Water Quality Investigations of On-farm Water Storage Systems in Mississippi: Lessons Learned and Future Directions

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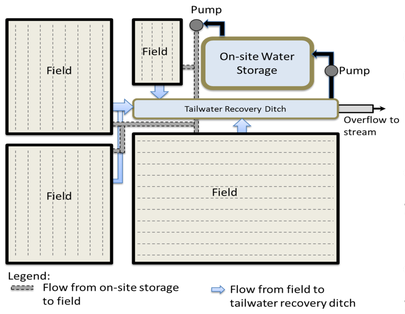
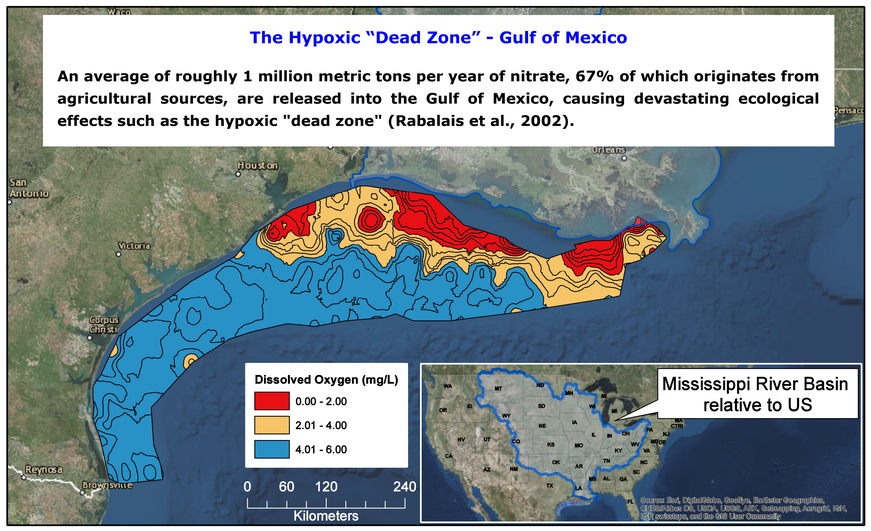
Introduction



- On-farm water storage (OFWS) systems are emerging structural BMPs that are gaining popularity for their water supply benefits.
- Financial assistance has been provided for their potential nutrient reduction benefits.
- Water quality monitoring and analysis of these emerging BMPs are necessary to better understand their effects on the environment.

Objective and Significance

- Understand the role that OFWS systems play as structural BMPs for nutrient reduction and water conservation in the Mississippi Delta Region (MDR).



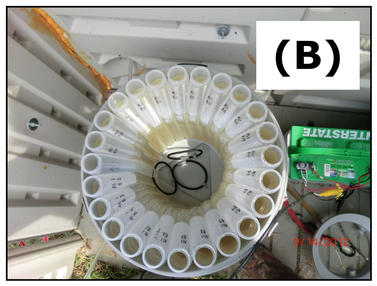
Materials and Methods

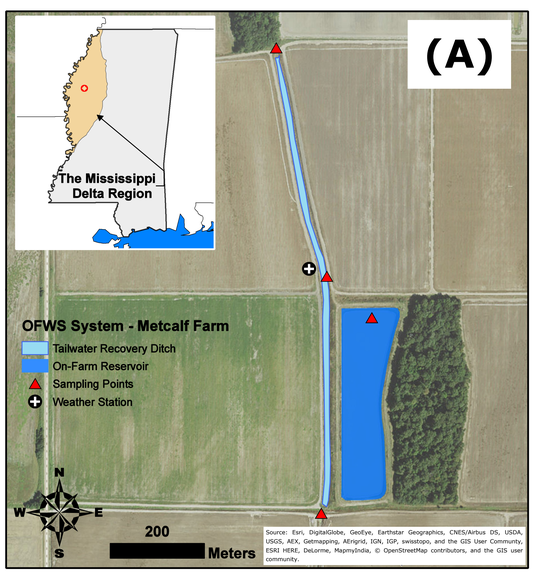
(A) Location of the edge of field monitoring network at the study site.

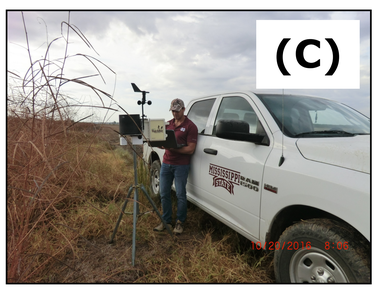
(B) Water sample collection conducted since 2012 to date.

(C) Weather data collection.

(D) Physical and chemical analyses.

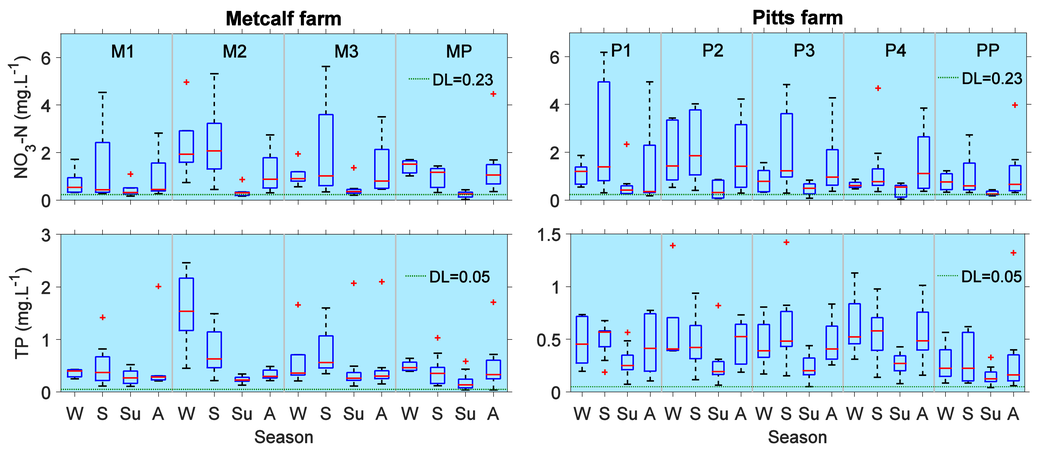






Results and Discussion

1) What is the seasonal efficiency of OFWS systems in reducing downstream nutrient pollution?



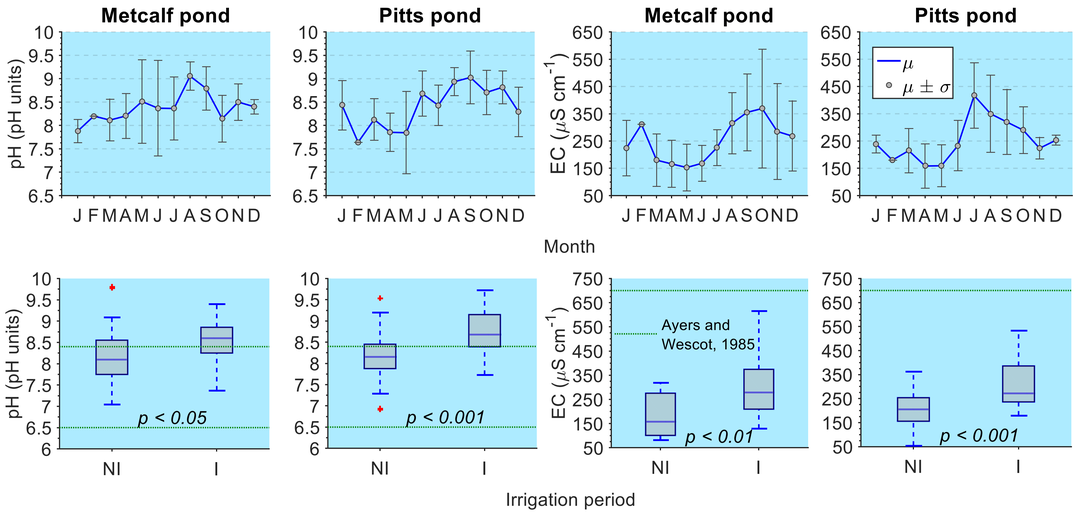
% of Nutrient Reduction*

Season	NO_3-N		TP	
	Metcalf	Pitts	Metcalf	Pitts
Winter	54	67	-	31
Spring	50	50	-	10
Autumn	-	32	22	-

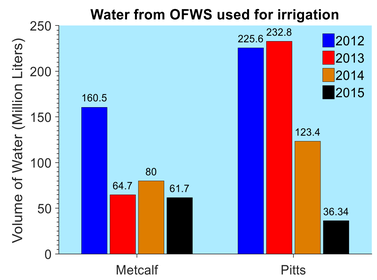
*In-ditch median nutrient concentration

- Results provide evidence of significant seasonal water quality changes among the monitored locations, which highlights downstream nutrient reduction.

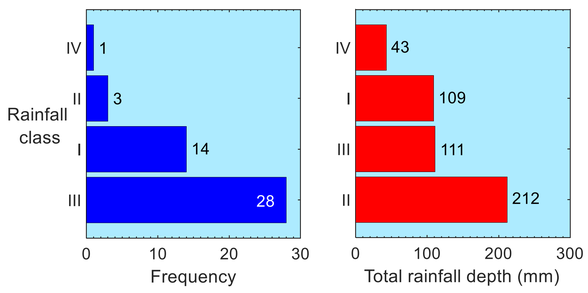
2) What is the quantity and quality of water captured and stored by the OFWS system?



- Based on pH and EC analyses, water from the pond used for irrigation would not be a major factor of stress to crops.



3) What are the impacts of antecedent dry time and rainfall events on in-ditch water quality?



Description of classes obtained using the *k*-means clustering method for linking rainfall characteristics and NO_3-N concentration

Class	*Water Quality*	*Rainfall characteristics*								
	NO_3 - N mg L^{-1}	RDEP mm	RIEP mm h^{-1}	RDuEP days	TBRS days	TBTR days	DNRE mm	INRE mm h^{-1}	DuNRE days	TBNRE days
I	**1.780**[a]	5.080[a]	1.250[a]	0.125[a]	2.958[a]	0.333[a]	**13.843**[a]	**2.566**[a]	**0.1667**[a]	**0.063**[a]
III	**0.332**[b]	1.778[a]	0.953[a]	0.042[a]	4.250[a]	0.813[a]	**1.270**[b]	**0.476**[b]	**0.083**[b]	**0.771**[b]

Medians in columns followed by the same lowercase letter are not significantly different between classes ($p > 0.05$)

Description		Units
RDEP	: rainfall depth of the event prior to sampling	mm
RIEP	: rainfall intensity of the event prior to sampling	mm h^{-1}
RDuEP	: rainfall duration of the event prior to sampling	days
TBRS	: time between previous rainfall and sampling events	h
TBTR	: time between two rainfall events before sampling	h
DNRE	: depth of next-to-last rainfall event	mm
INRE	: intensity of next-to-last rainfall event	mm h^{-1}
DuNRE	: duration of next-to-last rainfall event	days
TBNRE	: time before next-to-last rainfall event	h

- Significant differences were found between Class I and Class III rainfall events for the variables related to next-to-last rainfall event. This indicates that antecedent hydroclimate conditions play a more influential role on the level of NO_3—N in the ditch.

Conclusions

- Results indicate that the downstream nutrient reduction can vary with season, with significant reductions possible during spring.
- Based on the assessment of *in-situ* water quality analysis, water from the ponds is suitable for irrigation of crops. In-pond water used for irrigation reflects the amount of groundwater that was not pumped from the Mississippi Alluvial Aquifer.
- Recurrence of rainfall events might be a central factor to be considered for assessing and managing OFWS in reducing downstream nutrient pollution.

Acknowledgments

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