MISSISSIPPI WATER RESOURCES RESEARCH INSTITUTE
FINAL TECHNICAL REPORT FOR GRANT # G11AP20088

Responses of water quality and wetland plant communities to multi-scale watershed attributes in the Mississippi Delta

01 March 2014 to 28 February 2016

Dr. Gary N. Ervin[1] and Dr. Robert Kröger

[1] Corresponding author:
Dept. of Biological Sciences, Mississippi State University
Email: gervin@biology.msstate.edu
Phone: (662) 325-1203

ABSTRACT

This project aimed to understand the influence of local and landscape factors in shaping wetland functions within the Mississippi Delta. An understanding of scale effects on function is both critical and timely for Delta wetlands. Recent efforts aimed at restoration of marginal agricultural lands to wetlands have been sponsored through government and private wetland restoration projects. Unfortunately, the outcomes of these projects in terms of conservation goals are unknown. This means that decisions to enroll lands in such programs continue to be made without a full evaluation of specific practices that may result in the greatest conservation benefits. Additionally, with little to no long term monitoring conducted on many sites, the ultimate outcome of restoration efforts is unknown. A better understanding of the influence of local and landscape factors on wetland functions in existing restorations will permit more effective targeting of limited resources towards future restorations.

This two-year study resulted in a large database relating to soil and water variables and plant species inventories of 24 Wetlands Reserve Program (WRP) restorations and six natural wetlands within the northern half of the Delta. Thus far, our analyses have indicated that WRP wetlands harbor high levels of plant species diversity and that surrounding conservation practices may be buffering these wetlands from any potential negative impacts of agricultural land use within the Delta. An experimental study of seed bank responses to flooding suggested that some of the observed differences in wetland plant diversity may be attributed to the duration of flooding in natural wetlands. Ongoing analyses are aimed at more detailed examination of how within-wetland vs. landscape factors may be shaping water quality and plant species assemblages within these wetlands.

INTRODUCTION

Considerable effort in recent years has gone into enhancing wetland habitats across the Mississippi Delta, with the objectives and benefits of improving water quality, providing flood protection, and enhancing habitat for fish and wildlife, among others (USDA NRCS 2011). In the Mississippi Delta, some 190,000 acres have been enrolled in the Wetland Reserve Program (WRP) since its inception in 1992 (Kevin Nelms, USDA NRCS unpublished data). However, the success of these wetlands in providing the desired ecological functions (e.g., wildlife habitat, water quality improvement) has been inadequately examined (Faulkner *et al.* 2011), even though such studies are critically important for determining factors that may indicate potential success of future restoration or conservation efforts.

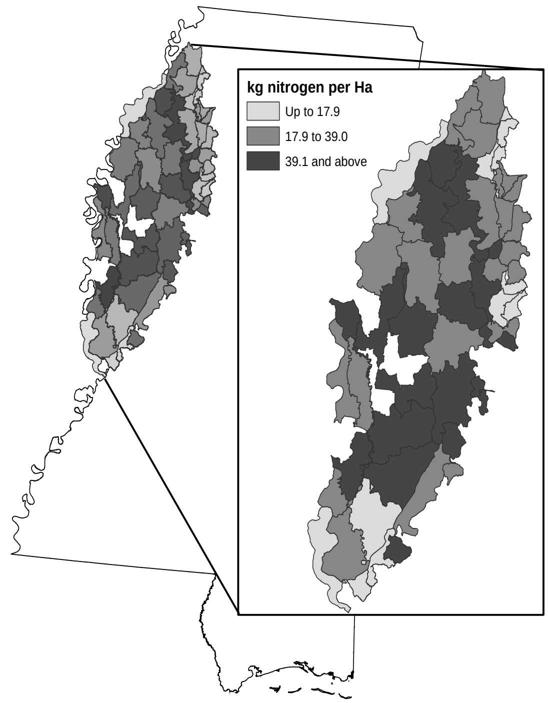

Figure 1. Watersheds within the MS delta containing WRP easements, shaded based on estimated nitrogen inputs per hectare of corn, cotton, and soybean (data from USDA NASS and USDA Economic Research Service). Boxed inset shows watersheds classified into three categories of nitrogen loading (low, medium, and high), for purposes of our proposed experimental design.

Lands enrolled in the WRP are exposed to a wide range of stressors that may limit success, in terms of restoring wetland structure and function. In the Delta region, these stressors primarily derive from agricultural land use. For example, estimates based on current agricultural data indicate that WRP lands in Mississippi experience nutrient loads in the range of 0.3 to 62 kg nitrogen per hectare and 0.3 to 45 kg phosphate per hectare within MS Delta watersheds (Figure 1). These data are based solely on average inputs of N and P fertilizers per hectare to the three major MS crops (corn, cotton, and soybeans), which themselves range from 0.5 to 78 percent of the area of individual watersheds within the Mississippi Delta (USDA National Agricultural Statistics Service [NASS] 2013).

To fully understand the degree to which land use impacts wetland function, it is critical to take a landscape approach to studying these ecosystems (e.g., Figure 2). Zedler and Kercher (2004) argue that wetlands are particularly susceptible to landscape-scale human activities because

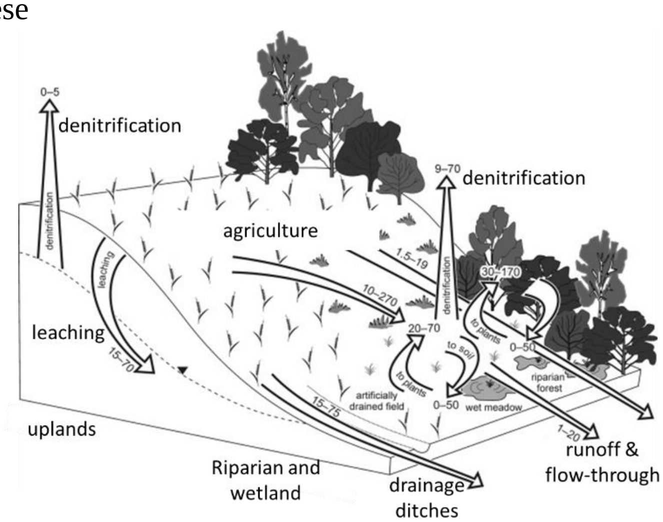

Figure 2. Fluxes of nitrogen (kg N per ha per yr) across a typical agricultural landscape at temperate latitudes. From Pärn *et al.* (2012).

wetlands are "sinks" within the landscape, influenced by both terrestrial and aquatic disturbances within the surrounding watershed. Within the wetland, water quality, plant species assemblages, community types, and plant conservation values all influence water quality in different ways, but also are affected differentially by their surroundings at different spatial scales (Matthews *et al.* 2009) (Figure 3). Thus, the restoration of complex ecosystem services and functions requires an integration of local and landscape approaches (Dosskey *et al.* 2005), which is currently lacking in both restored and reference wetlands within the Mississippi Delta (Faulkner *et al.* 2011).

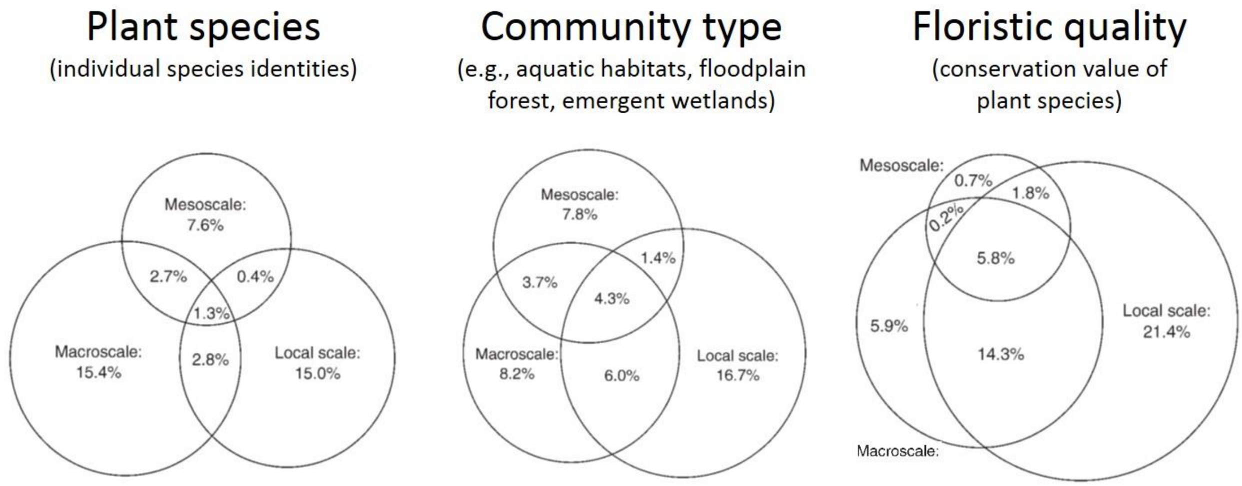

Figure 3: Environmental drivers vary across spatial scales in their relative influence on local-scale responses of wetland vegetation. Area of individual circles indicates the percent of variation in wetland plant variables explained by environmental factors at the local, meso-, and macroscales within and surrounding restored wetlands in Illinois. Modified slightly from Matthews et al. (2009).

Our specific objectives in this study were to:

1. Measure water quality and wetland plant species assemblages in restored (WRP) and naturally occurring wetlands in the Mississippi Delta, across the available gradient of estimated nutrient loadings.
2. Measure a suite of local-scale (within-wetland) factors anticipated to influence water quality and wetland plant species.
3. Assemble existing data on meso- and macroscale factors likewise thought to serve as environmental drivers of water quality and wetland plant species.
4. Quantify statistical linkages between our ecological responses (water quality and wetland plants) and potential environmental drivers at the three spatial scales of interest, as well as determine the relative importance of those environmental factors.
5. Translate these results into information that can be used to guide the placement of future wetland restoration efforts so as to optimize the likelihood of success, within the context of local and watershed-scale environmental factors and to predict the effect of future local to watershed scale changes on wetland function.

METHODS

Site selection

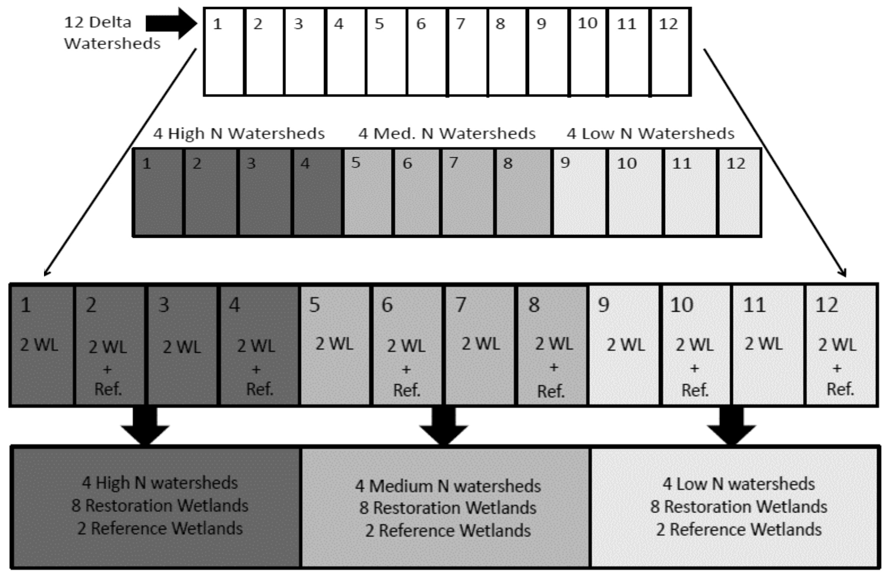

Figure4: Experimental design and wetland selection procedure. Med.=medium, WL=restored wetlands, Ref.=reference wetland. Sites will be selected with the aid of USDA personnel from candidate WRP land within the Mississippi Delta.

Twelve watersheds (HUC-12) containing WRP wetlands within the Mississippi Delta were selected for assessment (Figures 1 and 4). Fertilization and land use data from 2010-2012 were used to calculate approximate nitrogen loads (kg/ha) applied to each watershed, among the three most important crop species (Figure 1). From those data, watersheds were grouped into "high" (≥39 kg/ha), "medium" (17.9-39 kg/ha), and "low" (≤17.9 kg/ha) nitrogen fertilizer application loads (classified based on natural breaks approach in ArcMap 10.2). Those nitrogen loading groups were used to stratify study wetlands across the spectrum of nitrogen application conditions in Mississippi Delta (Figure 1). Four watersheds in each of the three nutrient load categories were selected randomly following determination of easements with landowner willingness to participate in this study. Two restored WRP wetlands in each selected watershed were monitored throughout the study, for a total of 24 restored wetlands (eight each in high, medium, and low nitrogen load watersheds). A reference (naturally occurring) wetland was identified in six of the 12 watersheds, with two in high nitrogen application watersheds, two in medium, and two low nitrogen application watersheds (Figure 2). Selection of wetland sites via landholder willingness was facilitated with the assistance of Kevin Nelms (USDA, NRCS).

Data Collection

Ecological Response - *Water quality*

Water quality was assessed within each wetland four times per year: 1) March, 2) April, 3) during the first plant sampling event (May), and 4) during the second plant sampling event (August). Water samples were measured *in situ* in two locations within each wetland: 1) at the inflow, 2) at the wetland outflow, if these are clearly defined. If there are no obvious in/outflows, sampling occurred at the most likely inflow and outflow locations. Samples were measured *in situ* for nitrate-N (NO_3- -N), dissolved oxygen (DO), conductivity, oxidationreduction potential (ORP), pH, and turbidity. During the first sampling (March) all sampling locations were marked via GPS to ensure all future measurements were taken from the same location. This sampling procedure allows for the determination of wetland function via the nitrate-N removal efficiency from inflow to outflow points. Nitrate-N is of particular importance in nutrient reduction best management practices (BMPs) within the Mississippi River Drainage Basin, as it is the leading cause behind the formation of the Gulf of Mexico hypoxic zone (Rabalais 2002).

Ecological Response - *Wetland Plant Species*

Floristic assessment inventories (e.g., Ervin et al. 2006) were conducted on plant species within the wetland sites in the spring (April-May) and in the late summer (July-August). Upon arrival, the site was visually inspected for area and site dimensions. Fifty circular plots (0.5 m^2 each) were evenly spaced along 10 transects at 20 m intervals, excluding portions of the site with standing water greater than waist deep. All plant species within the circular plots were recorded, and in the event of an unidentifiable specimen, a voucher sample was collected for eventual expert identification. Plant species were analyzed for overall species composition, the composition of species based on growth form and wetland indicator status, and their composition based on conservation value (Herman et al. 2006).

Macro- and Mesoscale Drivers - *Geospatial Data*

Land use/land use data were obtained from the United States Department of Agriculture's National Agricultural Statistics Service (http://www.nass.usda.gov). The 2014 Cropland Data Layer (CDL) was used for analyses, as it had a fine grain resolution (30 m) and included built-in classes for fallow/conservation land among a suite of anthropogenic and natural land cover classes. Future work on data collected in 2015 will use the 2015 CDL for analyses The land cover data were cursorily examined in comparison with aerial photography to ensure matches with wetland cover within the study region before this project began. These data have been verified in visual comparison with land cover in and around our study sites through the duration of this research.

Meso- and Local-Scale Drivers - *Soil Testing*

Soil sampling coincided with water quality sampling events (March, April, plant sampling 1, plant sampling 2) at each site in 2014. Three soil cores were taken from within the wetland in locations visually chosen for their heterogeneity (in an effort to represent the range of soil conditions present) and three taken within a 150 m buffer of the wetland. Within-wetland soil cores were homogenized, as were wetland buffer cores, and all were placed on ice and subsequently analyzed for total nitrogen, carbon, and phosphorus.

Local Scale Drivers - *Site Hydrology*

Twelve water level loggers were placed across nine of the twelve Delta watersheds. Within these watersheds, four loggers were placed in each nitrogen loading category. Of these four, one logger was placed in a reference wetland, while another was placed in a restored wetland within the same watershed. The remaining two were placed in two other watersheds within the same nitrogen loading category. The loggers recorded data every hour in a linear fashion over the duration of the study. This procedure captured hydrologic "fingerprints" of the wetlands and quantified site hydrology over the testing period.

RESULTS & DISCUSSION

Our initial examination of the data collected during 2014 revealed only one of the water quality parameters (conductivity, as measured during summer, Figure 5) that was strongly influenced by our *a priori* categorization of watersheds among low, medium, and high nutrient loadings (i.e., categories shown in Figure 1). Similarly, we found water quality parameters in restored wetlands as a group to not differ significantly from those in natural wetlands, except for summer conductivity measurements. Here, conductivity was highest for natural wetlands in high-agriculture-intensity watersheds; all other values were relatively similar to one another. Similarly, we found pH to be the only soil parameter correlated with the wetland and watershed categorizations. Here, soil pH was highest in the high agricultural intensity watersheds, at 5.1±0.1, followed by medium intensity (4.8±0.1) and then low intensity (4.5±0.1).

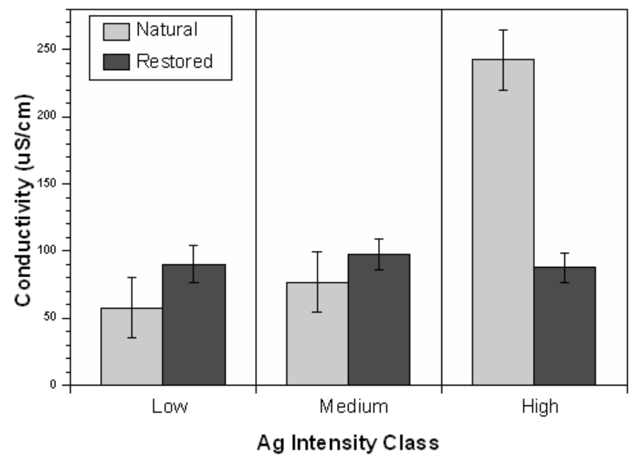

Figure 5. Conductivity, measured in our study wetlands during summer 2014, was the only water quality parameter that differed significantly among wetlands of the three agricultural use intensities or between natural and restored wetlands.

Whereas we found few differences in water quality and soil chemistry among wetlands when categorized by watershed-scale agricultural land use, we did find some interesting differences between the natural wetlands, as a group, and the restored wetlands. Soil organic matter composed a higher percentage of the soil in natural wetlands than in restored wetlands (~84% organic matter content in soil from natural wetlands, vs. ~36% in WRP soils), similar to what others have found in similar investigations (e.g., Theriot et al. 2013). There also was a greater percentage of organic matter in soils of wetlands surrounded by greater proportions of natural land cover (i.e., forests or wetlands).

The differences in the soil chemistry and landscape setting of the natural wetlands were correlated with some important differences in plant species cover between the two categories of wetlands. As noted by other investigators (e.g., Yepsen et al. 2014), natural wetlands tended to harbor more and a greater proportion of woody species (trees and shrubs) than did restored wetlands. Our preliminary examinations of the 2014 plant data showed such species as buttonbush (*Cephalanthus occidentalis*), swamp chestnut oak (*Quercus michauxii*), slippery elm (*Ulmus rubra*) and other bottomland hardwood species to occur on the six natural sites. On the restored sites, redvine (*Brunnichia ovata*) and trumpet creeper (*Campsis radicans*) frequently were recorded at 50% or more of our sample points per wetland. The proportion of those and other weedy plant species in restored wetlands also appeared to increase from low agricultural intensity watersheds to medium and high intensity watersheds, whereas they were much less abundant in natural wetlands (although the latter factor probably also is influenced by the active soil and vegetation management in many of our restored wetlands).

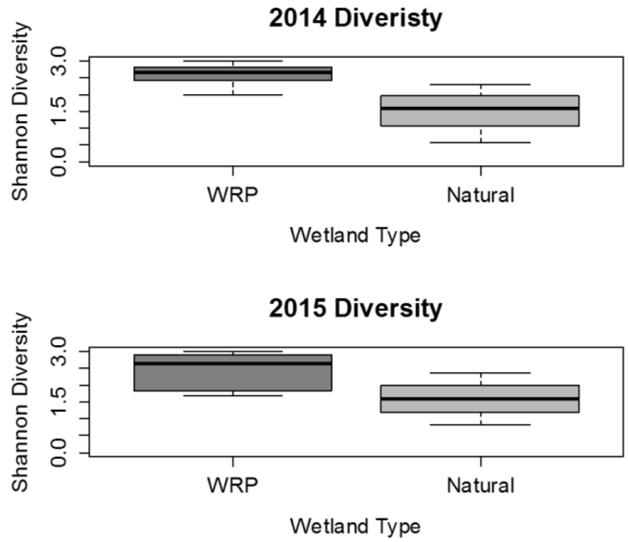

Figure 6. Plant species diversity was higher in restored wetlands in both years of the study ($P \leq 0.001$ for both comparisons).

We hypothesize that, as found by others, these differences in plant species among wetlands are influenced by differences in hydrology, soils, and/or water chemistry among wetlands. We also hypothesize that some of these differences will inform us about mechanisms that may enhance future design of wetland restorations to provide multiple benefits of restoring water quality as well as wildlife habitat in the Mississippi Delta. For example, suites of plant species found in wetlands with similar hydrological regimes (longer flooding period, earlier drawdown, etc.) may have similar influences on important water quality measures such as nutrient abatement or sediment retention, while also serving as important food or habitat for wildlife. These are questions that are being addressed by a follow-up WRRI grant to the Ervin lab (discussed in a separated Final Technical Report).

We also found that plant species diversity was significantly higher in the restored, WRP, wetlands in both years of our study (Figure 6). We attributed this in part to the management approaches applied in many of the WRP wetlands, which maintain somewhat disturbed conditions, but also to differences in hydrology between natural and restored sites. Hydrology is discussed more in the report on our other project, which was aimed more directly at the interrelationships between water quality and wetland vegetation.

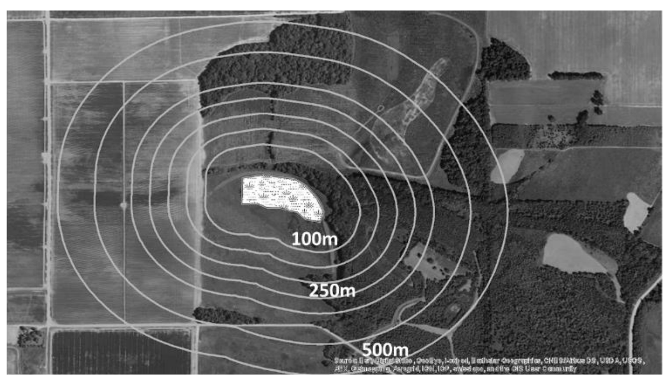

Figure 7. Land cover was examined at multiple distances from the wetland boundary, in terms of its relationship to wetland vegetation. Data from ESRI Digital Globe, a compilation of georeferenced data sources.

We found that, within 500 meters of the wetland boundaries (Figure 7), fallow land cover (usually consisting of land enrolled in conservation programs) was most strongly correlated with plant species diversity within the wetlands. We also found that the observed positive relationship between these two factors strengthened as larger areas around the wetland were included. We suspect that conservation lands in this landscape simply harbor a greater number of species adapted to the relatively diverse conditions present in the WRP wetland sites, and the close proximity has facilitated those species dispersing to our study wetlands. Other types of land cover showed general patterns in line with our expectations, but were not statistically significantly correlated with plant species diversity.

Based on a number of the patterns we observed in the above analyses, we initiated some experimental work to complement the observational studies described above and in our original proposal. We believe hydrology is a major driver of the differences in diversity that we found between the restored and natural sites. One potential mechanism for this is the influence that hydrology has on seed germination and plant establishment. To test this, we conducted an experiment examining the effects of three hydrologic regimes on seed germination. We imposed constant flooding, constant moist soil, and a fluctuating hydrology on seed banks from a subset of our natural and restored wetlands. We found similar numbers of seeds in the soil samples (~50 seeds per 70 cm^3 of soil) from both wetland types, as well as a similar proportion of seeds that germinated during our study (20-40% of seeds germinated). However, constant flooding resulted in a significantly lower proportion of seeds gemmating from the samples (Figure 8, Kruskal-Wallis P = 0.03).

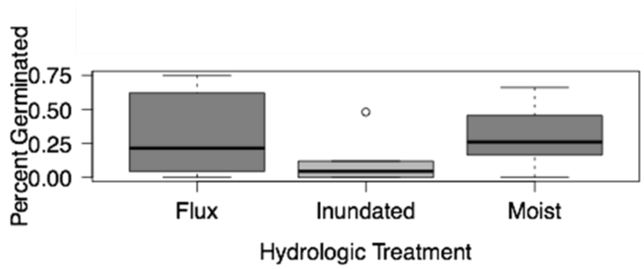

Figure 8. The constantly inundated treatment showed a significantly lower germination rate compared to that of constantly moist and fluctuating water level treatments (Kruskal-Wallis P = 0.03).

These results suggest that the year-round inundation observed in our natural wetlands may, in fact, have limited the number of species capable of establishing on those sites, consequently impacting the observed plant species diversity (Figure 6). Furthermore, it seems that, based on many of our analyses to date, within-wetland factors (habitat management, soil characteristics, hydrology) may be more important than broader-scale impacts (watershed-level nutrient loading, surrounding land use) in their effects on plant assemblages. We would caution that we are continuing our analyses of the data collected (see table below), and that subsequent information may or may not support these early observations.

References

Dosskey, M.G., Eisenhauer, D.E., Helmers, M.J. 2005. Establishing conservation buffers using precision information. Journal of Soil and Water Conservation 60(6), 349-354.

Ervin, G.N., Herman, B. D., Bried, J.T., Holly, D.C. 2006. Evaluating non-native species and wetland indicator status as a component of wetlands floristic assessment. Wetlands 26(4), 1114-1129.

Faulkner, S., Barrow Jr., W., Keeland, B., Walls, S., Telesco, D. 2011. Effects of conservation practices on wetland ecosystem services in the Mississippi Alluvial Valley. Ecological Applications 21(3), S31-S48.

Herman, B. D., J. D. Madsen, and G. N. Ervin. 2006. Development of coefficients of conservatism for wetland vascular flora of north and central Mississippi. GeoResources Institute Report Number 4001, Mississippi State University, MS. March 2006. 15pp. http://www.gri.msstate.edu/publications/docs/2006/03/4097MS-Coeff-of-Conservatism.pdf

Matthews, J.W., Peralta, A.L., Flanagan, D.N., Baldwin, P.M., Soni, A., Kent, A.D., Endress, A.G. 2009. Relative influence of landscape vs. local factors on plant community assembly in restored wetlands. Ecological Applications 19(8), 2108-2123.

Pärn, J., Pinay, G., Mander, Ü. 2012. Indicators of nutrients transport from agricultural catchments in temperate climate: a review. Ecological Indicators 22, 4-15.

Rabalais, N.N. 2002. Nitrogen in aquatic ecosystems. Ambio 31(2), 102-112.

Theriot, J. M., J. L. Conkle, S. R. Pezeshki, R. D. DeLaune, and J. R. White. 2013. Will hydrologic restoration of the Mississippi River riparian wetlands improve their critical biogeochemical functions? *Ecological Engineering* 60: 192-198

USDA Economic Research Service. Fertilizer Use and Price Data. Accessed 14 Nov 2013 from http://www.ers.usda.gov/data-products/

USDA National Agricultural Statistics Service. CropScape Cropland Data Layer. Accessed 14 Nov 2013 from http://nassgeodata.gmu.edu/CropScape/

USDA, Natural Resources Conservation Service (NRCS). 2011. Restoring America's Wetlands: A Private Lands Conservation Success Story. Accessed 21 Nov 2013 from http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1045079.pdf.

Yepsen, M., A. H. Baldwin, D. F. Whigham, E. McFarland, M. LaForgia, and M. Lang. 2014. Agricultural wetland restorations on the USA Atlantic coastal plain achieve diverse native wetland plant communities but differ from natural wetlands. *Agriculture, Ecosystems & Environment* 197: 11-20.

Zedler, J.B., Kercher, S. 2004. Causes and consequences of invasive plants in wetlands: opportunities, opportunists, and outcomes. Critical Reviews in Plant Sciences 23(5), 431-452.

PROGRESS RELATED TO STATED OBJECTIVES

1. Measure water quality and wetland plant species assemblages in restored (WRP) and naturally occurring wetlands in the Mississippi Delta, across the available gradient of estimated nutrient loadings.

This objective was completed. We have collected data from two growing seasons (2014 & 2015), including multiple water quality sampling trips during each year.

2. Measure a suite of local-scale (within-wetland) factors anticipated to influence water quality and wetland plant species.

We measured hydrology for twelve of our 30 study wetlands, sampled for soil characteristics multiple times during 2014, and collected data on water depth at each plant sampling location. Information will also be gathered from each land owner regarding specific site management activities conducted during the two years of our research.

3. Assemble existing data on meso- and macroscale factors likewise thought to serve as environmental drivers of water quality and wetland plant species.

We have assembled land use and land cover data for the entire region and have included analyses of these data in the above reported results, as well as multiple presentations given at state, regional, and international conferences.

4. Quantify statistical linkages between our ecological responses (water quality and wetland plants) and potential environmental drivers at the three spatial scales of interest, as well as determine the relative importance of those environmental factors.

These analyses were summarized above but are continuing, as part of Cory Shoemaker's dissertation research. We anticipate these analyses will form the basis for at least one peer-reviewed journal article submission.

5. Translate these results into information that can be used to guide the placement of future wetland restoration efforts so as to optimize the likelihood of success, within the context of local and watershed-scale environmental factors and to predict the effect of future local to watershed scale changes on wetland function.

This work will begin once we have assembled information on land owner management activities and have incorporated that information into our larger body of analyses of factors influencing plant and water quality in our study wetlands.

SIGNIFICANT FINDINGS

Information gained so far in this research project indicates that:

- WRP management results in a significantly altered wetland hydroperiod.
- The altered hydrology of WRP wetlands serves to enhance plant species diversity.
- WRP wetlands likely recruit plant species from adjacent or nearby conservation easements, very likely forming broad wetland "metacommunities" within the Delta's agriculture-dominated landscape.

We will build upon these findings to develop plans for future research that could use these insights to help direct future restoration/conservation efforts in the Delta.

CONTINUED RESEARCH

Although the project performance period has ended, much of the analyses of data collected remains underway. We have collaborated with Dr. Charles Bryson and Mr. John McDonald to identify the more difficult plant species from the field surveys, and plant identification is nearing completion. We currently are engaged in data analysis for one Master's student thesis that should result in at least one peer-reviewed publication, and we anticipate at least two publications to result from the doctoral dissertation that is still in progress.

Table 1. Anticipated products not yet completed from this project.

Type	Tentative title	Anticipated completion
Dissertation	*Assessing drivers of wetland plant community dynamics in the Mississippi Delta*	December 2017
Thesis	*Functions of Wetland Plant Assemblages in Water Quality Improvement in Natural Wetlands*	August 2016
Paper	Land use impact on wetland plant diversity in Mississippi Delta wetlands	Spring 2017
Paper	Responses of wetland seed banks from natural and restored wetlands to variation in flooding regime	Summer 2017
Paper	Long-term response of wetland seed banks to sediment and nutrient deposition	Spring 2018

FUTURE FUNDING POTENTIAL

Dr. Ervin made contact with Florance Bass and Doug Upton, at Mississippi DEQ, regarding future research projects that could expand on the findings resulting from this work while also contributing to wetland needs within Mississippi. Plans are to continue discussions with MS DEQ and to develop research plans that could be used to pursue potential funding opportunities that could take advantage of the information gained in this WRRI-funded project.

STUDENT TRAINING, OUTREACH, AND INFORMATION TRANSFER

Two graduate students are continuing work towards their degrees, with one planning to graduate during 2016, the other potentially as early as December 2017. These students have presented work from their projects at a number of regional conferences, resulting in one award for Best Student Presentation. The following are some of the products and future plans for results from this research.

Student Training

Name	Level	Major
Cory Shoemaker	Doctoral Student	Biological Sciences

Cory won the award for Best Student Oral presentation at the 2016 Mississippi Water Resources Conference, for a presentation on this work.

Name	Level	Major
Evelyn Windham	Master's Student	Biological Sciences

Evelyn was selected as the Department of Biological Sciences Teaching Assistant of the Year for the 2015-2016 academic year.

Name	Level	Major
McKenzie Gates	Undergraduate Student	Biological Sciences

Publications/Presentations

Ervin, G. N. and C. M. Shoemaker. 2015. Water quality-land use interactions in restored wetlands of the Mississippi Delta. Mississippi Water Resources Conference, Jackson, MS, 08 April 2015.

Gates, M., C. M. Shoemaker, E. L. Windham, and G. N. Ervin. 2016. Germination rates of Delta wetland seeds under varying conditions. MSU Department of Biological Sciences Undergraduate Research Program Symposium, April 08, 2016.

Shoemaker, C. M. 2015. Drivers of wetland plant communities in the Mississippi Delta. Department of Sciences and Mathematics, Mississippi University for Women, Columbus, MS, September 9, 2015. (Invited lecture)

Shoemaker, C. M. and G. N. Ervin. 2015. Drivers of plant community composition in Delta wetlands. Mississippi Water Resources Conference, Jackson, MS, 08 April 2015.

Shoemaker, C. M. and G. N. Ervin. 2015. Drivers of plant community composition in restored wetlands. Society of Wetland Scientists annual conference, Providence, RI, 03 June 2015.

Shoemaker, C.M. and G. N. Ervin. 2015. Drivers of wetland plant assemblages in restored and naturally occurring wetlands in Mississippi. MidSouth Aquatic Plant Management Society Conference, Mobile, AL, September 16, 2015
Shoemaker, C. M., E. L. Windham, and G. N. Ervin. Effects of land use on wetland plant diversity in Mississippi. Mississippi Water Resources Conference, Jackson, MS, 06 April 2016.

Planned web-based hosting of data and information

Final products from the project will be made available to scientists and the general public through the Ervin's membership in the Gulf Coastal Plain and Ozarks Landscape Conservation Cooperative (GCPO LCC). In particular, geospatially referenced data products resulting from this work can be made available via the GCPO LCC Conservation Planning Atlas (http://gcpolcc.databasin.org/). General information about the project and findings will be hosted through a GCPO LCC project page (gcpolccapps.org). All products made available in this manner will adhere to the data management best practices developed by the GCPO LCC.

Collaboration with Kevin Nelms of the USDA NRCS.

We have cooperated directly with the USDA NRCS in determining sites on which to conduct the research, but we also plan to maintain that collaboration to aid in information dissemination. Incorporation of our findings into the USDA NRCS WRP ranking tool will ensure that the most complete information is being applied to assessment and prioritization of WRP efforts within the region.