

PHOSPHORUS LOSS FROM TILE DRAINS: SHOULD WE BE CONCERNED?

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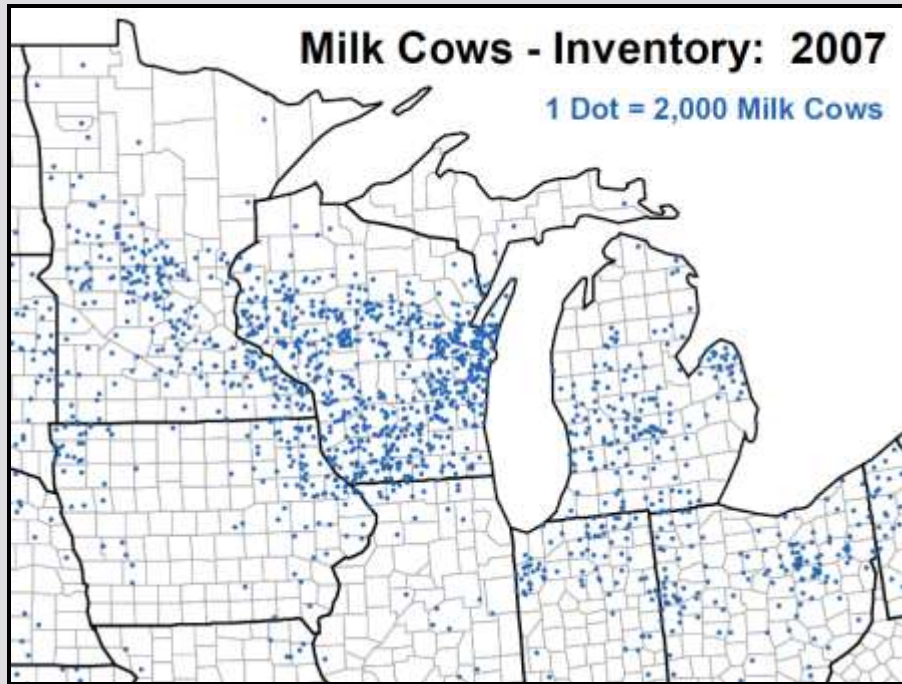
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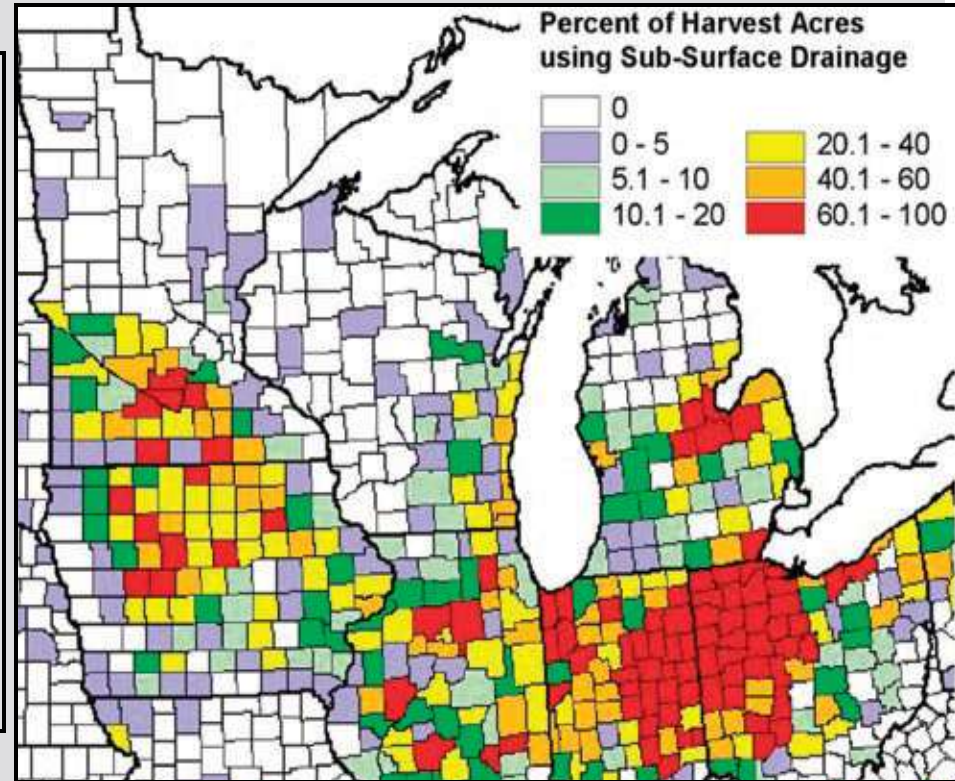
QUICK REVIEW

- General consensus is that tile drainage will reduce erosion and surface P losses, but increase N leaching losses.
- Discovery Farms has intensely monitored four farm sites that have tile drainage and extremely high soil test phosphorus values.
- The question is – how much P are losing, what is causing it, and what are our options for mitigation?

COWS & TILE DRAINAGE IN WI



U.S. Census of Agriculture, 2007



U.S. Census of Agriculture, 1992

STUDY OBJECTIVES

- Quantify P losses from tile drained fields
- Evaluate factors that influence P loss

FOUR DISCOVERY FARMS SITES

CP1: Chisel plowed, continuous corn

- Kewaunee Co., STP=80 ppm , slope 2-6%

CP2: Chisel plowed field, continuous corn

- Kewaunee Co., STP=56 ppm, slope 2-6%

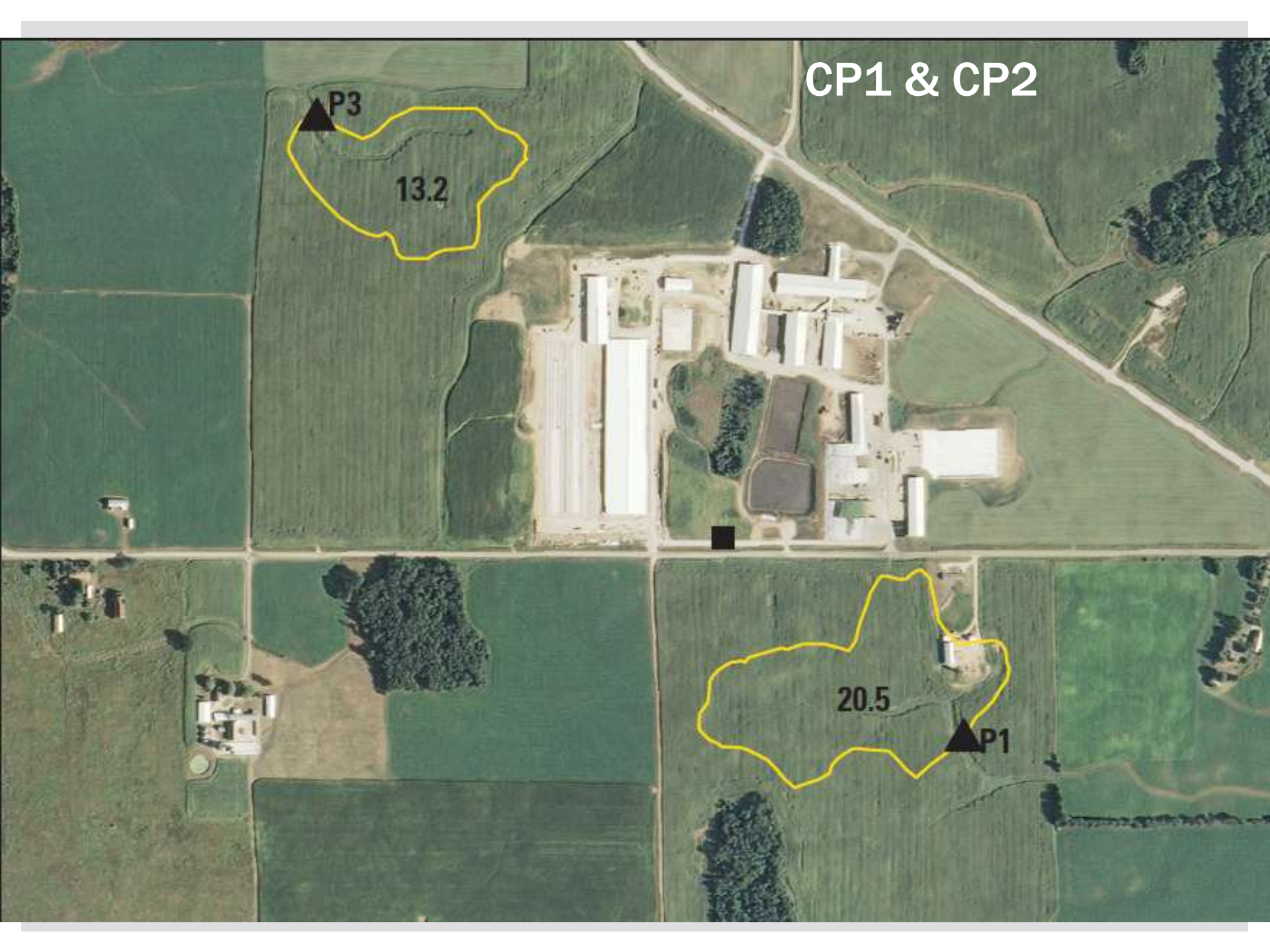
NT: No-till field, corn-soybean rotation

- Waukesha Co., STP=85 ppm, slope 1-3%

GP: Grazed pasture

- Manitowoc Co., STP=108 ppm, slope 2-6%

CP1 & CP2



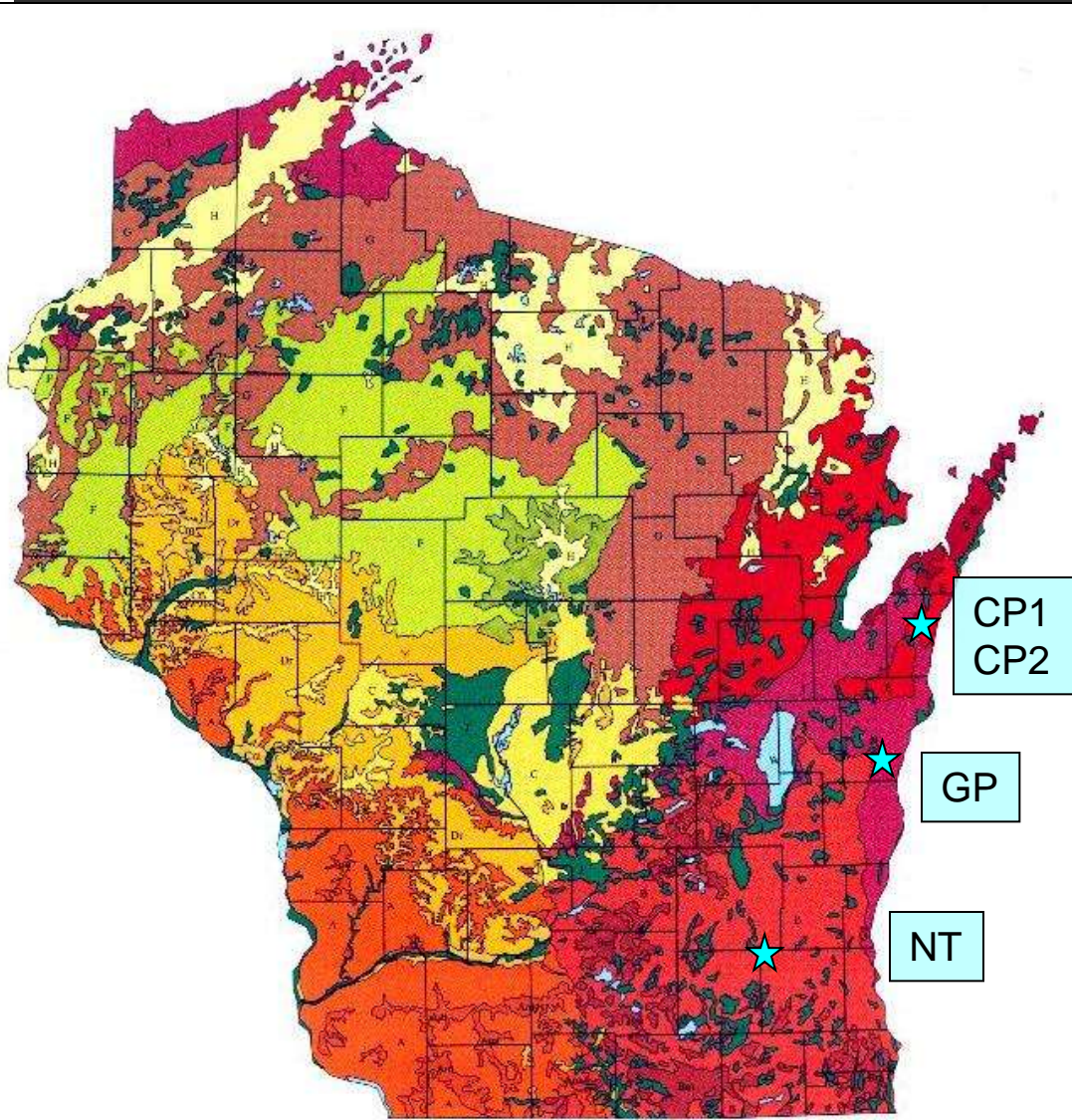


NT



GP

LOCATIONS – IN OR CLOSE TO LAKE MICHIGAN WATERSHED



F. Hole, 1976

USGS MONITORING



Methods of Data Collection, Sample Processing, and Data Analysis for Edge-of-Field, Streamgaging, Subsurface-Tile, and Meteorological Stations at Discovery Farms and Pioneer Farm in Wisconsin, 2001–7

<http://pubs.usgs.gov/of/2008/1015/>



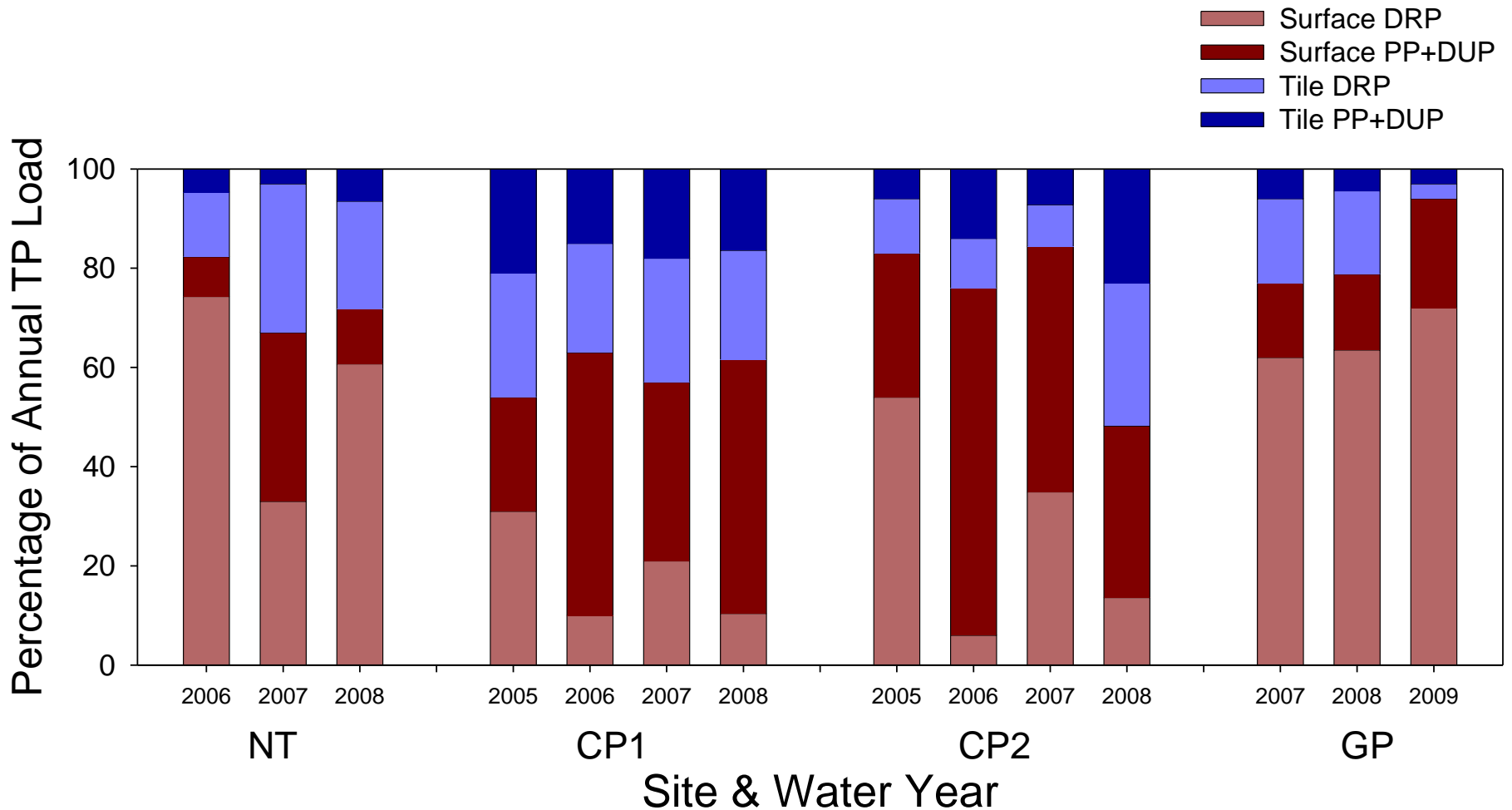
DATA

- Dissolved P = P in water
- Particulate P = P in sediment (in water)
- Total P = DP + TP
- Flux = lb/ac/yr
- Concentration = mg/L or ppm
- Flow-weighted concentration
 - Averaging concentrations over time
 - e.g.: 1,000 L with 1 ppm and 100 L with 50 ppm
 - Flow weighted = 5.5 ppm

TOTAL P LOSSES

	<u>2005</u>		<u>2006</u>		<u>2007</u>		<u>2008</u>		<u>2009</u>	
Site	Tile	Surface	Tile	Surface	Tile	Surface	Tile	Surface	Tile	Surface
----- lb/ac -----										
CP1	1.43	1.67	1.47	2.51	0.46	0.60	1.41	2.24		
CP2	0.24	1.17	1.47	4.55	0.39	2.10	1.53	1.42		
NT			0.49	2.27	0.53	1.05	2.73	6.93		
GP					1.25	4.14	2.63	9.73	0.27	4.33

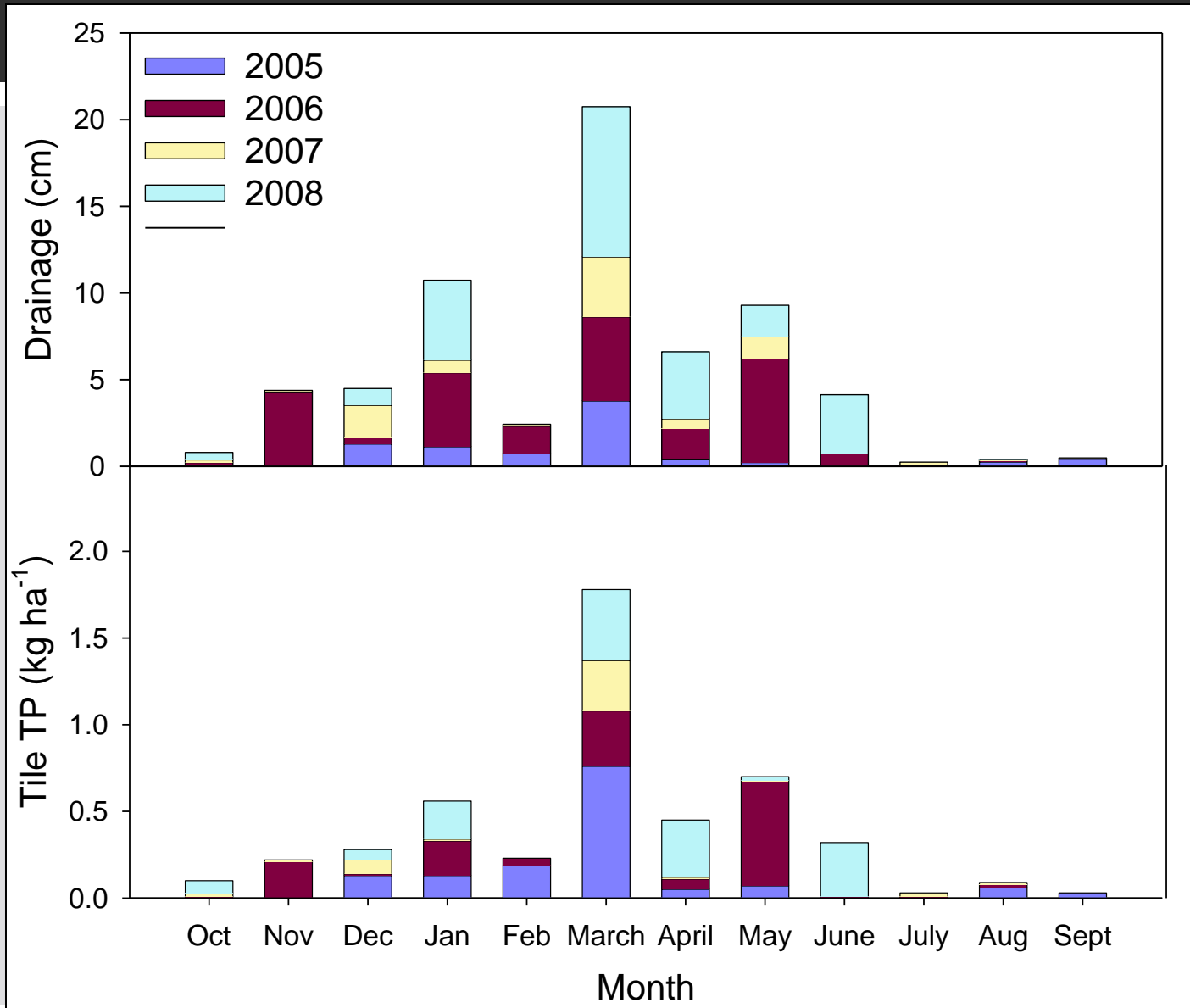
PERCENT OF ANNUAL P LOSS



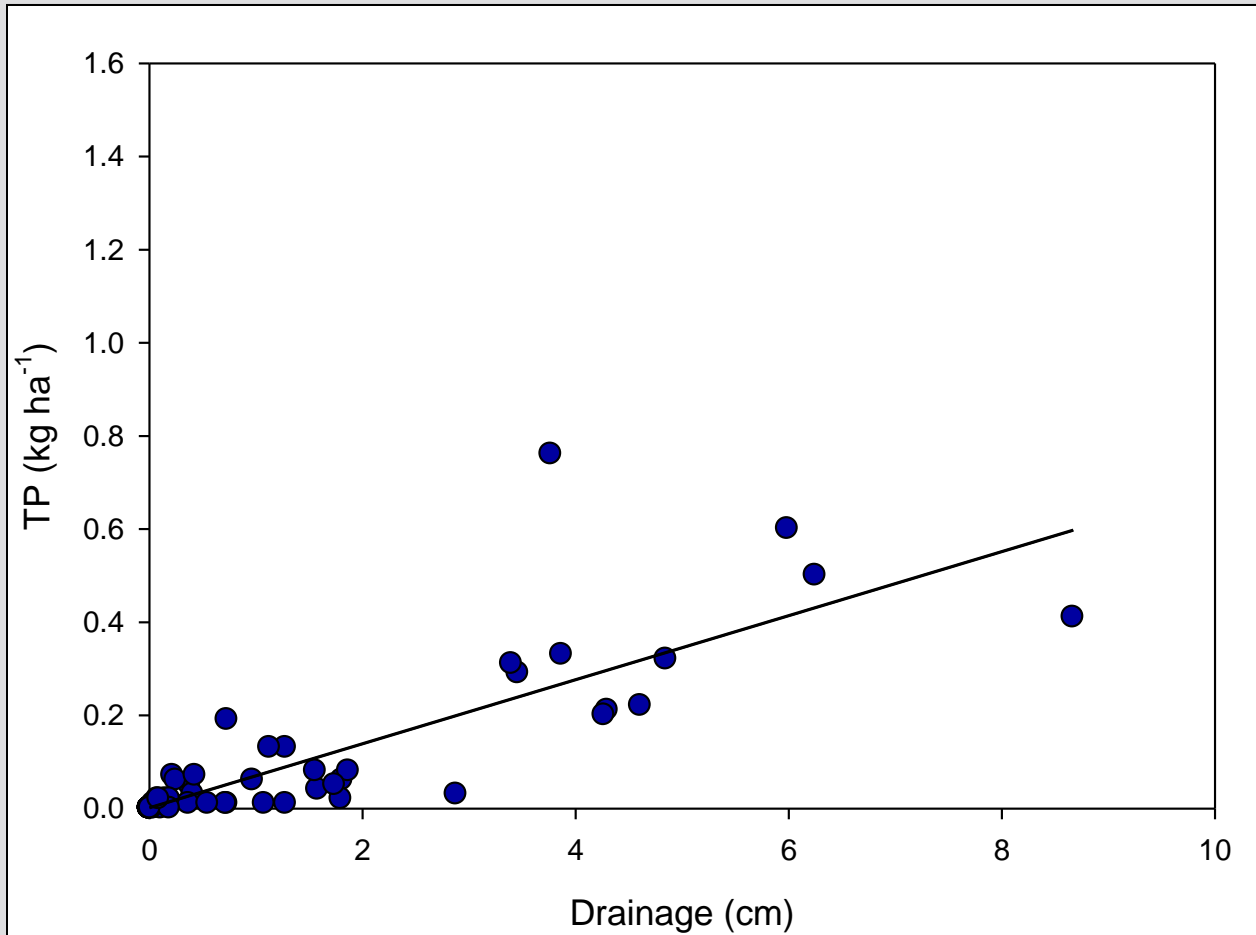
IS THIS A LOT?

Location	Bray P1 equiv.	Tile FW-TP	Tile TP
	mg kg ⁻¹	mg L ⁻¹	lb ac ⁻¹ yr ⁻¹
CP1	54	0.70	0.9
CP2	57	0.50	0.9
NT	85	0.22	1.3
GP	108	1.31	1.4
IL ¹	NA	0.15	0.2
Quebec ²	29	0.30	1.6
Quebec ²	58	0.08	0.4
Denmark ³	NA	0.10	0.4
MN ⁴	NA	>0.02	0.1
UK ⁵	42	1.11	1.9

WHEN DO WE LOSE P IN TILES?



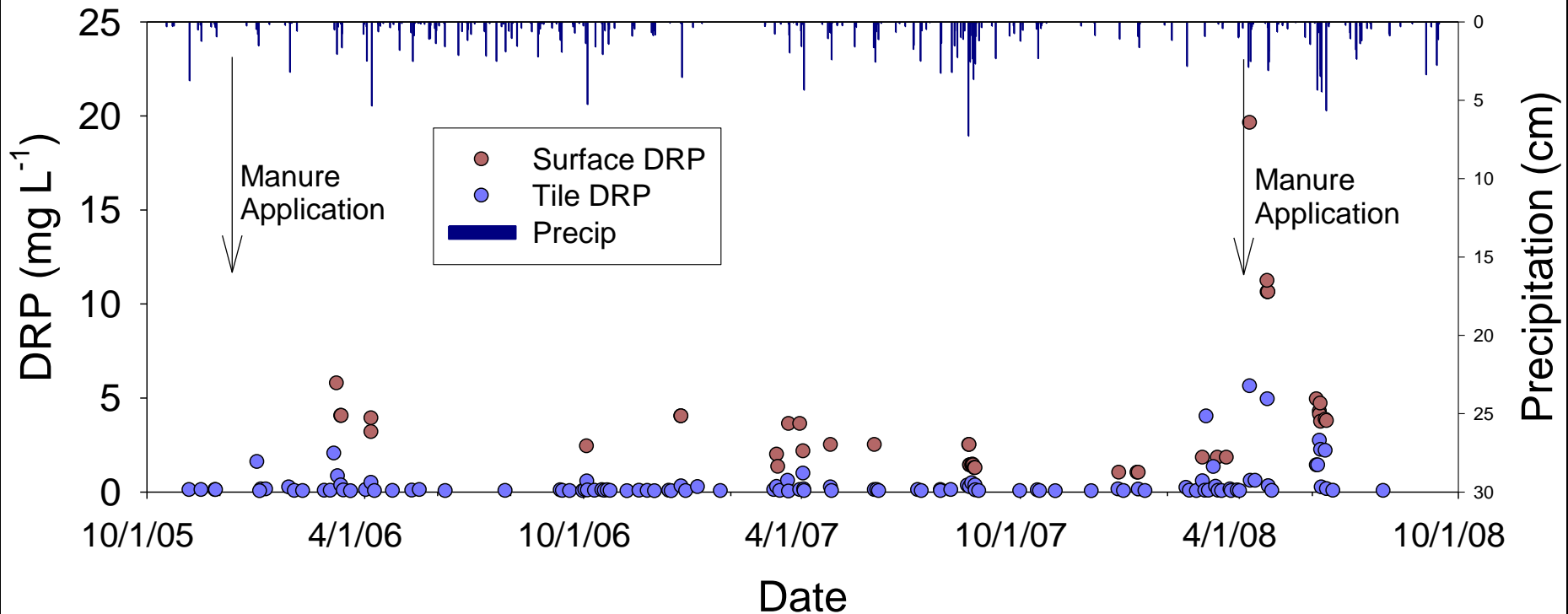
DRAINFLOW VS P LOSS



R² Table

Site	TP	DRP
CP1	0.69	0.80
CP2	0.67	0.80
NT	0.16	0.17
GP	0.78	0.80

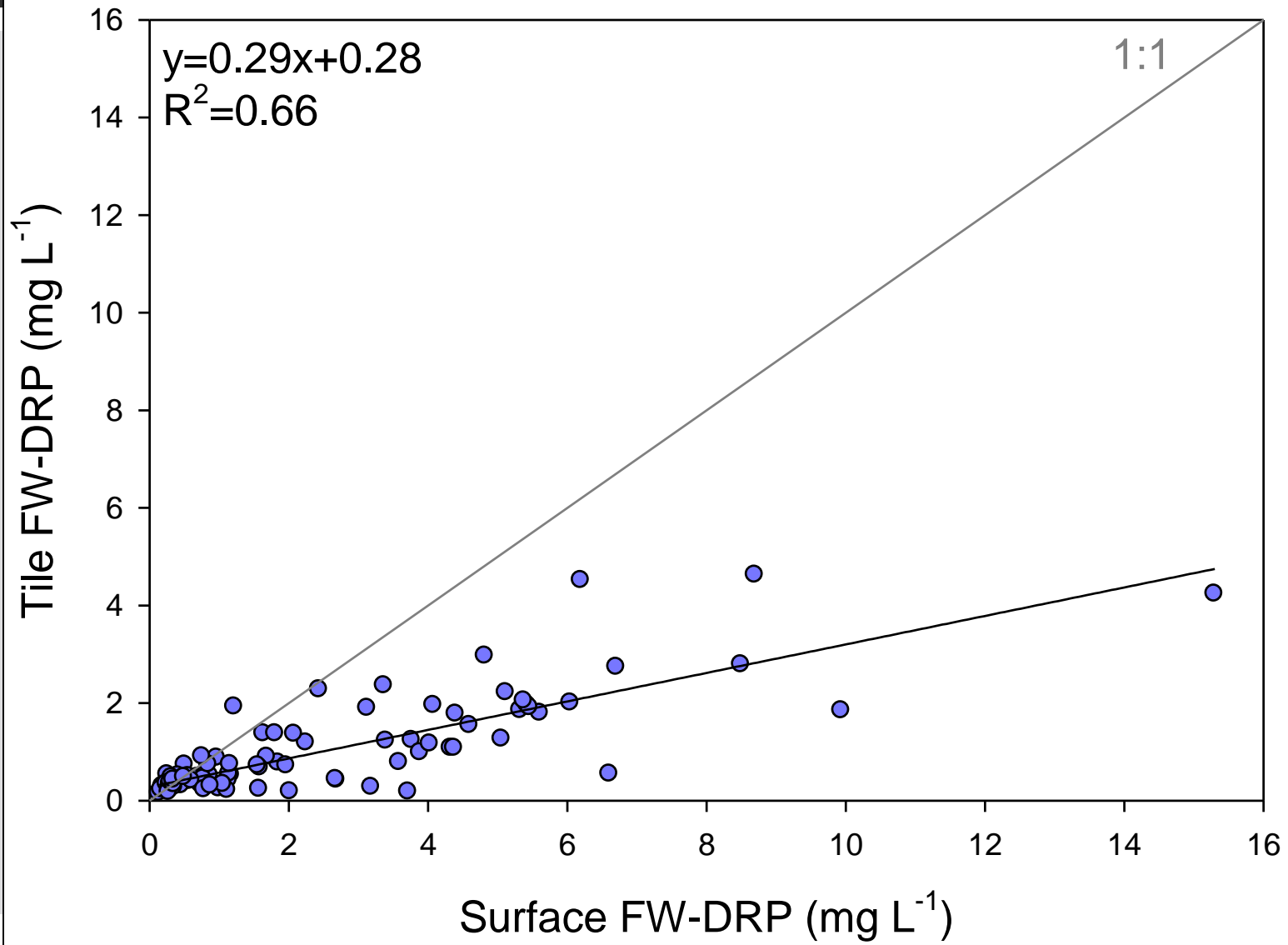
MANURE APPLICATIONS



The application on 4/1/08 was the only “clear” evidence of manure having a large impact on tile losses across all sites

4/8/2008 11:40

EVENT P CONCENTRATIONS: ALL SITES



CONCLUSIONS

- Tile drainage can represent between 17 and 52% of the total P loss from a field.
- Total flow explains most of the variation in P loss.
- Manure applications were not found to consistently affect P loss from drains.
- Since there is a significant relationship between overland flow and tile flow, a simple model may be effective in accounting for these losses.

SO..SHOULD WE BE CONCERNED?

- We need to exploring both management options (e.g. different manure applications) and engineering options (e.g. controlled drainage, tile filters) to determine if any reductions can be obtained.
- The best management option is to apply manure at appropriate times, not when tiles are flowing.

BEST THING TO DO IS CHECK TILE DRAINS



<http://www.nocafos.org/news.htm>

“Frothy-ness” is evidence of organic carbon loss – most likely from manure