PA Farm Conservation Practices Inventory

A survey of Pennsylvania farmers to document conservation practice implementation in the Chesapeake Bay Watershed

Analysis and Results
November 21, 2016

PennState
College of Agricultural Sciences

Farmer BMP Survey

To Document Unreported BMPs

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- Developed collaboratively by:

Penn State University	PA Dept of Environmental Protection
PennAg Industries	PA Farm Bureau
PA Assoc of Conservation Districts	PA Farmers Union
PA Assoc of Sustainable Agriculture	Professional Dairy Managers of PA
PA Dept of Agriculture	State Conservation Commission

- Administered by Penn State Survey Research Center
- Results analyzed and reported by Penn State College of Agricultural Sciences
- Funded by PA DEP

Survey Participation

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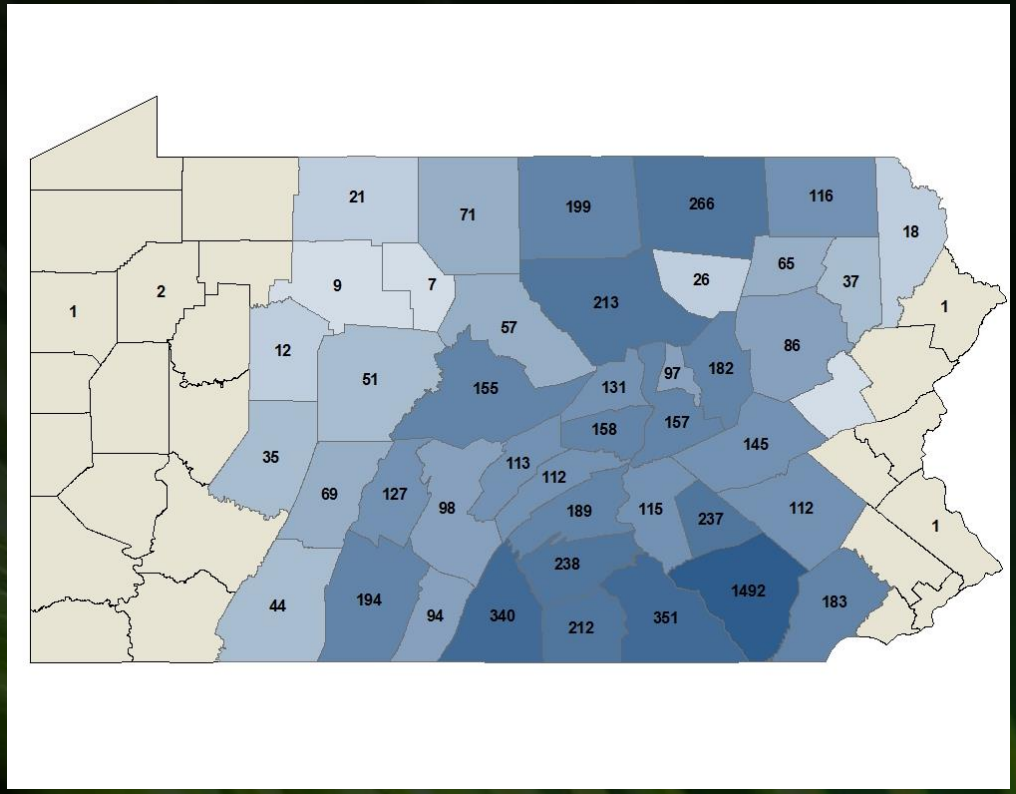
- Survey Conducted Feb – April 2016
- ~20,000 surveys mailed
- 6,782 returned
- Top 5 counties:
  - Lancaster (1492)
  - York (340)
  - Franklin (340)
  - Bradford (266)
  - Cumberland (238)



Survey Overview
Conservation Practices Recorded

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- Questions about 11 conservation practices or plans:

Nutrient/Manure Mgt Plans	No Till
Enhanced Nitrogen Mgt	Cover Crops
Manure Transport	Stream Bank Fencing
Animal Waste Storage Systems	Riparian Buffers
Barnyard Runoff Controls	Land Retirement
Ag E&S Plans/Conservation Plans	

- These are priority practices that achieve high levels of nutrient and sediment reductions, may have high instances of volunteer implementation, and are accepted into Bay model

BMPs Recorded in Survey

Crosswalk with CBP BMPs and RIs

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Table 1. Crosswalk between PSU survey practices and CBP BMPs and RIs

PSU Survey Practices	CBP BMP	CBP RI Practice
Cover Crops	Cover Crops	
No Till or Minimum Till	Conservation Tillage, High Residue, Minimum Soil Disturbance Tillage	
Riparian Buffers in Trees or Shrubs	Forest Buffers	RI-9, 10: Forest Nutrient Exclusion Area or Buffer on Watercourse Resource Improvement Practice, Forest Nutrient Exclusion Area on Watercourse (RI9), Forest Buffer on Watercourse (RI10)
Riparian Buffers in Grass	Grass Buffers/Vegetated Open Channel - Agriculture, Vegetated Open Channels - A/B soils, no underdrain, Vegetated Open Channels - C/D soils, no underdrain	RI-7, 8: Grass Nutrient Exclusion Area or Buffer on Watercourse Resource Improvement Practice
Barnyard Runoff Control Systems	Barnyard Runoff Control	RI-16: Barnyard Clean Water Diversion
Agricultural Erosion and Sedimentation Control Plans NRCS Conservation Plans	Soil Conservation and Water Quality Plans	
Manure Transport	Manure Transport	
Nutrient Management Plans (acres by row crops, pasture, and hay) • Act 38 nutrient management plans (acres by row crops, pasture, and hay) • NRCS 590 nutrient management plans (acres by row crops, pasture, and hay) • Manure management plans (acres by row crops, pasture, and hay) Advanced Nutrient Management Plans	Nutrient Management (Phase 5.3.2 or Phase 6.0)	
Stream Bank Fencing	Stream Access Control with Fencing, Exclusion Fence with Forest or Grass Buffer or Narrow Buffer	RI-4a, 4b, 5, 6: Watercourse Access Control Resource Improvement Practice, (RI-4a) Watercourse Access Control-Narrow Grass, (RI-4b) Watercourse Access Control-Narrow Trees, (RI-5) Watercourse Access Control-Grass, (RI-6) Watercourse Access Control-Trees
Animal Waste Storage Systems	Waste Storage Facility, Waste Treatment, Animal Waste Management System	Dry Waste Storage Structure (RI-1)

Tetra Tech Report (p. 5)

BMPs Recorded in Survey

BMPs NOT Reported in this Report

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- The following BMPs that were cost shared are NOT reported in the current results:

Nutrient Mgt Plans	Conservation Plans
Animal Waste Storage Systems	Stream Bank Fencing
Barnyard Runoff Controls	Riparian Buffers

- NONE of the following BMPs are reported in the current results:

No Till/Minimum Till	Land Retirement
Cover Crops	

Survey Results

BMPs Reported in this Report

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Practice	Amount Implemented				
NMPs/MMPs*	335,250 ac row crops	37,243 ac pasture	103,307 ac hay		
Enhanced Nutrient Management	97,562 acres				
Manure Storages	1,598 dairy storages	194 beef storages	213 swine storages	159 poultry storages	
Barnyard Runoff Controls	2,106 systems				
Agricultural E&S Plans	40,170 ac row crops	4,930 ac pasture	9,973 ac hay		
Conservation Plans	173,481 ac row crops	17,239 ac pasture	37,544 ac hay		
Stream Bank Fencing	1.34 million linear ft				
Watercourse Access Controls	Grass 10-35 ft width: 324 ac	Grass >35 ft width: 471 ac			
Riparian Buffers	Grass 10-35 ft width: 455 ac	Grass >35 ft width: 826 ac	Forest 10-35 ft width: 1,131 ac	Forest >35 ft width: 6,601 ac	

** Includes only non-cost shared NMPs. NMPs still need to be separated from MMPs for reporting purposes.*

Survey Results

Manure Transport Between Counties

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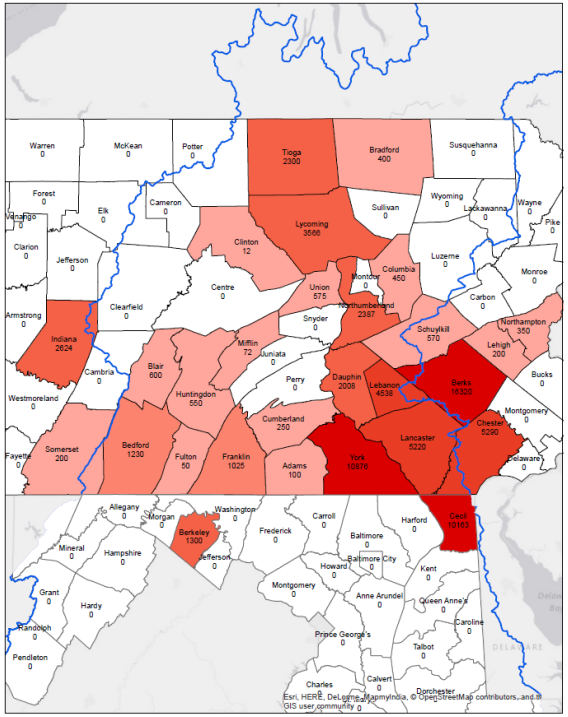
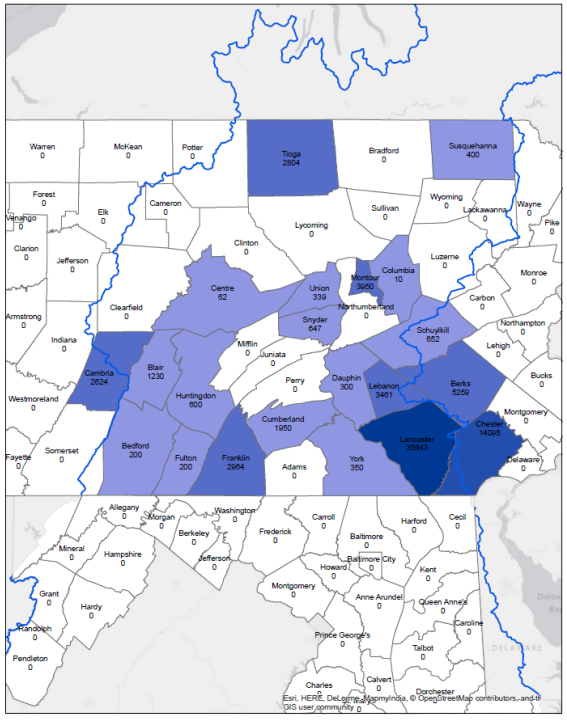
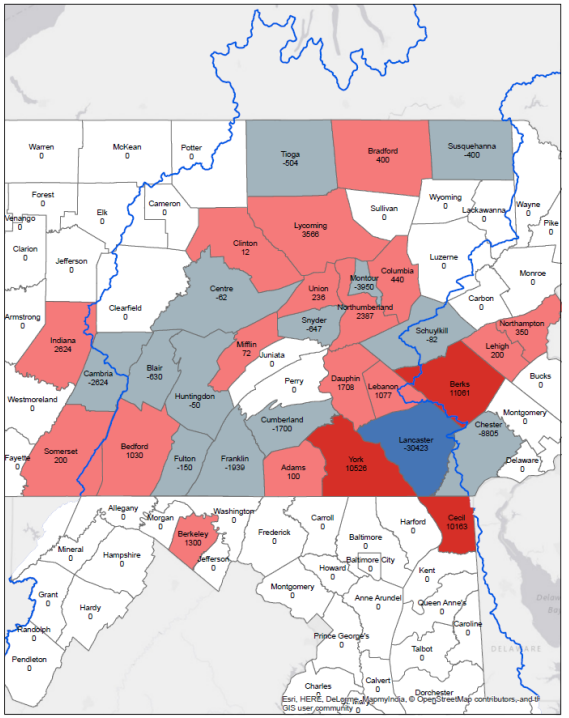
Chesapeake Bay Watershed Manure Import



Chesapeake Bay Watershed Manure Export



Chesapeake Bay Watershed Manure Net Change



- Amounts reported in tons
- Another 2000 tons exported to Jefferson Co (NY)

Survey Analysis
Data Reliability Analysis

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- Subsample of farm visit data compared to survey returns for the following BMPs:

Non-Cost Shared NMPs and MMPs	Ag E&S Plans
Enhanced Nutrient Management	Conservation Plans
Animal Waste Storage Systems	Stream Bank Fencing
Barnyard Runoff Controls	Riparian Buffers

- For all these BMPs, adequate sample size existed to develop statistically acceptable results
- Manure transport not statistically analyzed because of small sample size

Survey Analysis

Analyzing Results: Verification Process

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- 10% randomly selected for farm visits by Penn State Extension to assess inventory results and help researchers analyze data
- Extension staff trained in July; conducted farm visits August through first week of Sept.
- 42 Extension agents typically trained in agronomy, horticulture, nutrient management, livestock systems with Master's degree or higher
- Farm visit data entered through Sept. 16

PennState Extension

Survey Analysis
Verification Process Details

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- Extension staff did not have copies of completed surveys
- Plans and acres covered by plans verified through on farm completeness review of plans (using DEP Checklists)
- Structural practices (storages, barnyard runoff controls, fencing, buffers) field verified through visual assessments using available RI standards
- If plans or practices did not meet standards, they were not counted

PennState Extension

Survey Analysis
Statistical Analysis

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- Survey responses compared to farm visit reports
- Analysis completed separately for each BMP
- Determined difference in reporting (survey response minus farm visit report)
  - Negative number = under reported by farmer
  - Positive number = over reporting by farmer
  - Zero = accurately reported by farmer
- Developed mean difference and 95% confidence interval for each BMP
- Statistical analysis concludes that survey data is reliable

Sample Statistical Analysis

Nutrient/Manure Management Plans

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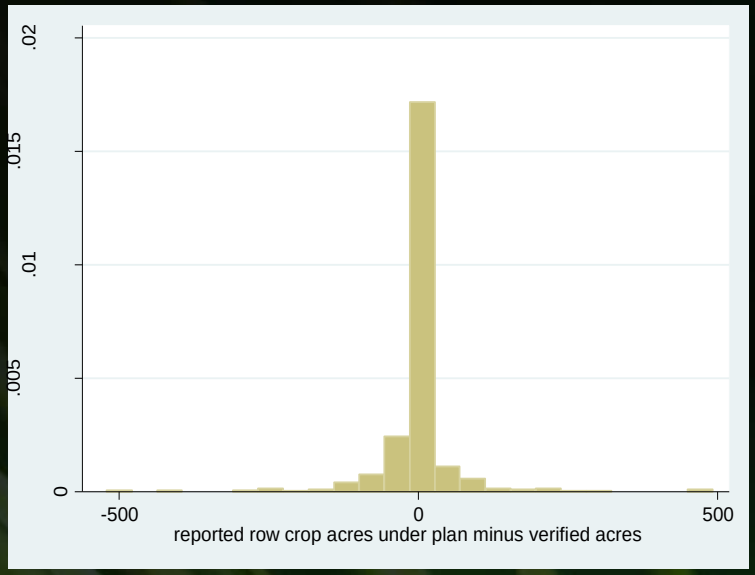
For acres of row crops:

- Mean difference between reported and verified acres: -2.86 acres
- 95% confidence interval: -8.44, 2.73



- Example:
  - If farmer reported 300 acres, we expect him to actually have 302.86 (and we are 95% confident he actually has between 297.2 and 308.4 acres)

Statistical Analysis of BMPs

Reported (blue) v Expected (magenta)

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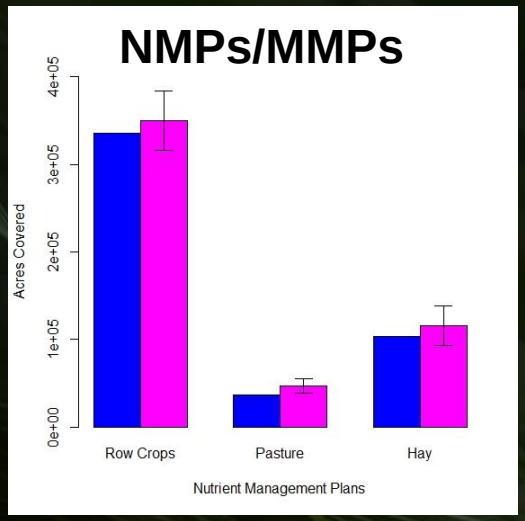

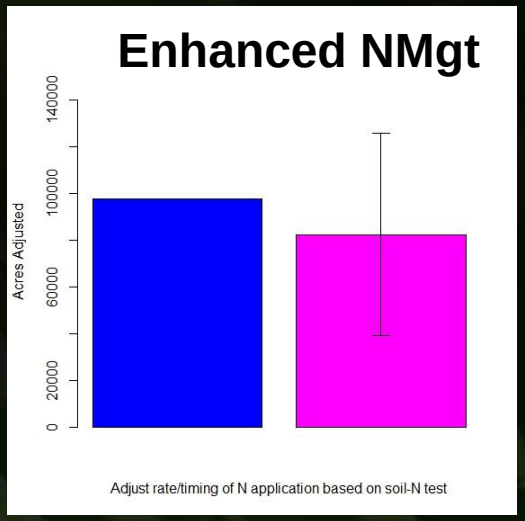

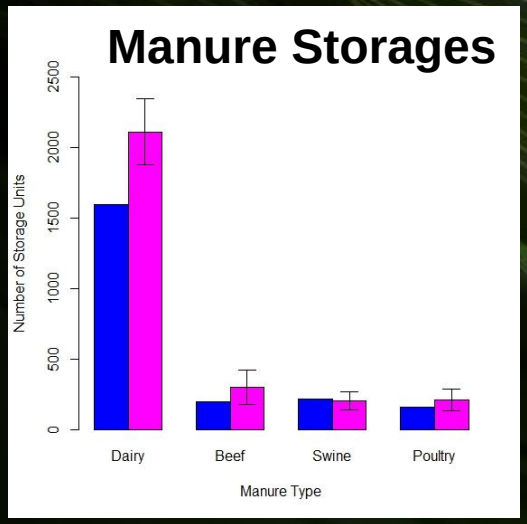

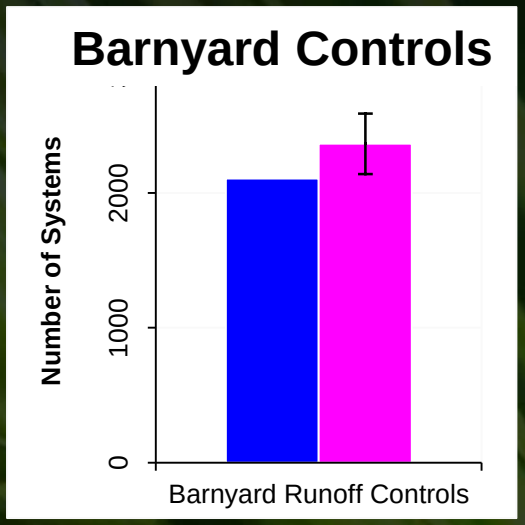

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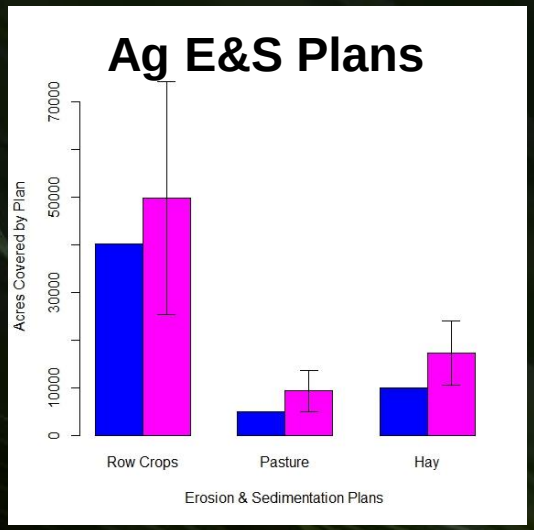

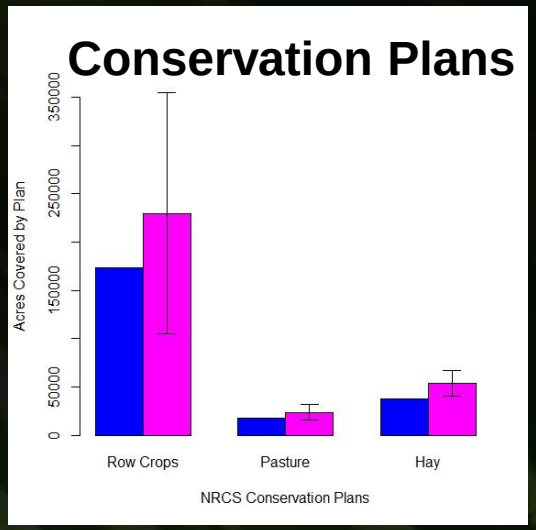

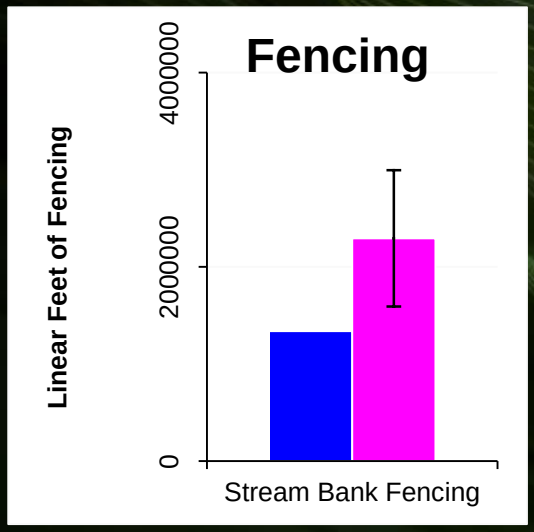

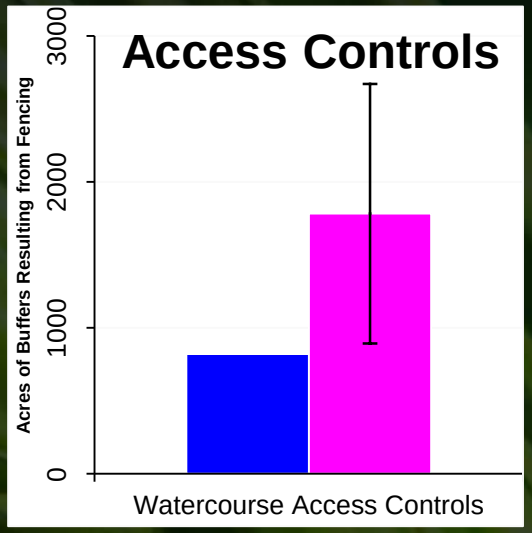

Statistical Analysis of BMPs

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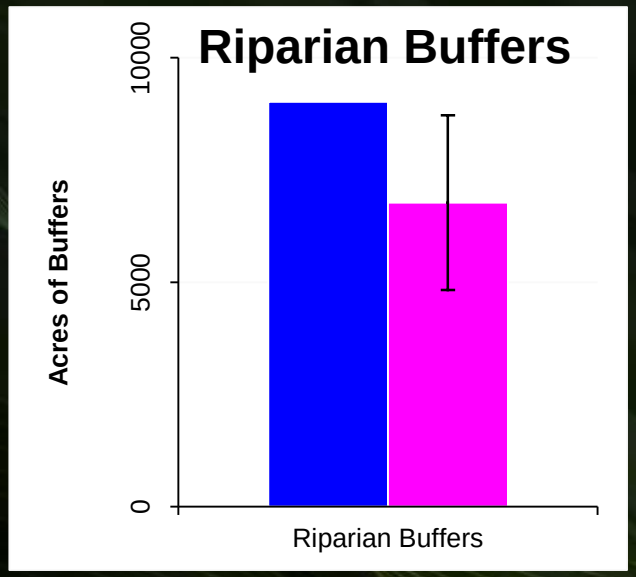

Survey Results

Adjusted for Under and Over Reporting

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Practice	Amount Implemented				
NMPs/MMPs*	350,103 ac row crops	40,769 ac pasture	115,514 ac hay		
Enhanced Nutrient Management	82,303 acres				
Manure Storages	2,113 dairy storages	299 beef storages	318 swine storages	207 poultry storages	
Barnyard Runoff Controls	2,364 systems				
Agricultural E&S Plans	60,380 ac row crops	13,068 ac pasture	26,521 ac hay		
Conservation Plans	229,636 ac row crops	23,818 ac pasture	59,450 ac hay		
Stream Bank Fencing	2.3 million linear ft				
Watercourse Access Controls	Grass 10-35 ft width: 705 ac	Grass >35 ft width: 1024 ac			
Riparian Buffers	Grass 10-35 ft width: 342 ac	Grass >35 ft width: 620 ac	Forest 10-35 ft width: 850 ac	Forest >35 ft width: 4,958 ac	

** Includes only non-cost shared NMPs. NMPs still need to be separated from MMPs for reporting purposes.*

Questions?

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