Monitoring the Effectiveness of Best Management Practices for the Reduction of Total Suspended Solids in Agricultural Runoff

Presented By: The Ecological Conservation Organization

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Introduction

- Agriculture run-off has been identified as a contributing source to nonpoint source pollution and therefore negatively effecting water quality and crop yield
- BMP (best management practices) implementation can help reduce pollution of waterways.

Goals and Objectives

- Determine concentrations of TSS (total suspended solids) from agricultural fields
- Assess pre BMP and post BMP sites to determine any statistical difference in TSS
- Determine any importance of crop cover on field in relation to TSS concentrations

Site Description

- Pre- BMP
  - Water eroding through earthen levee from rain or irrigated water
- Post-BMP
  - Drop Pipe
  - Flashboard Riser

Best Management Practices

- Flashboard risers are water control structures made with removable boards that can be used to adjust the level of water held behind the structure.
- Drop pipes reduce gulling or erosion of soils by transporting water through a confined system and reduce erosion by the precipitation of suspended sediment by the “ponding” of water.

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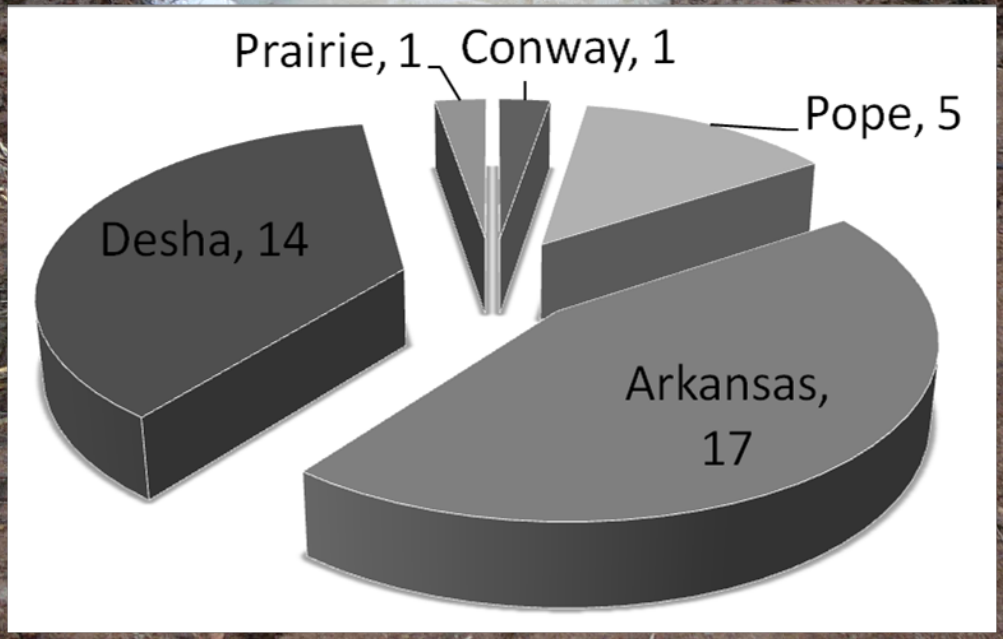
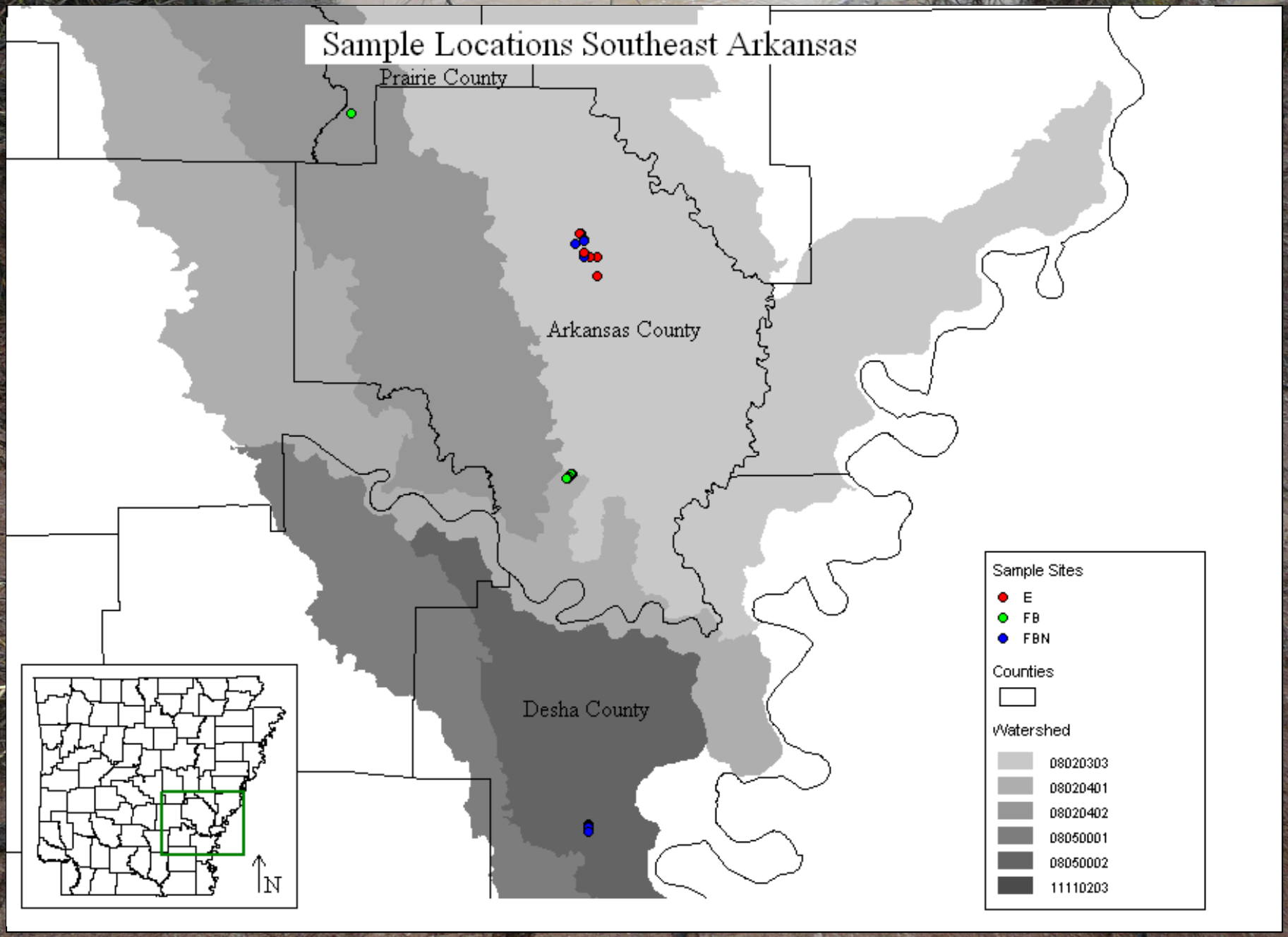
Site Selection

- Land Ownership Cooperation
- Accessibility
- Proximity to one another

- 38 Sampling Locations
- Five counties, two physiographic regions
  - Arkansas River Valley - Conway and Pope Counties
  - Mississippi Alluvial Plain - Arkansas, Desha and Prairie Counties




Sample Locations Southeast Arkansas
Prairie County
Arkansas County
Desha County
N
Sample Sites
E
FB
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Counties
Watershed
08020303
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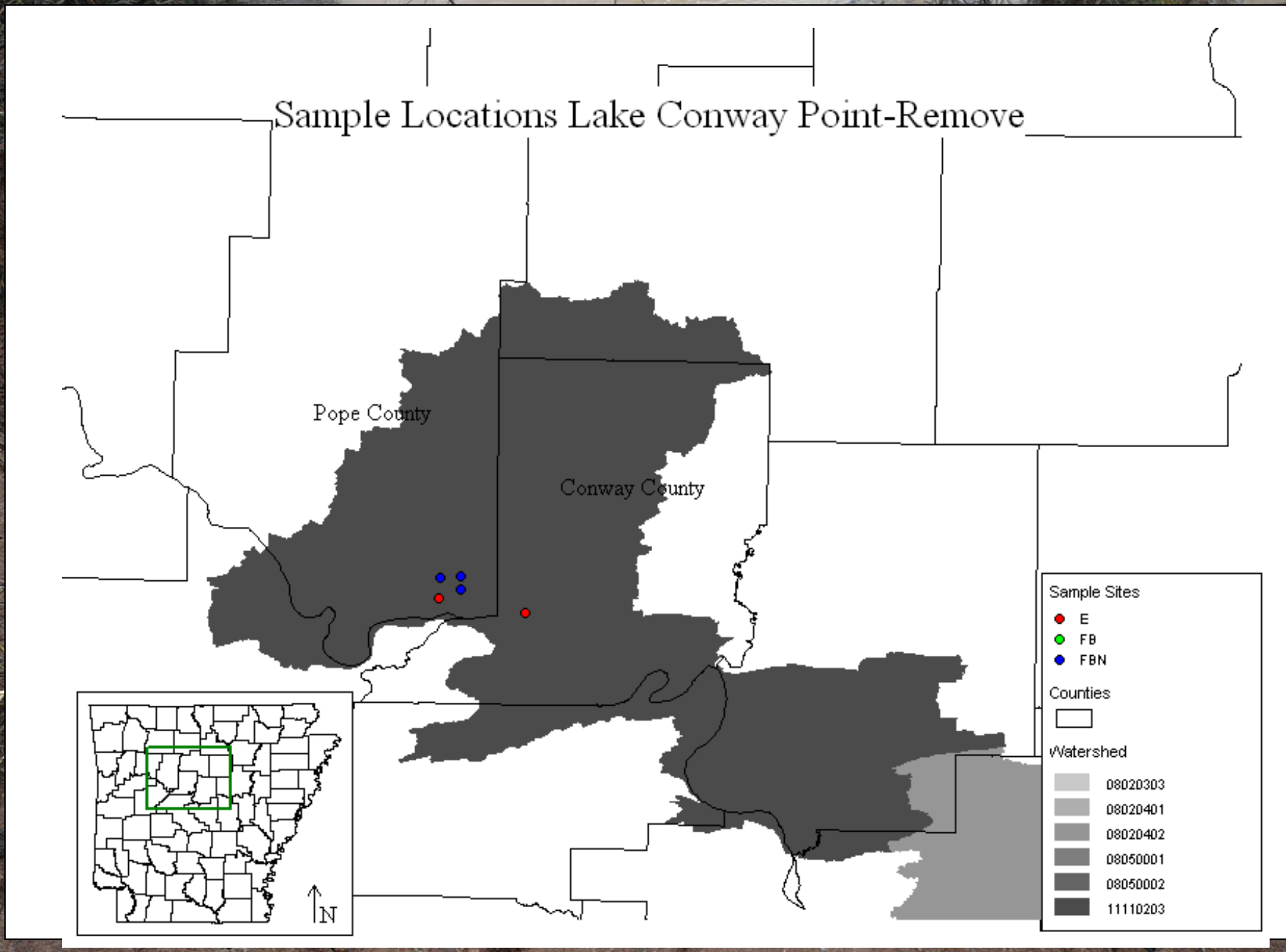

Sample Locations Lake Conway Point-Remove
Pope County
Conway County
Sample Sites
E
FB
FBN
Counties
Watershed
08020303
08020401
08020402
08050001
08050002
11110203
N

Sampling Protocol

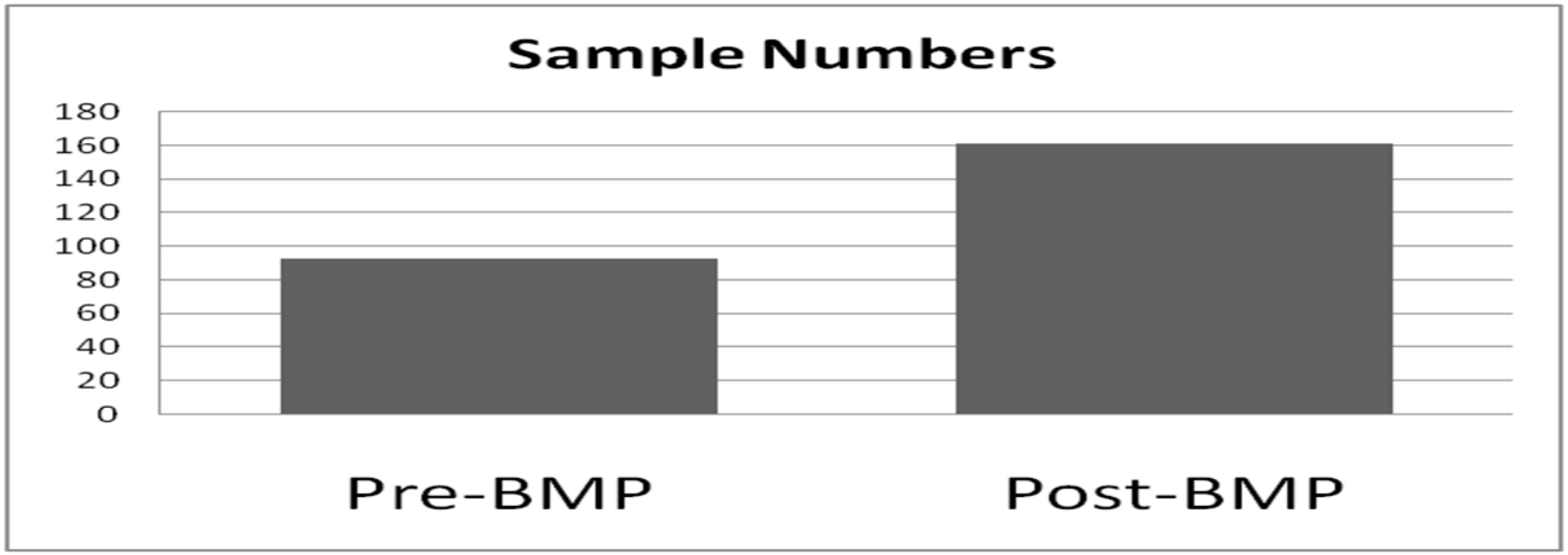
- Soil Saturation to produce run-off
- Irrigation or rain events
- Seasonality differences
- Samples from sites containing a BMP
- Samples from eroding sites with planned BMP

Data Interpretation

- Statistical Methods
  - Outliers were determined and removed from data set
  - Mann-Whitney Test
    - Mann-Whitney was used to determine statistical differences strictly between Pre-BMP and Post-BMP samples
  - ANOVA
    - determined any significant differences in the type of BMP implemented
    - determined any significant differences in the type of field cover
  - Tukey's Pairwise Comparison
    - compare differences between the following categories: no field cover containing BMP, no field cover without BMP, field cover containing BMP and field cover without BMP.

Results

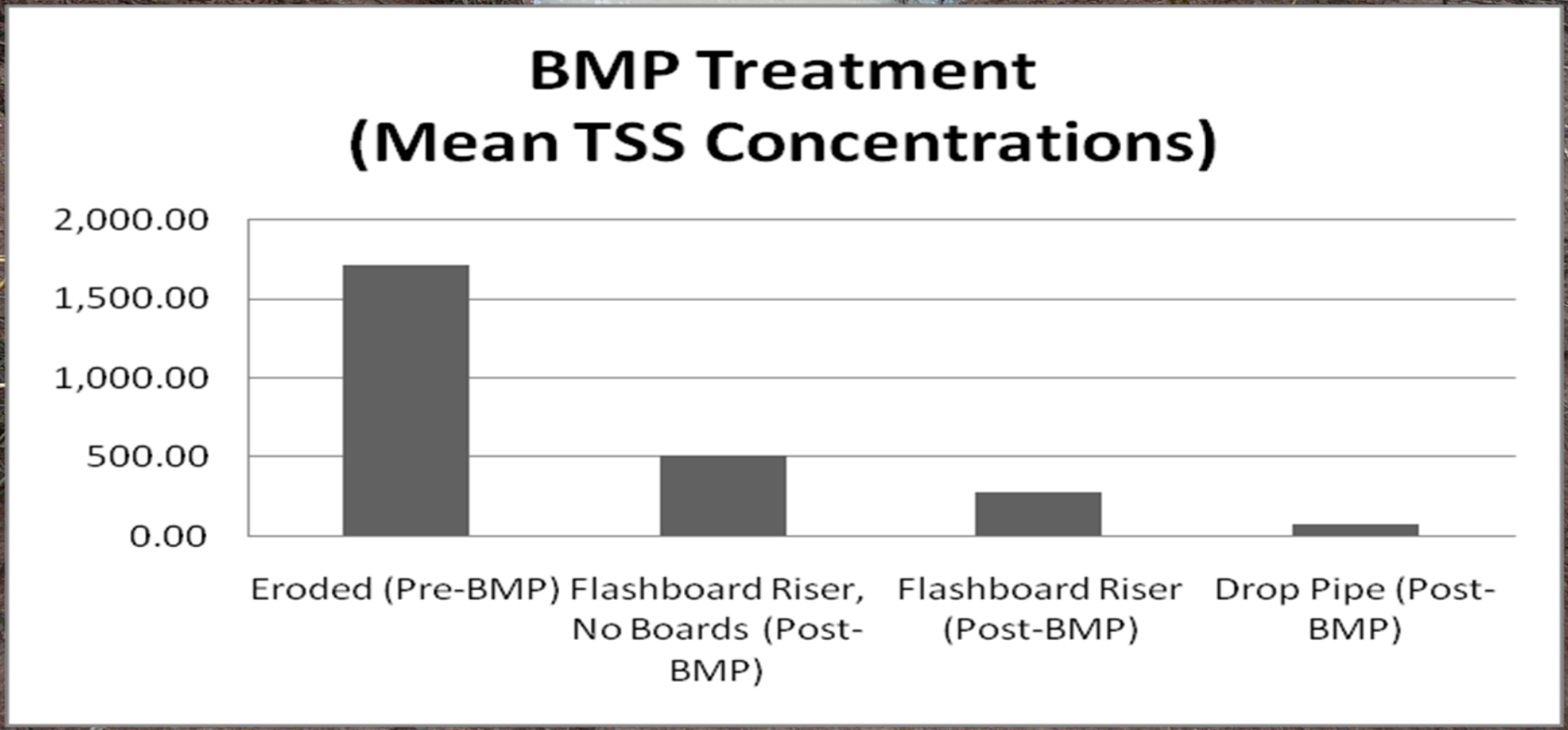
- 254 utilized samples (outliers removed +- 3 std dev.)
  - 93 Pre-BMP (4 -18,740 mg/L TSS mean 1,715)
  - 161 Post-BMP (2 – 5,029 mg/L TSS mean 389.32)



Results

Treatment	Count	Mean TSS (mg/L)	Standard Deviation
Eroded (Pre-BMP)	93	1,715.24	3,670.72
Flashboard Riser, No Boards (Post-BMP)	89	512.03	907.32
Flashboard Riser (Post-BMP)	56	281.5	437.09
Drop Pipe (Post-BMP)	16	84.06	40.22
Total	254		

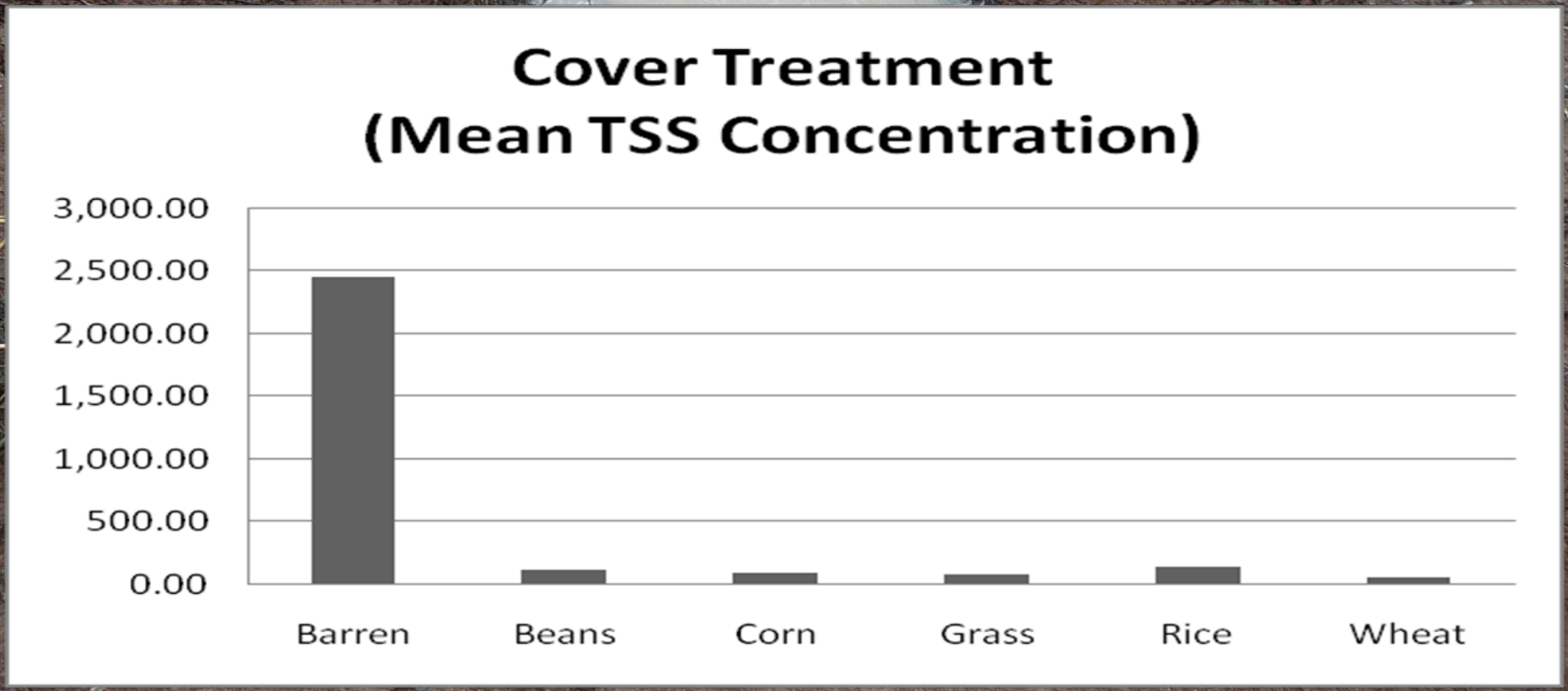
To test the effectiveness of the BMP a Mann-Whitney (Wilcoxon) test was used to compare the medians of TSS concentrations in the Pre-BMP sites to Post-BMP sites. The test resulted in a p-value >0.01, therefore concluding the Pre-BMP sites had a statistically significant higher TSS concentrations than Post-BMP sites with 99% confidence.



Results

Cover	Count	Mean TSS (mg/L)	Standard Deviation
Barren	**82**	**2,458.38**	**3,711.09**
Beans	**52**	**124.08**	**258.31**
Corn	**8**	**98.86**	**52.83**
Grass	**32**	**85.36**	**84.24**
Rice	**68**	**146.44**	**316.62**
Wheat	**12**	**56.42**	**15.01**
Total	**254**		

A multifactor ANOVA was utilized to determine significance levels amongst the TSS concentrations between cover types. The test concluded that the concentration of TSS from barren fields was significantly higher then all other cover types. No statistical differences for the concentrations of TSS between the remaining cover types (Beans, Corn, Grass, Rice, and Wheat) was found to be significant.



Results

Percent Reduction for BMP Implementation for Field Types

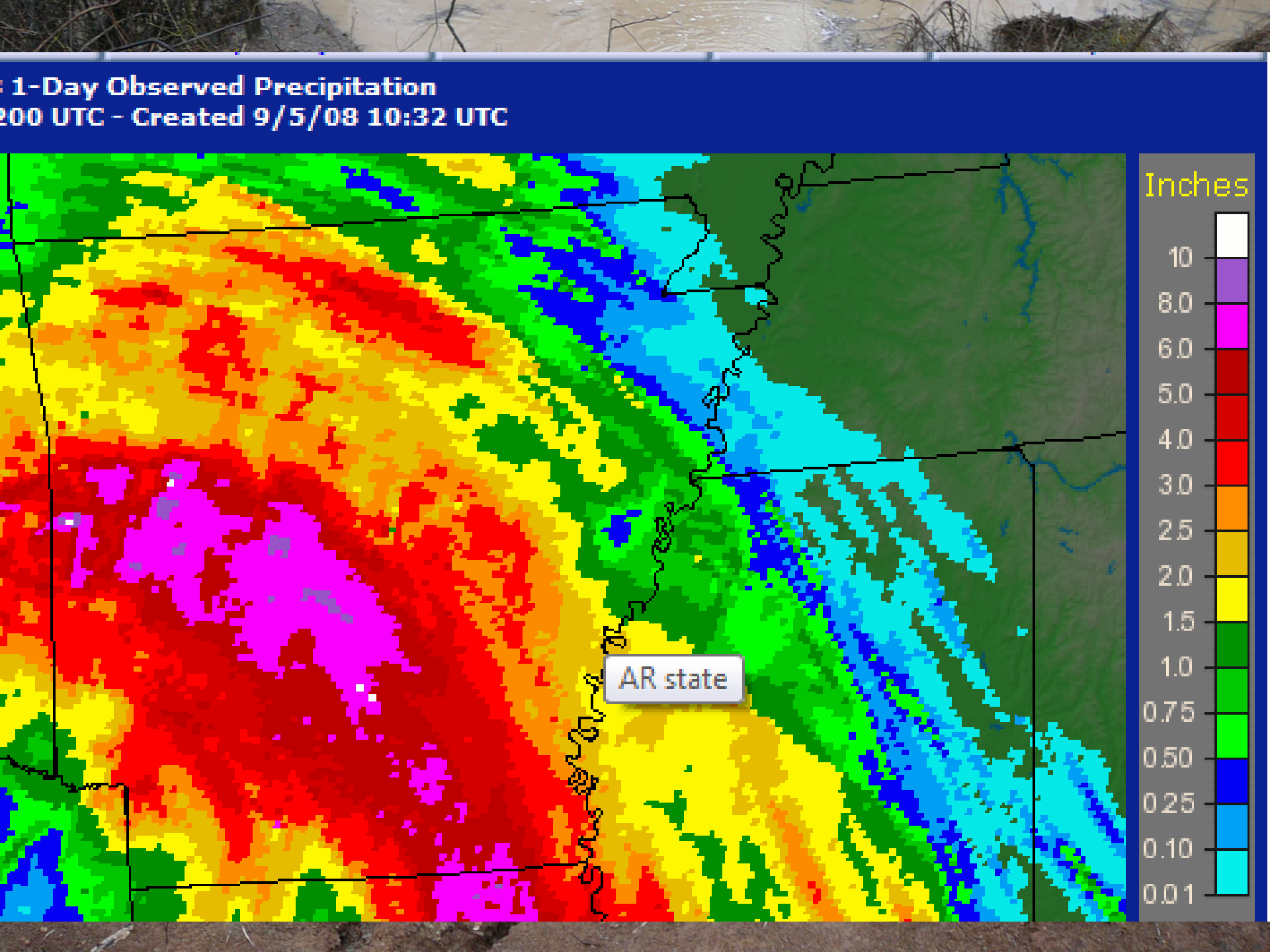
Field Type	Pre-BMP Mean TSS (mg/L)	Post-BMP Mean TSS (mg/L)	Percent Reduction
Barren	4,608.62	2,071.79	55.00%
Covered	2,519.67	127.88	94.90%
Percent Reduction	45.30%	93.80%	

- A Tukey's Pairwise comparison was performed based on BMP presence and cover presence. Sites characterized as barren & Pre-BMP contributed statistically higher TSS concentrations than all other sites. The remaining characterizations demonstrated TSS concentrations descending in following order: Cover & Pre-BMP, Barren & Post-BMP, and Cover & Post-BMP.

Difficulties

- Weather conditions presented the largest barrier in the project.
- Roads often become nearly impassable when soils exceeded their saturation point.
- Storms can be unpredictable with regards to precipitation amount.
- Timing of runoff.
- Cold/wet nights
- **MUD, MUD, AND MORE MUD**

Difficulties


1-Day Observed Precipitation
200 UTC - Created 9/5/08 10:32 UTC
Inches
10
8.0
6.0
5.0
4.0
3.0
2.5
2.0
1.5
1.0
0.75
0.50
0.25
0.10
0.01
AR state

Conclusion

- Significant lower TSS at sites with drop pipes or flashboard risers.
- Significant lower TSS at sites with cover crop.
- Combination of BMP and cover crop had greatest significant reduction of TSS concentrations over any other combination.

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