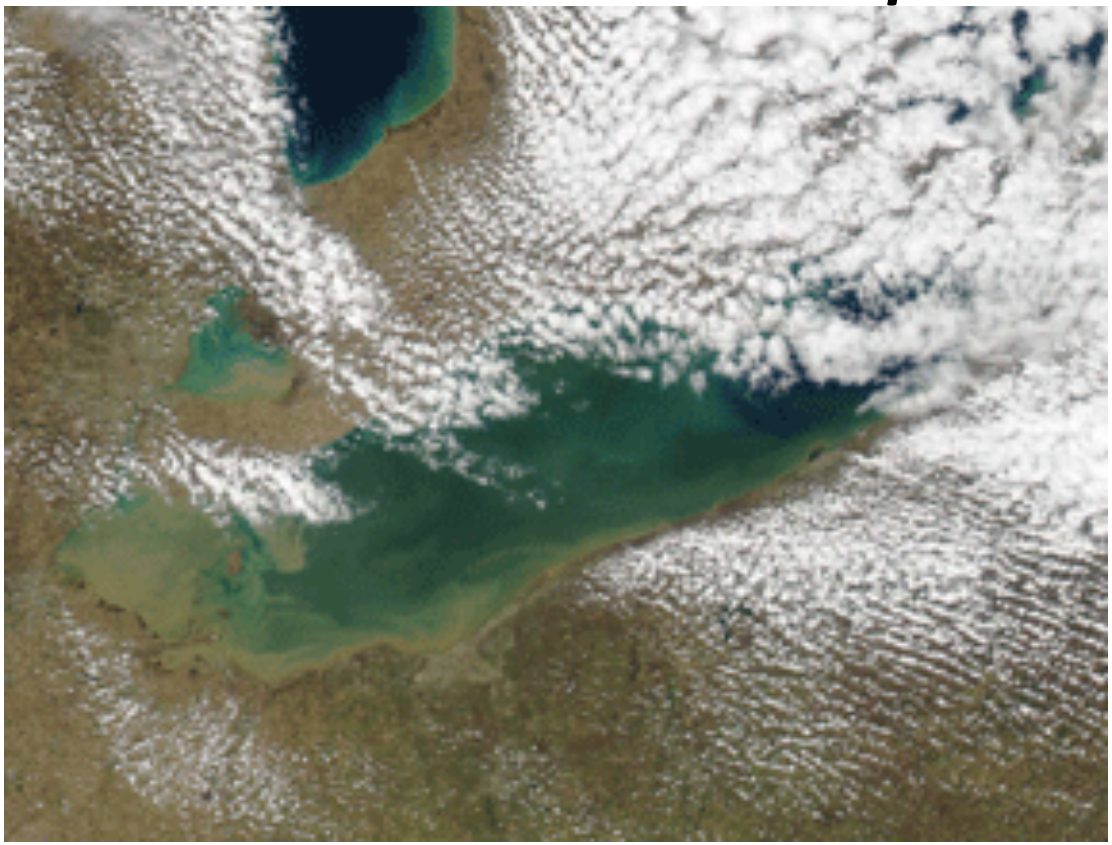








The DRP or Dissolved Reactive Phosphorus Issue



- **April 21, 2011, satellite photo of Lake Erie illustrating heavy sedimentation from recent heavy rainfalls.**

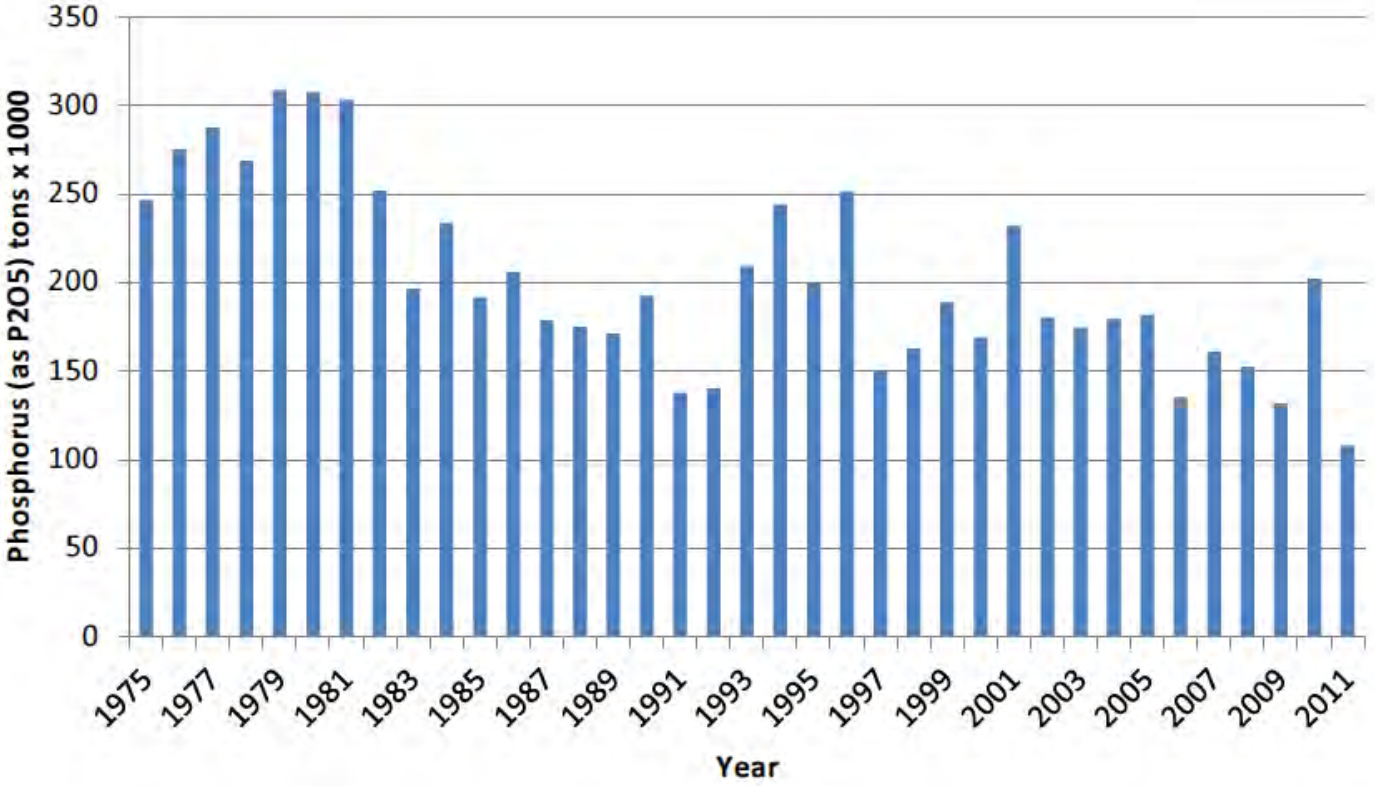


Figure 2-1. Phosphorus commercial fertilizer sales for the state of Ohio from 1975 to 2011.
Source: American Association of Plant Food Control Officials (AAPFCO).

Ohio USDA-NRCS Web Site

- ***The increased use of no-tillage has been alleged as a cause for the increase in dissolved reactive phosphorus due to a stratification of phosphorus at the surface in continuous no-tillage systems.***

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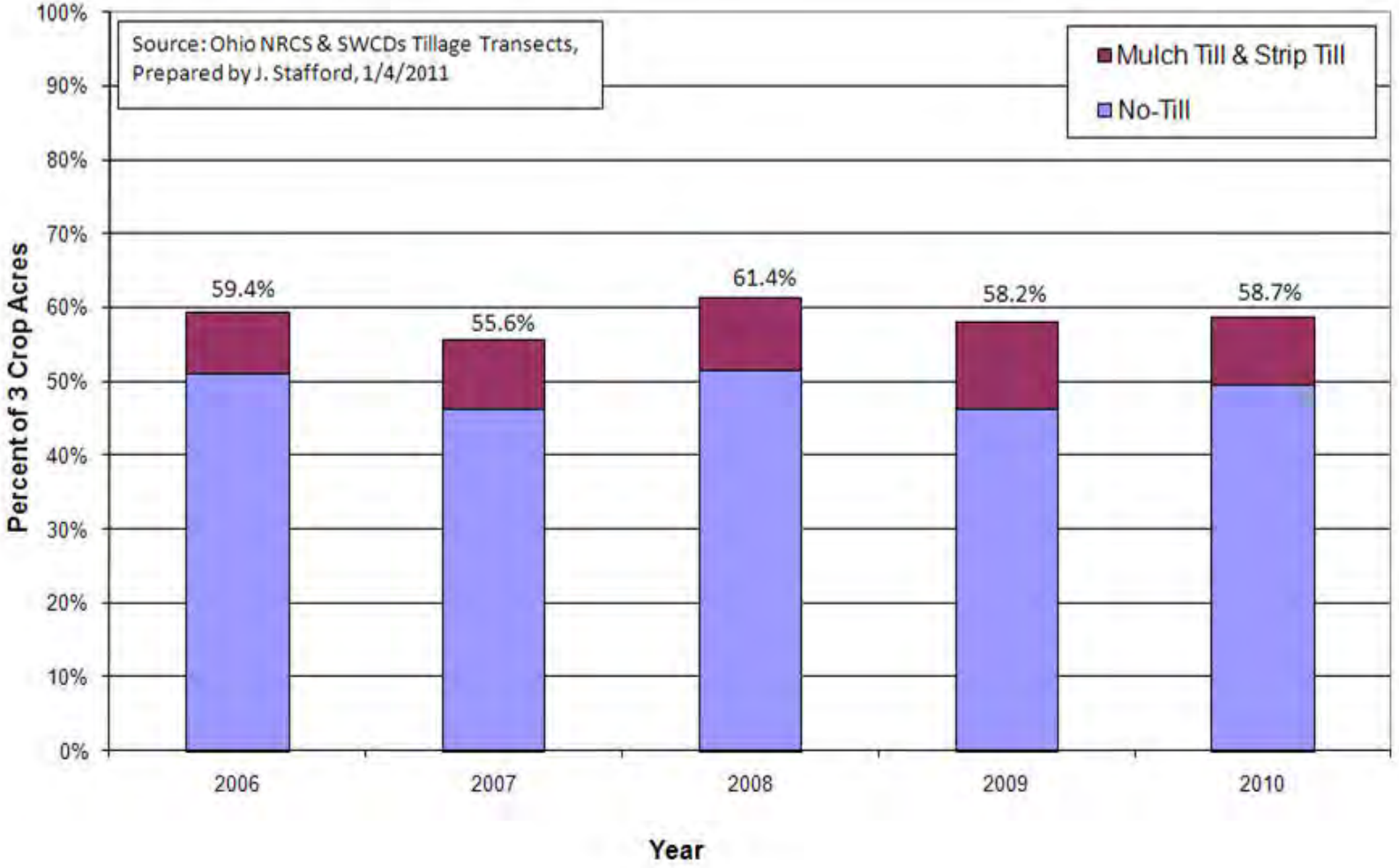

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Tillage Definitions

No-Tillage = acres in which the soil is not stirred and more than 30% residue is left at planting

Mulch Tillage = acres in which the soil is stirred and which leaves more than 30% residue cover on the surface at planting

Conservation tillage = the sum of acres planted using either Mulch Tillage or No-Tillage

Conventional tillage = acres stirred extensively (chiseling and disking, etc) such that there is less than 30% residue and/or clean till acres that have been moldboard plowed

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	Corn	Soybeans	Wheat	Total
Five Year Average Acres - 2006 - 2010				
Mulch Till Average Acres	133,098	139,203	23,201	295,501
No Till Average Acres	210,636	979,917	303,438	1,493,991
Conventional Till Average Acres	746,690	414,557	101,960	1,263,207
Total	1,090,424	1,533,676	428,599	3,052,700
Five Year Average Percentages - 2006 - 2010				
Mulch Till Average Percent	4.4%	4.6%	0.8%	9.7%
No Till Average Percent	6.9%	32.1%	9.9%	48.9%
Conventional Till Average Percent	24.5%	13.6%	3.3%	41.4%
Total Crop Percent	35.7%	50.2%	14.0%	100.0%

- *In any given year, approximately 40% of the watershed still has no form of conservation tillage or protective residue cover on the soil surface at the time of planting. That equates to 1,263,207 acres of bare cropland soil in the watershed at planting time.*

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Ohio USDA NRCS Website

Broadcast surface applications

Fall or winter applications

Two years of fertilizer in one year on the corn crop

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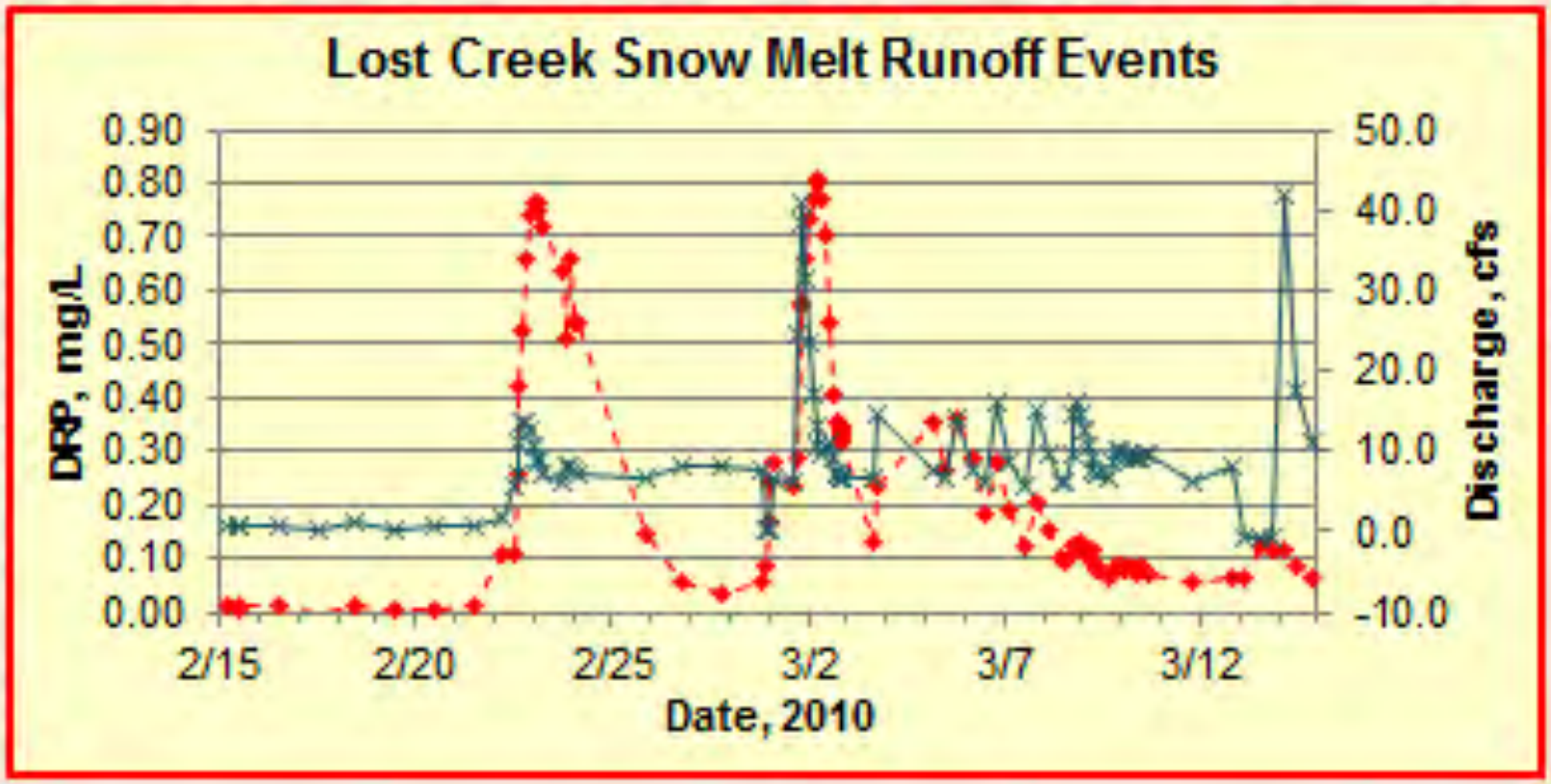
Time P was Applied

- 44%~ September through October
- 16%~December–February
- 33%~March-May
- 7%~Summer

Winter Broadcasting of fertilizer in the Lost Creek Watershed, 2010



Ohio Agriculture Retailer Survey
Percent of P Applications

- 15% Broadcast P/Tilled after 7 days
- 18% Broadcast P/Tilled within 7 days
- 31% Broadcast P/No Incorporation
- 4% Incorporated Band P/Strip-tilled
- 33% Incorporated Starter P/Planter

~2013 Mail Survey

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- 61% of the Lake Erie Basin total phosphorus load (all sources) came from cultivated cropland.
- 2.05 Lbs/Ac average Total P was delivered to edge of Cultivated Fields.
- 32% Less Total P Delivered because of Conservation Practices on the Land Now. NRCS USDA 2011 CEAP Study

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A gradual long term increase in soil phosphorus levels within the basin over a thirty-forty year period

“Death by a thousand Cuts”

More soil compaction in the basin, decreasing infiltration, and increasing surface runoff in major storm events

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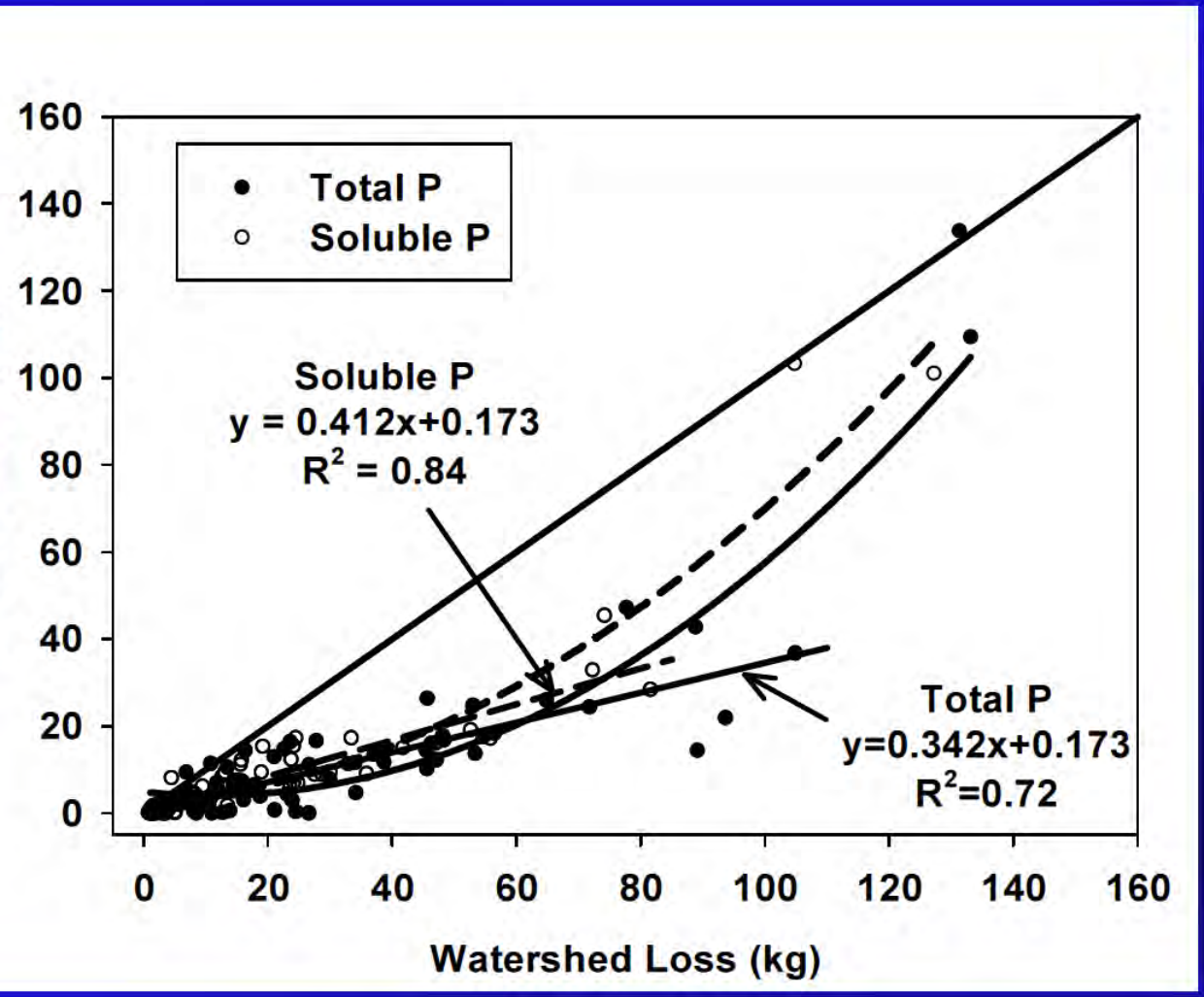


Fraction of annual watershed loading originating from tile

	Soluble P	Total P
2005	0.317	0.234
2006	0.346	0.300
2007	0.313	0.264
2008	0.756	0.759
2009	0.591	0.485
2010	0.669	0.630
AVG	0.499 (0.447)	0.445 (0.383)

-40% of annual total phosphorus load at EOF from tile discharge (Enright and Madramootoo, 2004)

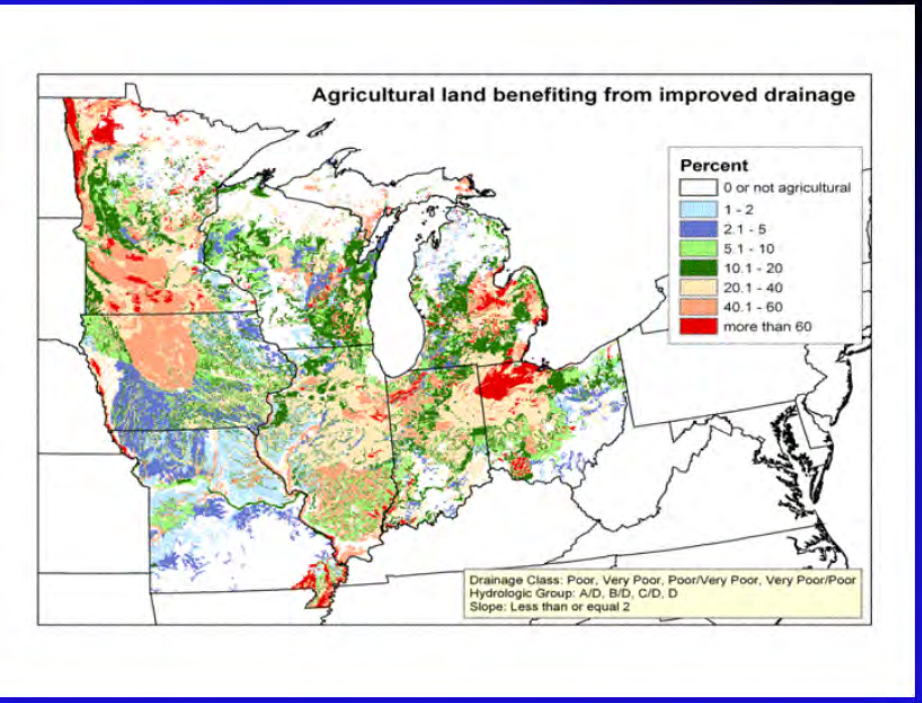
- 25% of TP and 50% of soluble P leaving watershed originated in tile drainage (Culley and Bolton, 1983)

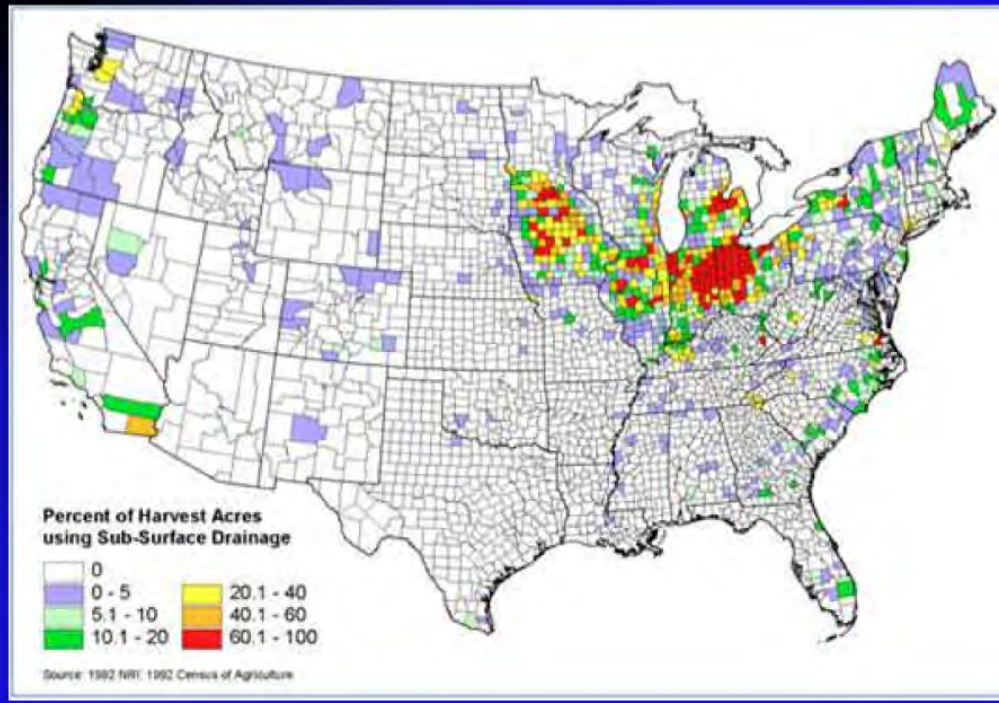
Extent of Tile Drainage

43 million ha of soil in US classified as wet; 31 million drained (Pavlis, 1987)

37% of cropland acres in the Midwest (Zucker and Brown, 1998)

- number of acres drained essentially remaining constant
- random drains converted to systematic drains and aging drainage infrastructures are being updated
- intensity (split spacing) increasing to accommodate larger farming enterprises and shorter windows for agricultural practices





Necessity of Tile Drainage

25% of cropland in US and Canada could not be farmed without tile drainage (Skaggs et al., 1994)

Tile Drainage (Fausey et al., 1987):

- provides trafficable conditions for field operations
- promotes root development by preventing exposure of plants to excess water

Laying subsurface drain tile with a machine. Shallow tiles and ditches were generally dug by hand. About four miles west of Dawson, Lac qui Parle County, circa 1905. (MHS photo)

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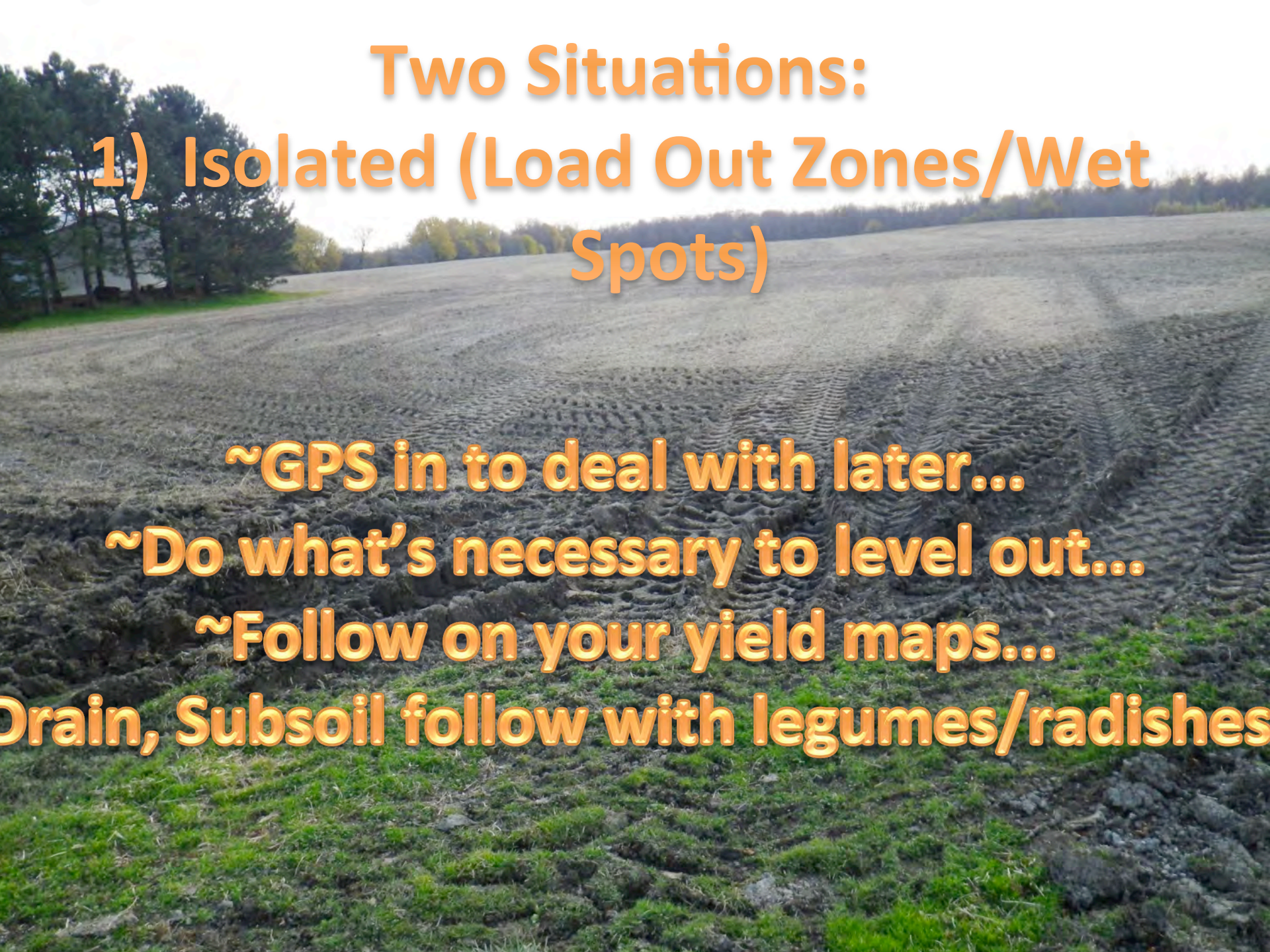
Two Situations:
1) Isolated (Load Out Zones/Wet Spots)
~GPS in to deal with later…
~Do what's necessary to level out…
~Follow on your yield maps…
Drain, Subsoil follow with legumes/radishes

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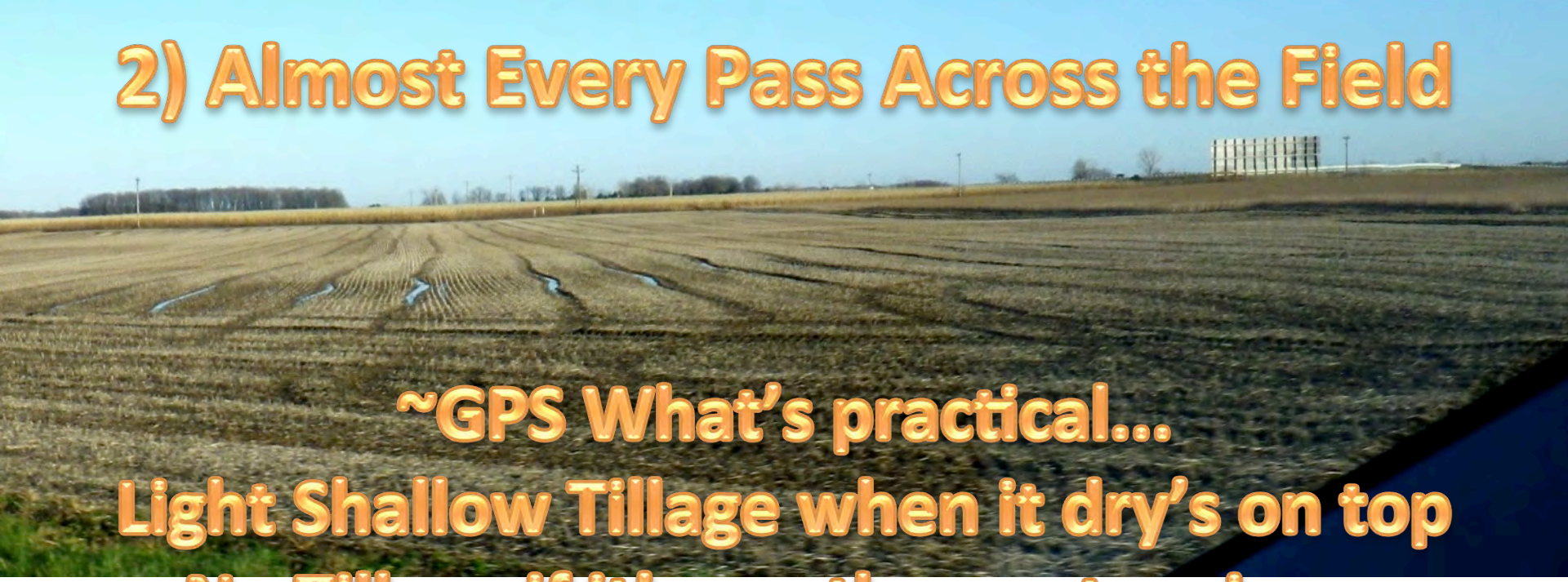
2) Almost Every Pass Across the Field



~GPS What's practical...

Light Shallow Tillage when it dry's on top

No Tillage if it's another wet spring...

Follow on Yield Maps...

Drain, subsoil, follow with legumes/radishes...


"Smeared Goobers"

Systematically Destroyed Soil Structure

Principals of Soil Health

- Limit Soil Disturbance
- Increase Soil Microbial Diversity
- Grow Living Roots Year Round
- Keep the Soil Covered
- Reduce Compaction

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Ohio Phos Task Force ~Soil Health

- Improve soil structure, aggregate stability, reducing compaction,
  - ~Increase water infiltration
  - ~Reduce nutrient runoff.
- Increase soil organic matter
  - ~Improve water holding capacity

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~Reduce water loss thru tile

~Increase Microbial Activity

~Filter and Recycle Nutrients

Applications must interact with the soil

~Without causing large Soil Disturbance

The Key Players

Progressive farmers, crop consultants and fertilizer dealers

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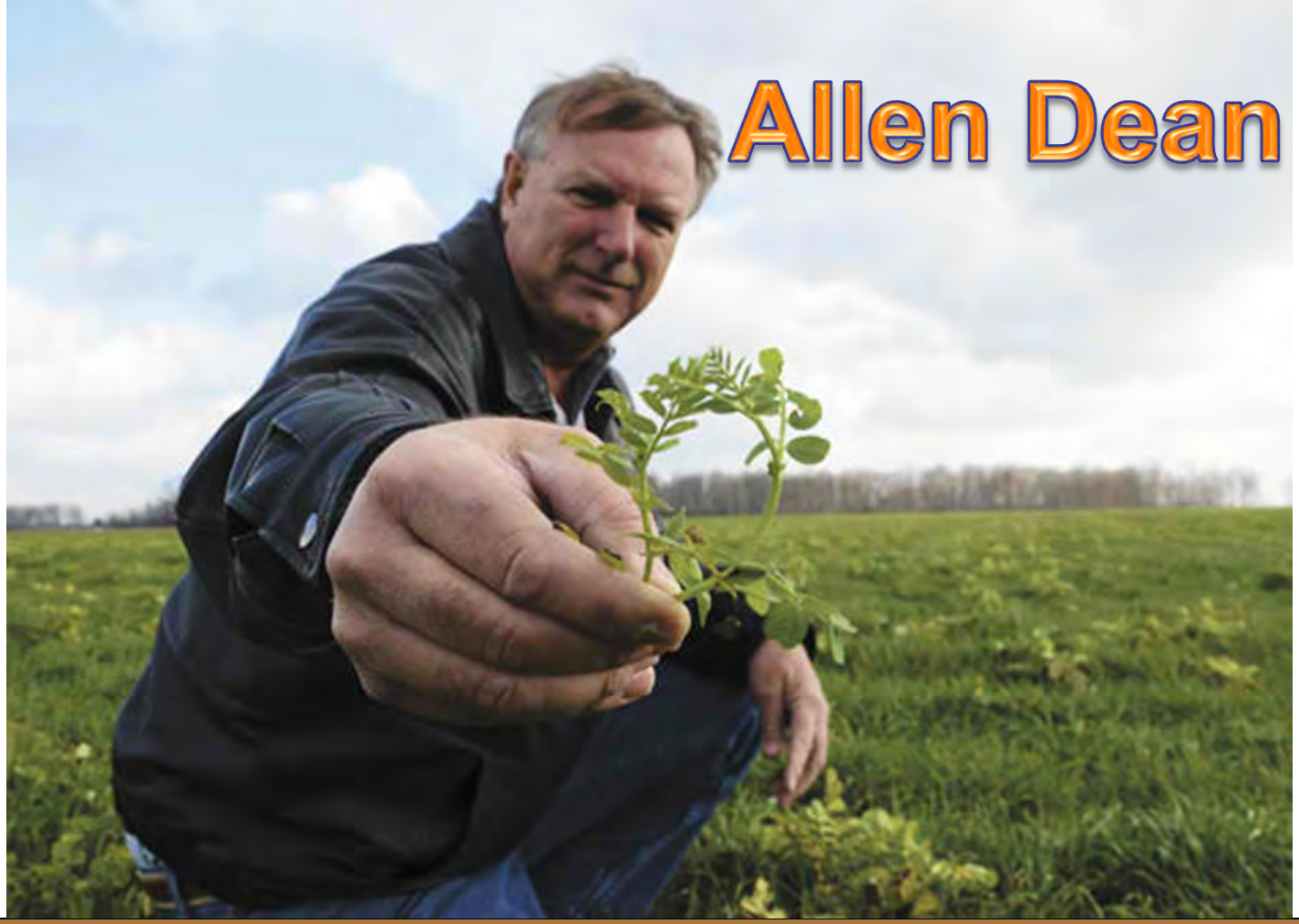

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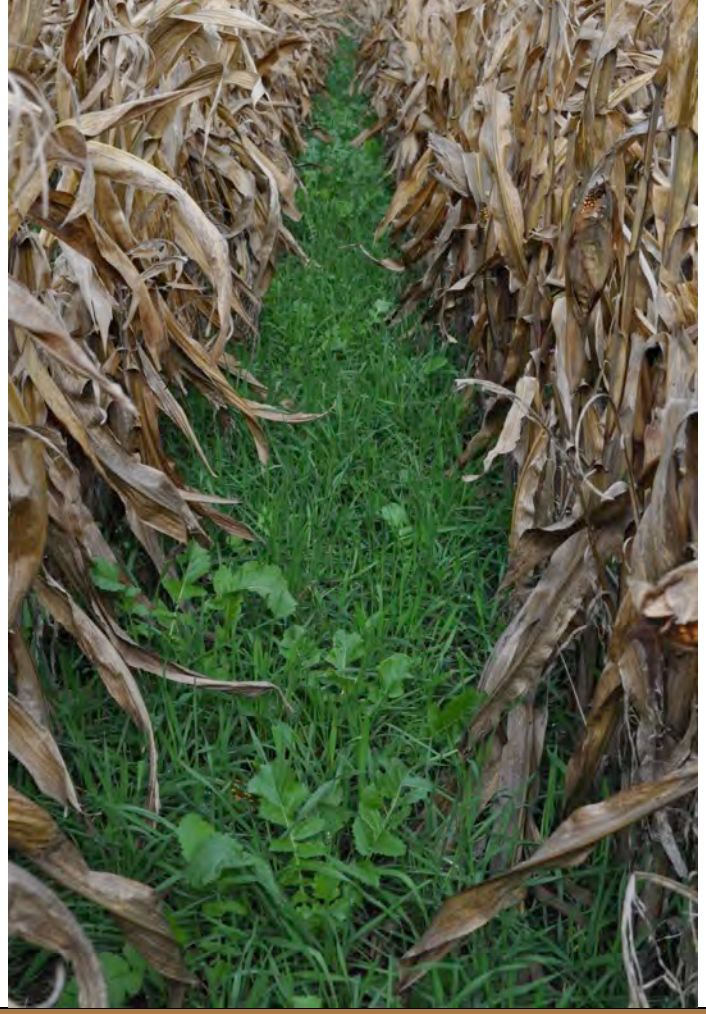

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Joe Nester

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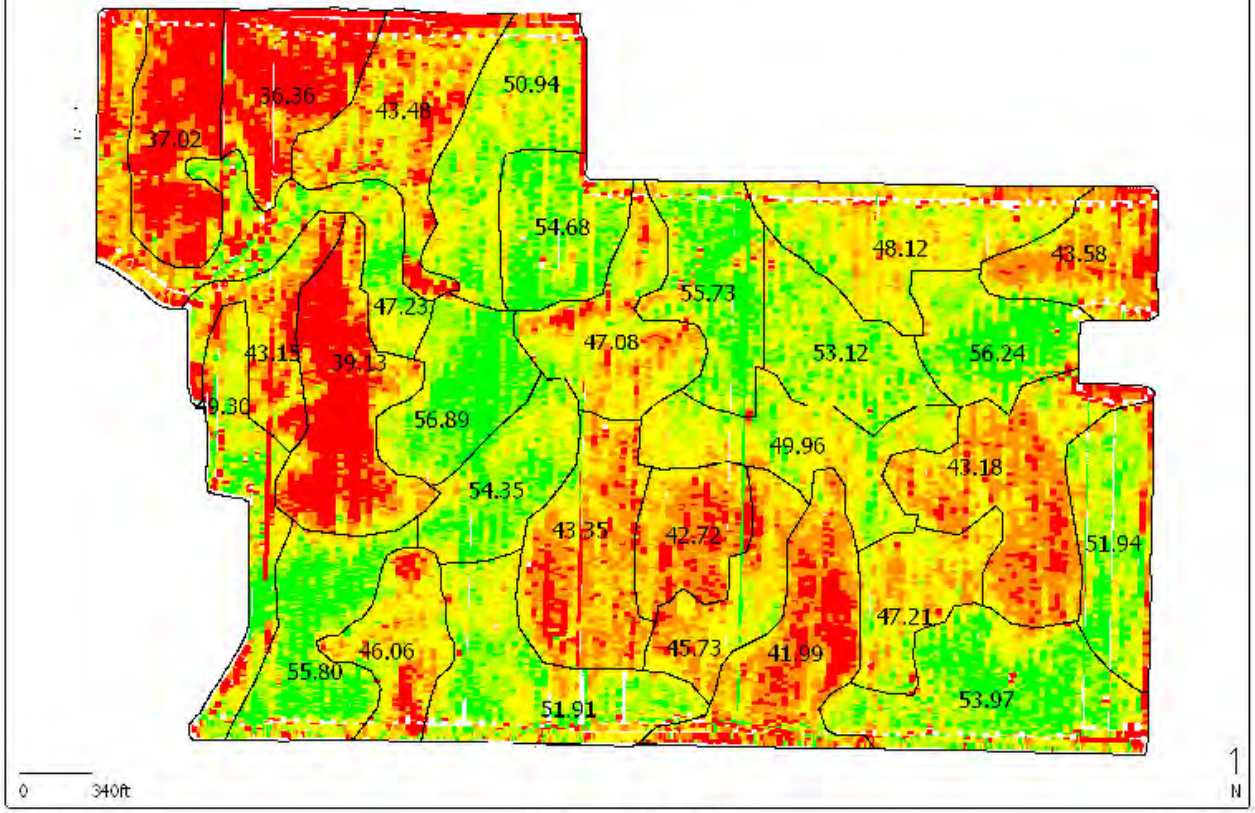
SMS Map



1/11/2011 1:32:24 PM Ag Leader Technology SMS Advanced Page 1 of 2

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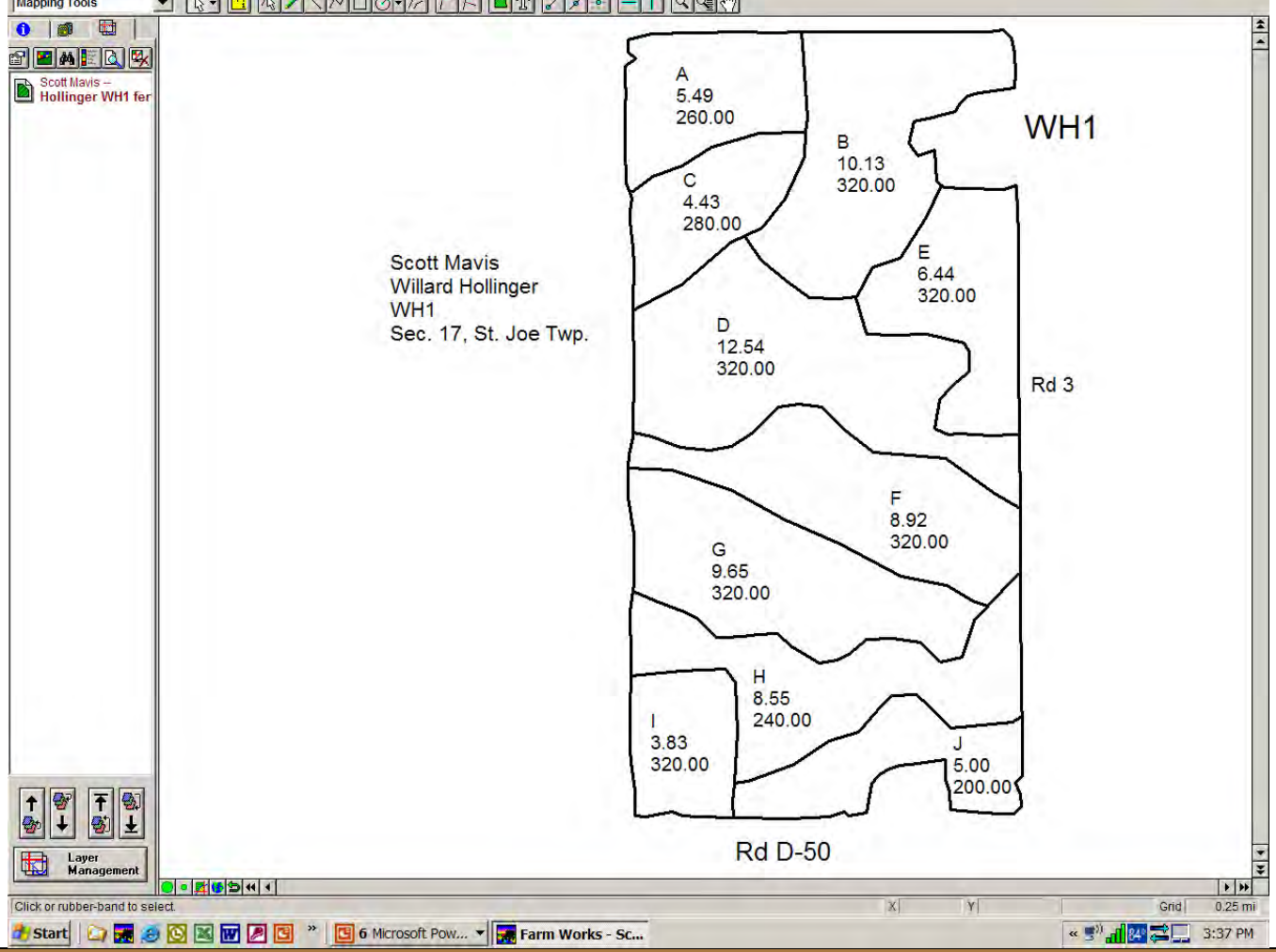

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Application For Fall 2008 Crop Corn
Sample Zones B, D, E, F, G, I Acres 51.5

Product	Rate/Acre	Unit/Acre	Amt. Required	Required Unit	Est. Cost/Applied Acre
2008 Blend 1	320.0	Pounds	8.24	Tons	$147.84

Application Notes 21.4 N - 66.6 P - 92.2 K - 9.9 S - 0 B - 0 Zn - 0 Mn - 0 Ca - 0 M

**2008 Blend 1, 12% AMS, 40% MAP, 48% POT

Application For Fall 2008 Crop Corn
Sample Zones C Acres 4.4

Product	Rate/Acre	Unit/Acre	Amt. Required	Required Unit	Est. Cost/Applied Acre
2008 Blend 1	280.0	Pounds	0.62	Tons	$129.36

Application Notes 18.8 N - 58.2 P - 80.6 K - 8.7 S - 0 B - 0 Zn - 0 Mn - 0 Ca - 0 M

**2008 Blend 1, 12% AMS, 40% MAP, 48% POT

Application For Fall 2008 Crop Corn
Sample Zones H Acres 8.6

Product	Rate/Acre	Unit/Acre	Amt. Required	Required Unit	Est. Cost/Applied Acre
2008 Blend 1	240.0	Pounds	1.03	Tons	$110.88

Application Notes 16.1 N - 49.9 P - 69.1 K - 7.4 S - 0 B - 0 Zn - 0 Mn - 0 Ca - 0 M

**2008 Blend 1, 12% AMS, 40% MAP, 48% POT

Application For Fall 2008 Crop Corn
Sample Zones J Acres 5.0

Product	Rate/Acre	Unit/Acre	Amt. Required	Required Unit	Est. Cost/Applied Acre
2008 Blend 1	200.0	Pounds	0.50	Tons	$92.40

VRT Strip till with Auto Steer

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- **<u>Deshler Farmers Elevator Company</u>**
- **Precision Farming Program**
- **<u>Program consists of the following:</u>**
- **1. Soil Samples based on 2.5 acre grids using DGPS (differential global positioning system)equipment.**
- **2. Field maps will show contoured results of soil tests - including Phosphorus, Potassium, Organic Matter, pH, CEC, and Lime recommendations maps.**
- **3. Nutrient recommendations will be made for corrective treatment where required.**
- **4. Recommendations will be applied using VRT (variable rate technology) equipment in conjunction with DGPS. Regular application fees apply.**
- **Program costs and billing procedure:**
- **$4.00 per acre, per year, with a three year commitment.(total $12/acre)**
- **No premiums for custom application of fertilizer or lime using VRT equipment. This will be billed at normal pricing structure.**

Agronomy Precision Farming Challenge

Let us show you the advantage of our Precision Farming Program. Give us 40 acres to grid sample and show you the results. If you don't see the advantage of being in our program we will not enroll you in our program and there will be no cost to you. Call the Agronomy Center at 419-669-3300 or 1-877-669-3066 to take the Challenge today!

Oil Seed Radishes

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Jerry and Les Seiler

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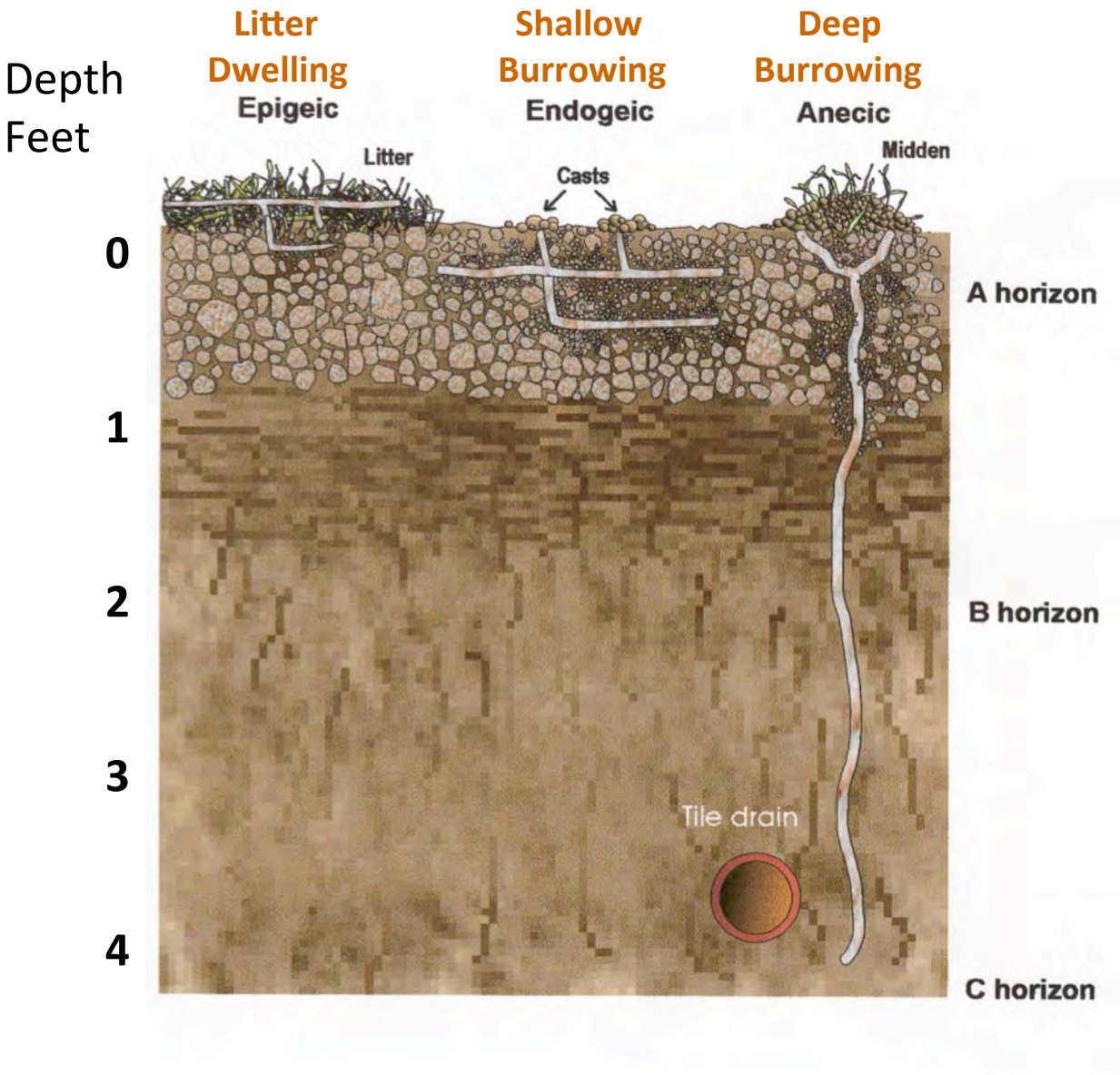

There are ~ 3000 <u>Species of Earthworms</u>

- Litter Dwelling *(Epigeic)* Species
- Shallow Burrowing *(Endogeic)* Species
- Deep Burrowing *(Anecic)* Species
  - construct burrows that extend ~3-4 feet deep
  - cannot tolerate dry or frozen soil
  - come to the soil surface to feed, breed, and migrate

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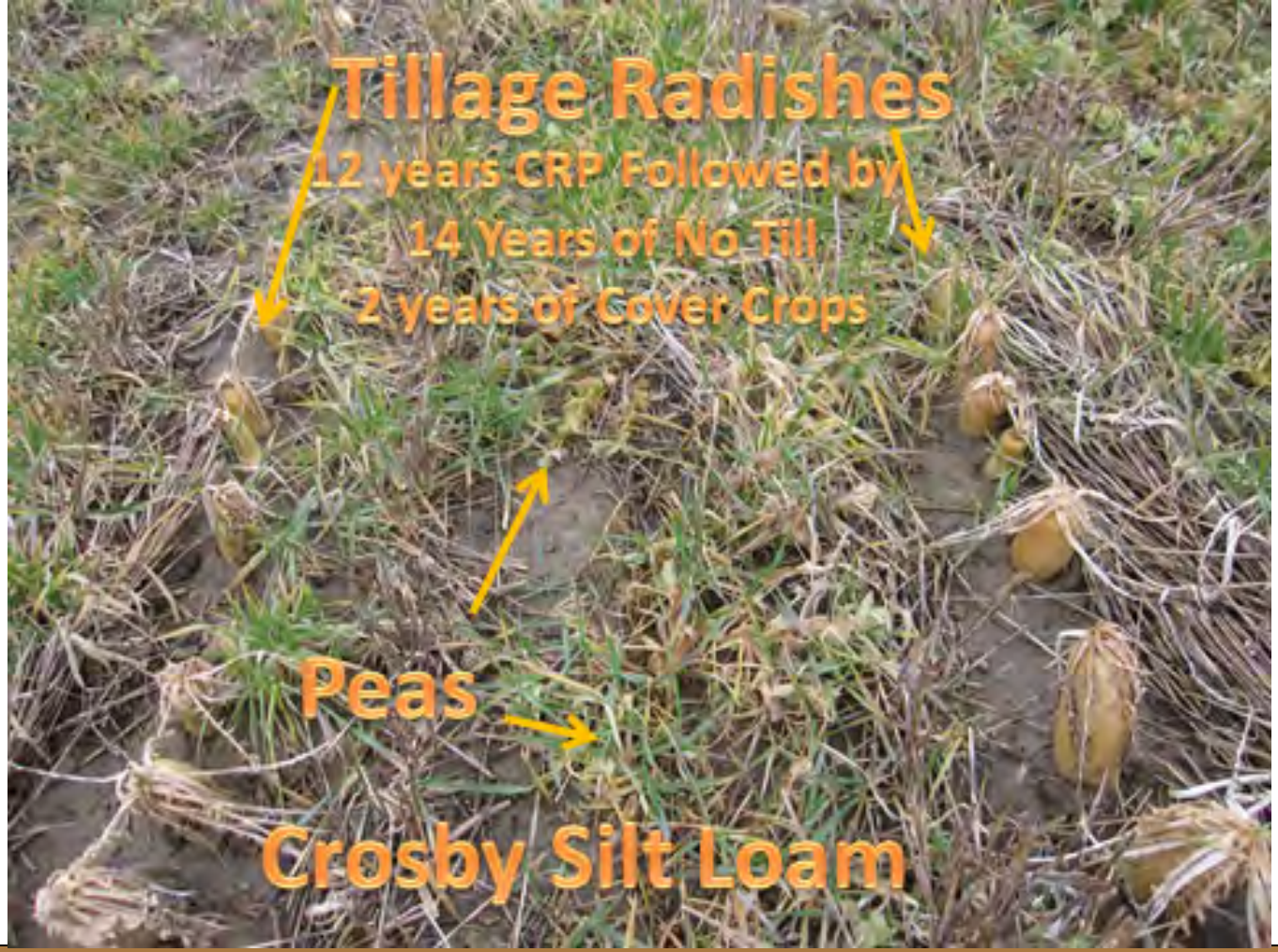

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Major changes in the new 590 standard include:

- Combines 590 (Nutrient Management) and 633 (Waste Utilization)
- Encourages the application of nutrients as close to the time of uptake as possible.
- Eliminates nutrient application on frozen/snow covered soil.

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- Addresses the 4 Rs.
- Increases emphasis on the risk indices (nitrogen and phosphorus index).
- Exceeding Tri State Recommendations trigger a risk assessment. Considered a temporary situation.
- Lists additional conservation practices to combine with 590 ~(Systems)

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Strategies for Addressing Agricultural Induced Phosphorus Transport

Upland Management
- 4Rs
- Interruption of connection to surface

Structural Hydrologic Control
- Water table management
- blind inlets

Filtration
- End-of-tile and in-stream
- Enhanced bioreactors

Edge-of-field
- Buffers (vegetated and saturated)
- wetlands

Ditch Design and Management
- Two stage, natural, and over-wide ditches
- Dredging
- Vegetated channels

Upland Management (4 Rs)

- Rate
  - adhere to soil test recommendations
  - apply only what is needed in crop year; avoid multi-year applications (Algoazany et al., 2007)

- Source
  - manure vs. commercial (Phillips et al., 1981)

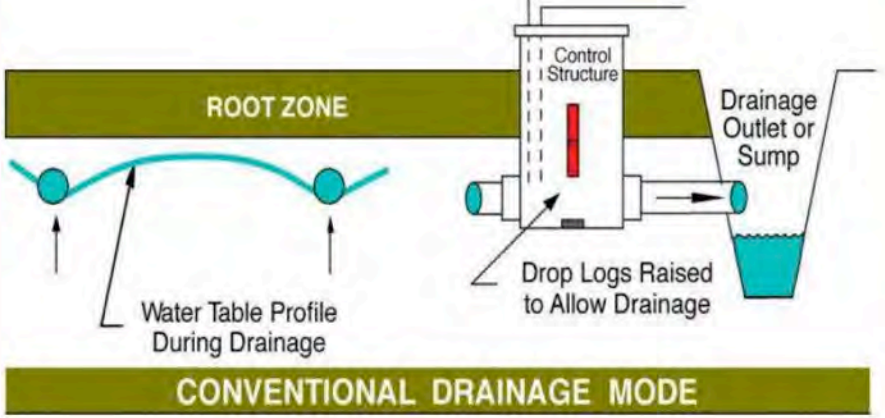
- Placement
  - incorporation
  - precision application
  - banding vs. broadcast

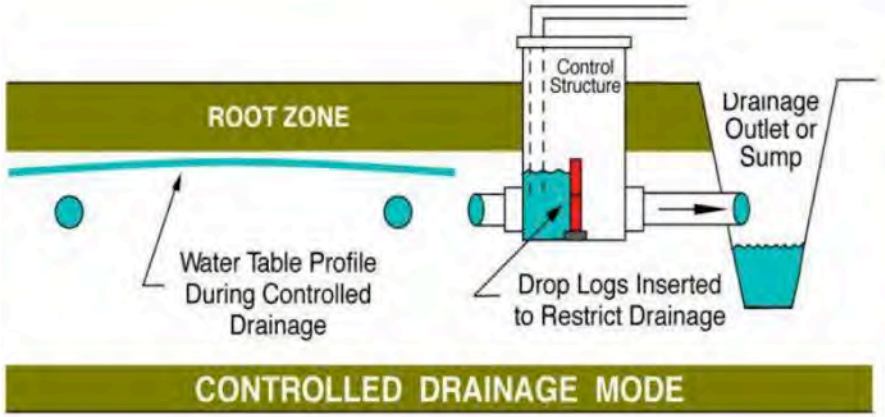
- Timing
  - be cognizant of weather predictions and avoid application prior to rainfall
  - avoid winter time manure applications – winter applied manure had greatest concentrations of dissolved P in tile effluent (Phillips et al., 1981)

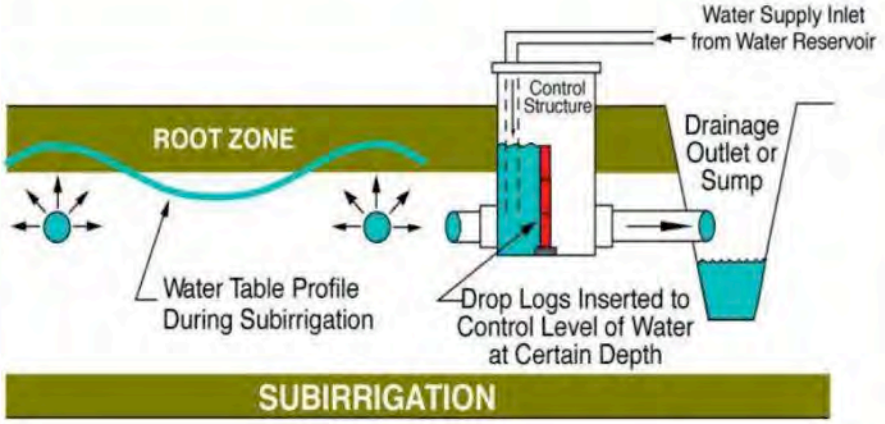
Conclusions – Cropping & Management

- More frequent, lower rates of fertilizer result in less loss
- Longer rotations lose less P
- No-till may result in > SP loss, but must balance that with < TP loss
- More P lost with corn (due to P applications???)

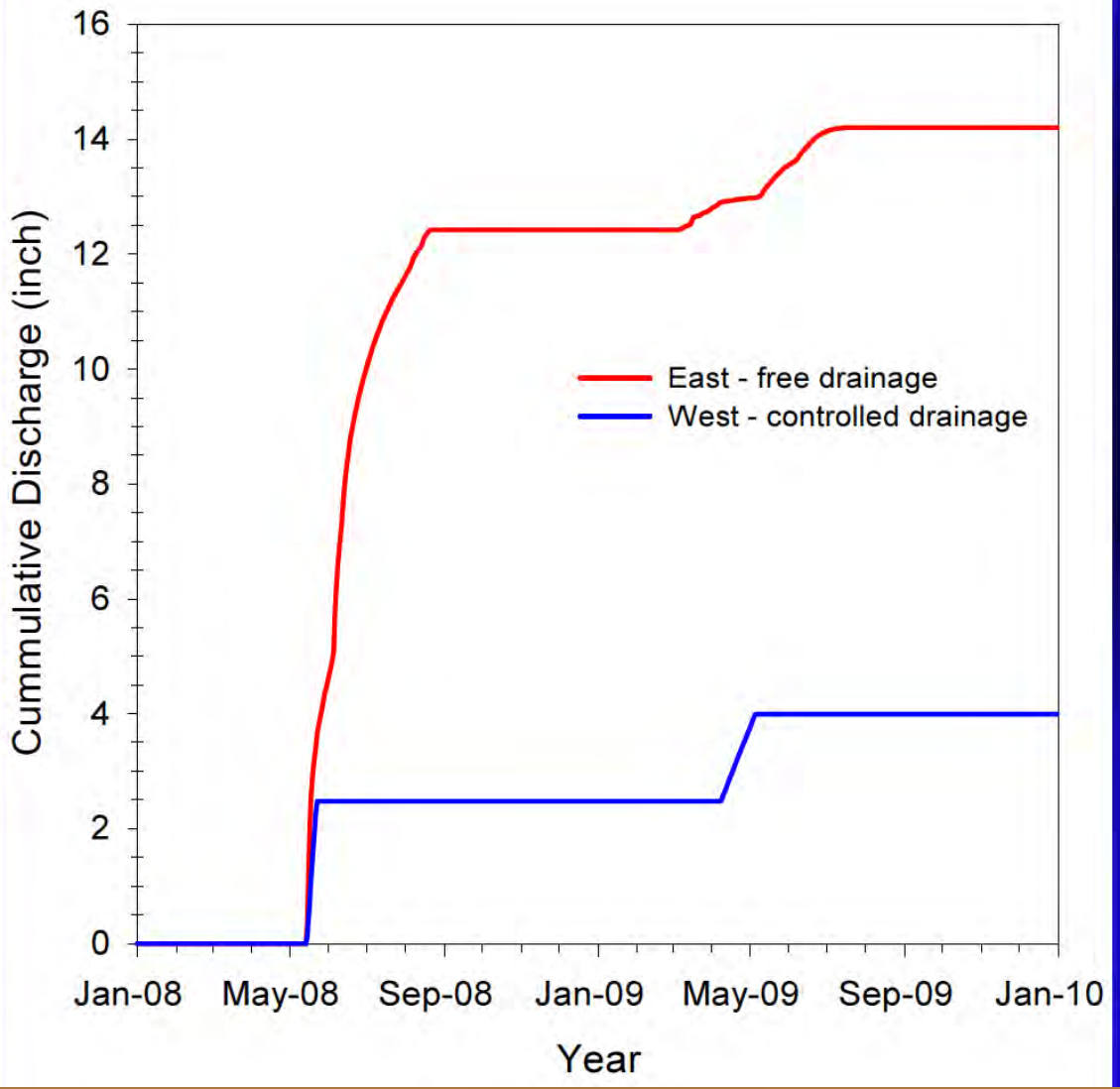
Water Table Management







Controlled Drainage Effectiveness (MN)



~30-60% reduction in annual drain flow

~30-50% reduction in annual nitrate load

~30-40% reduction in annual TP and DRP load

Provided by Jeff Strock

Ditch Filter #2 (Gypsum filter)

Provided by Peter Kleinman
USDA-ARS, State College, PA

Provided by Peter Kleinman
USDA-ARS, State College, PA

Rainfall patterns and storm events will still drive the timing of algal blooms

Efforts to reduce nutrient loading will reduce the blooms overall.

Need to build upon the success of the last 20- 30 years in sediment reductions with conservation tillage practices.

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Use A Whole Tool Box of Conservation Practices

Versus Vice Grip and Crescent Wrench Regulations

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Conservation Systems:

~Conservation Tillage

~Controlled Traffic

~Cover Crops

~Controlled Drainage

~4 R's

~VRT

~Involving Progressive Farmers/CCA's/ Fert Dea;ers

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