A. Title Page

Professional Development Grant Report
Arkansas Tech University

Participation in the 2009 Regional Society of Wetland Scientists Meeting

by

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B. Restatement of problem researched or creativity

I recently gave a talk entitled "Community Structure of Wetland Birds During Migration Through the Rainwater Basin" at the 2009 South Central Chapter Meeting of the Society of Wetland Scientists (SWS). This conference was held October 22-24, 2009 in Denton, Texas. I was also a co-author on 3 talks presented by ATU students, entitled:

- "Nutrient Reserves Dynamics of Waterfowl Migrating through the Rainwater Basin of Nebraska"
- "Evaluation of Management Strategies on Moist-soil Seed Availability in the Mississippi Alluvial Valley" and
- "Food Preference of Wintering Waterfowl on Wetland Reserve Program Sites in Arkansas."

Since travel funds were not provided by the conference, I applied for and received funds from Arkansas Tech University's Professional Development Grant Committee. Abstracts of all presentations are included in the meeting program (Attachment 1).

C. and D. Brief Review of the Research Procedures and Summary:

Participating in this conference allowed me to attend numerous talks and gain important knowledge about current wetland research which I plan to incorporate into the Wetland Ecology class I teach. My presentation was well received by conference attendees and several other researchers expressed interest in future collaboration. The ATU students also did an outstanding job presenting their research and undergraduate Micah Tindall was awarded 1st place in the student presentation competition for his talk based on his undergraduate research project (beating out graduate students from such schools as University of Alabama, Louisiana State University and University of Mississippi). In addition to the distinction of winning the student presentation

contest, Micah was also awarded $800 to attend and present his research at the 2010 National Wetlands Meeting in Salt Lake City, Utah.

While at the conference, I was also able to participate in the Executive Board meeting of the South-Central Chapter of SWS. We voted on several orders of Chapter business including financially supporting a student from an underrepresented group to attend the 2010 meeting in Salt Lake City. We also discussed the possibility of the 2010 regional SWS meeting being held in Arkansas, hosted by either ATU or a private consulting firm.

E. Conclusions and recommendations

I believe it its extremely important for faculty and students at Arkansas Tech to have the opportunity to attend and present their research at regional meetings. The interaction with fellow researchers is essential for professional development and staying updated on current trends in our respective fields. In conclusion, the conference was extremely beneficial in fostering scientific exchanges between diverse groups of students and professionals involved in wetland management and research.

Attachment 1. Meeting agenda and program

Society of Wetland Scientists
South Central Chapter Fall Meeting
October 22-24, 2009
Denton, Texas

Constructed and Natural Wetlands in Urban Landscapes

The South Central Chapter (SCC) of SWS will hold their Fall 2009 chapter meeting at the University of North Texas (UNT) in Denton, TX on October 22-24, 2009. The meeting will be held in the Environmental Education Science and Technology (EESAT) building, which houses the UNT Institute of Applied Sciences, the Department of Geography, the Sky Theater, and other programs focused on the environment. Additional information on the meeting location can be found at http://www.cep.unt.edu/eesat.html.

The meeting agenda includes a workshop entitled "GIS Applications: Wetland Hydrology" or a field trip to two constructed wetlands south of Dallas (Oct. 22). The scientific agenda will focus principally on constructed and natural wetlands in urban landscapes, and will begin with a plenary session on Friday morning (Oct. 23) and transition to a general contributed session in the afternoon. A social is scheduled for Friday night at the Lewisville Aquatic Research Facility (Oct. 23), and the meeting will culminate with student talks on Saturday morning (Oct. 24). The meeting will adjourn by noon on Saturday. A preliminary agenda is provided below.

Attending the Meeting

- Registration is open on-line at www.sws.org/regional/southcentral/, and includes specific details about the meeting. You may also register upon arrival inside the main entrance of the EESAT building at UNT.
- Parking passes will be available to pick up at the registration desk inside the main entrance of the EESAT building. Permits are to park in D, Visitor and G parking lots. You can reference the campus map at www.unt.edu/transit/pdf/parkingmap.pdf for locations of lots. On this map, the meeting location is next to lot D (#11) and is labeled "EESAT Building". Additional information regarding directions is available on the chapter website.

Meeting Agenda

Thursday, October 22

9:00 AM – 3:30 PM GIS Applications: Wetland Hydrology (**Nick Enwright**, UNT; **room 340**)

-The objective of this workshop is to accomplish GIS-related tasks, using ArcGIS 9.3 (Environmental Systems Research Institute, Redlands, California), essential to understanding aspects of wetland hydrology. This workshop will include hands on experience with topics such as: (1) introduction to high resolution elevation datasets (LiDAR, Aerial Survey/Photogrammetry), (2) creation of digital elevation models (DEM), (3) delineating catchments for wetlands, (4) estimating volume of wetlands, and (5) understanding the relationship between wetland depth/volume/inundated area. This highly technical workshop will be suited for individuals with varying levels of GIS experience, yet is better suited for individuals with a more intermediate level of GIS experience.

9:00 AM – 5:00 PM	Constructed Wetlands of central Texas (**Mike Smart**, Lewisville Aquatic Ecosystem Research Facility, **Loretta Mokry**, Alan Plummer Associates)

- The field trip includes tours of two constructed wetlands near Dallas, TX. Meet inside the main entrance of the Environmental Education Science and Technology Building at UNT for departure. Lunch is included; transportation provided.

Friday, October 23 (room 120)

8:00 – 9:00 AM	Registration and Coffee
8:45 – 9:00 AM	Welcome and Overview of Meeting Agenda – **Julia Cherry, Kevin Stevens**
Keynote Agenda	
9:00 – 9:30 AM	*Water Resource Issues in Texas* – **Tom LaPoint**, Institute of Applied Science, UNT
9:30 – 10:00 AM	*Overview of Texas Wetlands* – **Jeff Raasch**, State Wetland and Joint Venture Program, Texas Parks and Wildlife Department
10:00 – 10:15 AM	BREAK
10:15 – 10:45 AM	*Reservoir Restoration and Invasive Species* – **Mike Smart**, Lewisville Aquatic Ecosystem Research Facility
10:45 – 11:15 AM	*Constructed Wetlands for Water Polishing* – **Loretta Mokry**, Alan Plummer Associates, Inc.
11:15 – 11:45 AM	*Created Reservoirs and Nutrient Dynamics along the Bosque River* – **Robert Doyle**, Baylor University
11:45 AM – 1:00 PM	Lunch on own
Contributed Session (abstracts, p 4-9)	
1:00 – 1:20 PM	*Coastal wetland and barrier island restoration in Louisiana: overview of the EPA Restoration Approach and Projects* – **Kenneth Teague**, EPA
1:20 – 1:40 PM	*Using a constructed wetland to enhance environmental education in local schools in Louisiana* – **Eddie Millhollon**, Louisiana State University
1:40 – 2:00 PM	*What can we do in agriculture to improve nutrient management and improve aquatic ecosystem health?* – **Robbie Kröger**, Mississippi State University
2:00 – 2:20 PM	BREAK
2:20 – 2:40 PM	*Community structure of wetland birds during spring migration through the Rainwater Basin* – **Lisa Webb**, Arkansas Tech University
2:40 – 3:00 PM	*Hurricanes and fire in coastal marshes: management implications* – **Julia Cherry**, University of Alabama
3:00 – 3:20 PM	*The new mitigation rule: understanding and working with the new regulations after the first year* – **Matt Stahman**, SWCA Environmental Consultants
3:20 – 3:40 PM	*The loss and restoration of black mangroves in the Bird's Foot Delta of the Mississippi River* – **Andy Nyman**, Louisiana State University
Chapter Business Meeting	4:00 – 5:00 PM
Social 5:30 – 8:30 PM	Lewisville Aquatic Ecosystem Research Facility (transportation provided; cash bar)

Saturday, October 24 (room 120)

8:30 – 8:40 AM Welcome

Student Presentations (abstracts, p 4-9)

8:40 – 9:00 AM	*Changes in understory vegetation of long term monitoring plots at the University of Mississippi Field Station* – **Rani Menon**, University of Mississippi
9:00 – 9:20 AM	*Evaluation of management strategies on moist-soil seed availability in the Mississippi Alluvial Valley* – **Victoria Olmstead**, Arkansas Tech University
9:20 – 9:40 AM	*Nutrient reserve dynamics of waterfowl migrating through the Rainwater Basin of Nebraska* – **Paul Tidwell**, Arkansas Tech University
9:40 – 10:00 AM	*Continued improvement of agricultural runoff in Northwest Louisiana using a constructed wetland* – **Darinda Dans**, Louisiana State University
10:00 – 10:20 AM	BREAK
10:20 – 10:40 AM	*Food preference of wintering waterfowl on wetland reserve program sites in Arkansas* – **Micah Tindall**, Arkansas Tech University
10:40 – 11:00 AM	*The role of hurricane and fire disturbance on plant productivity and accretion in a saltwater marsh in Grand Bay National Estuarine Research Reserve, MS* – **Anna Braswell**, University of Alabama
11:00 – 11:20 AM	*Flooding stress in Louisiana's coastal marshes: consequences and indicators* – **Vanessa Tobias**, Louisiana State University
11:20 – 11:40 AM	*Using Geographic Information Systems to quantify the functionality of coastal prairie freshwater wetlands in Galveston Bay, Texas* – **Nicholas Enwright**, University of North Texas
11:55 AM – 12:15 PM	Presentation of Awards and Adjournment

Contact Information

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Abstracts for the Contributed Session and Student Presentations (in alphabetical order):

Braswell, A.[1], Cherry, J.A.[1], May, C.[2]; University of Alabama[1], The Nature Conservancy[2]

The role of hurricane and fire disturbance on plant productivity and accretion in a saltwater marsh in Grand Bay National Estuarine Research Reserve, MS

Coastal ecosystems are subject to disturbance from both land and sea and, in particular, fire and hurricanes. Although coastal wetlands have adapted to these disturbances, climate change is predicted to increase frequency and intensity of wildfires and hurricanes along the Gulf Coast. Thus, it is important to understand how these ecosystems react to large-scale disturbances. We initiated a study to examine the effects of prescribed burning on a *Juncus romerianus* dominated marsh. In July 2008, we established three plots along each of six transects, spanning low, mid and high marsh (n=18 plots), after which bimonthly measurements of accretion, plant biomass and porewater chemistry were collected. In fall 2008, all study plots were affected by Hurricanes Gustav and Ike, which deposited 15.4 ± 2.4 mm of sediment in the low marsh; in January 2009, half of the transects were burned. Accretion was largely influenced by initial input of hurricane sediment. This pulse has been sustained through the subsequent 11 months of sampling, with most of the variance over time contributed by the storms and not the fire. Low marsh gained and retained more sediment from the hurricane than high or mid marsh. Following the fire, above-ground biomass was significantly lower, and has slowly recovered since the burn, with low marsh recovering faster than mid or high marsh. These results suggest that the effects of disturbance varied spatially within the marsh, and could reflect spatial variation in physical (tides, erosion) or biological (plant production, decomposition) processes. Further sampling should elucidate the extent of disturbance effects within different parts of the marsh and the potential interactive effects of fire and hurricanes on ecosystem processes. As sea levels rise from effects of global climate change, understanding the role of disturbance in maintaining key ecosystem processes will be imperative for sustainability of coastal areas.

Cherry, J.A.; University of Alabama

Hurricanes and fire in coastal marshes: management implications

Low-lying coastal wetlands are particularly vulnerable to climate change, especially sea-level rise and changes in tropical storm frequency and intensity. To persist in the long-term, coastal wetlands must adjust vertically by maintaining surface elevations relative to sea-level or migrate inland. Maintenance of surface elevations depends on rates of accretion (both mineral and biogenic) outpacing eustatic sea-level rise and local subsidence. With rates of sea-level rise predicted to increase over the next 100 years, some marshes may not be able to adjust fast enough, leaving inland migration as the primary means of accommodating rising seas. In many areas, however, inland migration may be limited by biological or physical barriers to dispersal. Here, I examine the role of fires and hurricanes for coastal wetland persistence and their potential management implications.

Dans, D., Millhollon, E.P.; Louisiana State University

Continued improvement of agricultural runoff in Northwest Louisiana using a constructed wetland

The Flat River, a tributary of the Red River in Northwest Louisiana, has been designated as impaired by the state's Department of Environmental Quality, with the primary suspected cause of the impairment identified as agricultural runoff. In 2004, a constructed wetland designed to detain runoff from 400 acres of agricultural land for water quality improvement prior to egress into the Flat River became operational at the Louisiana State University AgCenter's Red River Research Station in Bossier City, LA. To determine the improvement of runoff water quality, water samples are collected using automatic samplers at four locations along the wetland system. Additionally, during periods of no rainfall, samples are taken at three locations within each shallow and deep wetland. Data will be presented to show the effectiveness of the system over the last year in reducing total nitrogen 56%, total phosphorous 55%, phosphate 47% and suspended solids 31% and increasing dissolved oxygen 6%. This wetland system continues to function properly five years after it was first implemented, thus showing an effective way to improve the water quality of agricultural runoff.

Enwright, N.; University of North Texas

Using Geographic Information Systems to quantify the functionality of coastal prairie freshwater wetlands in Galveston Bay, Texas

Galveston Bay is a vital natural resource to the state of Texas. About one third of all the annual commercial fishing incomes in Texas come from Galveston Bay. Coastal prairie freshwater wetlands (CPFW) in the lower Galveston Bay

watershed are capable of providing important functions to enhance/maintain the overall water quality integrity of the bay, such as intercepting and filtering surface pollutants. In the decision of *Solid Waste Agency of Northern Cook County v. U.S. Corps of Engineers* 531 U.S. 159 (2001) the U.S. Supreme Court overturned the Migratory Bird Rule used by the U.S. Corps of Engineers to extend federal protection to isolated wetlands based on migratory bird use. As a result the U.S. Corps of Engineers, Galveston District removed protection from isolated wetlands outside of the 100-year floodplain. More recently, however, in *Rapanos v. United States* 547 U.S. 715 (2006) the U.S. Supreme Court could not reach a majority decision concerning the filling of several wetlands in Michigan. As part of the decision, Justice Kennedy introduced a "significant nexus" test. Explaining the test in the decision, Justice Kennedy wrote that wetlands have a significant nexus and would be considered jurisdictional waters if they "significantly affect the chemical, physical, and biological integrity of waters more readily understood as 'navigable.'" The objective of this study is to deploy a conceptual framework, developed by Dr. Margaret Forbes of Baylor University, using GIS to assess the functionality of wetlands in the Galveston Bay area. The model will assess the capacity of wetlands to store surface water and remove pollutants, including nitrogen, phosphorus, heavy metals, and organic compounds. Understanding the geography of wetlands and the functions they are capable of providing in the Galveston Bay area may prove insightful for local officials and regulatory agencies concerning the "significant nexus" of CPFW's.

Kröger, R.; Mississippi State University

What can we do in agriculture to improve nutrient management and improve aquatic ecosystem health?

Nutrients have been identified as one of the dominant sources of impairments of aquatic systems. Agriculture has been the starting place of finger pointing, with the spotlight now highlighting the dire the effects of nutrient pollution on local ecosystems (fish kills, unpleasant recreational activities) as well as at broad regional scales such as the Gulf of Mexico hypoxia. Agriculture is not the big bad wolf anymore, with farmers becoming advocates of environmental stewardship and eagerly implementing management practices to improve agricultural production but at the same time provide significant environmental benefits. In terms of nutrient management landowners and stakeholders have three main avenues whereby they impact nutrient reductions: input, edge of field and primary aquatic ecosystem management. Input management includes split fertilizer applications, variable rate timing of fertilizer applications as well as precision agriculture. Edge of field management involves including drop-pipes and flashboard risers to mitigate surface runoff, improve sedimentation and reduce erosion. This can be coupled with buffer strips of varying widths to further improve nutrient reductions, sedimentation while at the same time providing a wildlife habitat. Primary aquatic ecosystem management is the least utilized management practice but as the greatest potential for nutrient reductions. The utilization of tailwater recovery wetlands, implementation of weirs in drainage ditches to improve hydraulic residence and increase biogeochemical and microbial processes, and maintaining diverse wetland hydrophyte assemblages all result in improved nutrient reductions, pesticide adsorptions and sedimentation. Interested stakeholders and state and federal agencies should begin to holistic develop management plans for agricultural areas that encompass all three manage areas rather than focusing on one specific technique to achieve the desired nutrient management.

Menon, R., Holland, M.; University of Mississippi

Changes in understory vegetation of long term monitoring plots at the University of Mississippi Field Station

Long term monitoring is important to study the changes in ecosystems due to natural and anthropogenic disturbances. The University of Mississippi Field Station spreads over 740 acres with pine and mixed hardwood forest, bottomland forest, open fields, wetlands (including eight constructed wetlands), ponds and springs. After a pine bark beetle infestation in 1995, 20 sites were established in 1996 for understory monitoring to study the changes in vegetation. Sites were randomly chosen from a GIS map and marked as long term monitoring plots (LTMP) and include two wetland sites (P 16 and Q 10). Overstory and understory vegetation is sampled on a biannual basis. Vegetation was assessed using 1m x 1m quadrats to record the number of species, total foliar cover and total open space. Results from comparison of data from previous years for understory vegetation indicate that there is a general decrease in total percent foliar cover and increase in total percent open space. In 2008, the total number of species decreased for eleven plots (including the wetland plot Q 10) and increased for eight plots (including the wetland plot P 16). In P 16, *Lonicera japonica* was the dominant species by foliar cover in 1996 but in 2008, species like *Digitaria sanguinalis* and *Boehmeria cylindrica* became dominant. In Q 10, *Eleocharis obtusa* continues to be the dominant species from 1996 to 2008.

Millhollon, E.P., Gossett, D.R., Dans, D.R., Meekins, S., Williams, S., Kilbourn, A.; Louisiana State University

Using a constructed wetland to enhance environmental education in local schools in Louisiana

A welcome trend in Louisiana schools is an increasing focus on educational activities that increase knowledge and awareness of the importance of protecting our environment, particularly the quality of fresh water sources within local watersheds. This is especially significant in Louisiana where an extensive system of wetlands, bayous, rivers, and lakes for outdoor recreation has given the state its slogan of "Sportsman's Paradise". Unfortunately, the past century saw many of Louisiana's wetlands drained for agricultural or urban use. This trend has changed since the 1990s and existing wetlands are being protected or restored. The importance of protecting and restoring the state's wetlands, particularly coastal wetlands, was made alarmingly clear following the devastation in Louisiana that resulted from Hurricanes Katrina and Rita. Many schools statewide have incorporated instruction on the importance of wetlands into their curricula. In Northwest Louisiana, a constructed wetland system located on Louisiana State University Agricultural Center's Red River Research Station has been shown to significantly improve water quality of runoff from agricultural land and has tremendous potential as an environmental classroom to supplement school curricula and provide students "hands on" experience in studying the importance of wetlands in protecting their local watersheds. Examples of ways the wetland system supplements local school curricula will be presented.

Nyman, J.A., Huber, M.F.; Louisiana State University

The loss and restoration of black mangroves in the Bird's Foot Delta of the Mississippi River

The end of the Mississippi River contains >46,000 ha of wetlands and is known as the Bird's Foot Delta because of its shape. Although it protrudes ~65 km into the Gulf of Mexico, freshwater vegetation prevails because of massive freshwater inflows from the Mississippi River. Saline waters intrude only during tropical storms and continental drought. The most salt-tolerant and flood tolerant plant native to Louisiana, black mangrove (*Avicennia germinans*), does not grow in the Bird's Foot Delta. In 1936, black mangrove was common but by 1967 it was absent. The loss of black mangrove occurred when navigation and flood control most confined the river within levees, which probably increased freshwater inflow to the Bird's Foot Delta. In recent decades however, salinity has increased probably because of (a) wetland restoration projects constructed upstream to restore river flow to marshes there, (b) reduced river inflow caused by disposal of sediments that were dredged from the navigation channel, and (c) more frequent tropical storm surges. The Bird's Foot Delta may be lost within several decades because tropical storm intensity is expected to increase further and because river inflow is expected to decrease further. Bird's Foot Delta wetlands cannot persist indefinitely but their longevity can be promoted. A lack of salt tolerant plant species is one factor limiting longevity of Bird's Foot Delta wetlands. The purpose of this project was to reestablish in the Bird's Foot Delta populations of black mangrove that can serve as sources of seed and vegetative spread. In April, 2009, we planted 400 black mangrove seedlings, of which 60% survived through July, 2009. In 2010, we will plant seedlings from a different source within Louisiana to increase genetic diversity.

Olmstead, V.G., Webb, E.B.; Arkansas Tech University

Evaluation of management strategies on moist-soil seed availability in the Mississippi Alluvial Valley

Although wetland habitat in the Mississippi Alluvial Valley (MAV) has been drastically reduced, it remains a vital wintering area for waterfowl. Wetland Reserve Program (WRP) lands seek to offset wetland habitat losses by providing increased waterfowl food items, particularly moist-soil seeds. Wetland management strategies include burning, disking, and tilling and can have an effect on seed production and successional patterns of the plant community. To better understand WRP contributions for wintering waterfowl habitat, it is important to evaluate the effect of management strategies on seed production and availability to waterfowl. The objective of this study was to determine the effect of management strategy on seed mass on WRP sites in Arkansas and Mississippi and compare them to Wildlife Management Areas (WMAs) in Arkansas. We examined moist-soil sites with active management and drawdown before 1 June and passive management with no little or no water manipulation. We collected 10 core samples (10cm depth, 785.4cm^3) along a transect within each wetland during fall 2008. We sorted 180 samples from 18 WRP sites in Mississippi and collected 120 WRP and 40 WMA core samples in Arkansas. We used a single factor ANOVA to compare seed mass (g) between management types and states. Management type and state had no effect on seed mass (both $F<2.00$, both $P> 0.16$). We also tested for differences in moist-soil seed distribution at various soil depths using a single factor ANOVA. Seed availability was greater at the 0-2.5cm depth than at the bottom 2.5-5cm or 5-10cm depths ($F= 34.46$, $P<0.01$). However, management type did not affect the availability of seeds ($F=0.02$, $P=0.90$). Further research is needed to verify the effect of wetland management strategies on seed mass, as well as examine effects on plant community composition, species richness and presence of exotics.

Stahman, M.; SWCA Environmental Consultants

The new mitigation rule: understanding and working with the new regulations after the first year

In April 2008, the U.S. Army Corps of Engineers (USACE) and Environmental Protection Agency (EPA) issued a new wetland mitigation rule aimed at establishing equivalent standards for all types of mitigation under the Clean Water Act Section 404 regulatory program. The "new rule" can be found in the Federal Register, Vol. 73, No. 70, pages 19594 to 19669 (2008). A copy of the new rule is available for download at http://www.usace.army.mil/cw/cecwo/reg/citizen.htm. The purpose of this presentation is to discuss critical highlights of the new mitigation rule. Specifically, we will focus on major differences between former wetland mitigation guidance and the current rule. These include an overview of the goals of the new mitigation rule, key mitigation terms, new USACE permittee requirements, the 12 fundamental components of mitigation documents, mitigation banking establishment timelines, importance of functional assessments, and the emphasis on watershed-based planning. We will also provide examples of implementation of the new rule for USACE permittees and wetland mitigation bankers in the southeast. This presentation is targeted to those interested in how the new rule is being implemented and how it has changed, for the better, the face of wetland mitigation.

Teague, K.G.[1], Landers, T.[1], Taylor, P.[1], McDonald, S.[1], McQuiddy, D.[1], Hill, T.[1], Ethridge, B.J.[1], Peckham, J.[1], Mintz, P.[2], Magee, M.[1], Llewellyn, C.[3], Rojo, M.[1], Kaspar, P.[1]; EPA Region 6, Dallas, TX[1], Retired, EPA Region 6[2], ORISE Intern, EPA Region 6[3]

Coastal wetland and barrier island restoration in Louisiana: overview of the EPA Restoration Approach and Projects

The State of Louisiana has lost, and continues to lose, more coastal wetlands than any other coastal state in the U.S. Landloss rates estimated by USGS range from a high of 39.4 mi^2yr^{-1} for the period 1956-78, to a low of 10.3 mi^2yr^{-1} for 1990-2000. Causes of Louisiana coastal wetland loss include elimination of Mississippi River connectivity with its delta, resulting in near-elimination of deltaic function and survival. Other causes include channelization for navigation and oil/gas exploration and production (canals), and oil/gas production-induced subsidence and faulting. Wetland impoundment and water-control strategies, or "marsh management" may also play a role in wetland loss. "Diking" and draining for urban land use has historically been a cause of wetland loss, and continues today, although these losses are supposedly mitigated. Finally, wetland drainage for agriculture was historically a significant cause of wetland loss. In1990, Congress passed the Breaux Act, or the Coastal Wetlands Planning, Protection and Restoration Act, creating a program of coastal wetland restoration consisting of Federal agencies and the State of Louisiana, "chaired" by the U.S. Army Corps of Engineers. EPA participates in the CWPPRA program, and we sponsor coastal wetland and barrier island restoration projects with the Louisiana Office of Coastal Protection and Restoration. Over the past 10 years or so, EPA has evolved a restoration approach based on the following:

- Reintroduction of Mississippi River water
- Barrier island restoration
- Beneficial Use of dredged material
- Marsh creation using dredged material from the Mississippi River.

We will present an overview of restoration projects that either have been, or are currently being constructed, in engineering and design, or are currently being proposed. We will briefly introduce some science issues associated with these projects.

Tidwell, P.[1], Webb, E.[1], Vrtiska, M.[2], Bishop, A.[3]; Arkansas Tech University[1], Nebraska Game and Parks Commission[2], U. S. Fish and Wildlife Service[3]

Nutrient reserve dynamics of waterfowl migrating through the Rainwater Basin of Nebraska

The Rainwater Basin (RWB) of Nebraska is one of the most threatened and least studied wetland complexes in North America. Conversion of wetlands to agricultural fields has led to the destruction of over 90% of the original wetland area. The approximate 400 remaining wetlands provide essential stopover and staging habitat to many migratory wetland birds in the Central Flyway, including 5-7 million waterfowl, 30 shorebird species and the endangered whooping crane. Limiting conditions at stopover sites may increase competition for food resources and can result in a slower nutrient acquisition rate, ultimately causing individuals to stay longer to meet nutritional demands required to complete migration. Previous research in the RWB found wetland density and area within 10 km of study wetlands to be the best predictor of waterfowl abundance. However, it is uncertain what benefits waterfowl derive from these habitats. Therefore, the goal of this study is to determine effects of wetland density and area on body condition and rate of mass

gain by waterfowl using RWB wetlands. For springs 2007-2009, we collected 86 female mallards (*Anas plathyrhynchous*) from wetlands of varying area and density. We used regression analyses to identify density and area effects on estimated fat and found no relationship ($R^2 = 0.02$; $P = 0.20$ and $R^2 = 0.04$; $P = 0.06$, respectively). A one-way analysis of variance indicated fat estimates increased each week of migration ($F = 6.80$; $P < 0.01$). We compared estimated to actual fat for birds collected in 2007 and found estimates were weak predictors of actual fat ($R^2 = 0.58$, $P < 0.01$). Therefore, results may change with the analysis of actual fat for 2008 and 2009 seasons. Further analysis will examine the effect of wetland area and density on waterfowl food selection and rate of mass gain during migration.

Tindall, M., E.Webb; Arkansas Tech University

Food preference of wintering waterfowl on wetland reserve program sites in Arkansas

The Mississippi Alluvial Valley (MAV) contains some of the most important migratory and wintering habitat for waterfowl in North America. Most waterfowl scientists and wetland managers assume foraging habitat is the limiting factor for waterfowl in winter. An ongoing study at Arkansas Tech is examining waterfowl forage availability on private wetlands within the MAV, however very little is know about what food type waterfowl prefer on private wetlands. The objective of this study is to evaluate waterfowl food selection on Wetland Reserve Program (WRP) sites in the MAV of Arkansas and determine if birds are selecting food in proportion to availability. We asked for donations of hunter killed dabbling ducks sampled during the legal hunting season from WRP wetlands in 3 counties within the MAV of Arkansas. To determine availability, we collected 5 benthic core samples and 5 water columns samples at each wetland. In the laboratory, esophagi were removed from the birds, contents were washed and sorted. All samples were identified to family and weighed. To determine food preference, enumerated esophageal contents were compared to the total abundance of that prey species for each respective wetland. Mean aggregate mass of esophagus contents was 93% vegetation and 4 % invertebrates. However, mean aggregate availability (by mass) was 20% vegetation and 80% invertebrates. Mean diet of adult birds was 90% vegetation and 6% invertebrates, whereas mean diet of juvenile birds was 97% vegetation and 3% invertebrates. These results indicate that waterfowl on WRP sites in Arkansas prefer vegetation, specifically *Polygnum sp.* seeds, compared to invertebrates as food items during winter. By evaluating diet preference for a variety of species, we will be better able to provide recommendations for managing wintering waterfowl habitat on privately owned wetlands.

Tobias, V.D.[1], Nyman, J.A.[1], DeLaune, R.D.[1], Foret, J.D.[2];
Louisiana State University[1], NOAA National Marine Fisheries Service Estuarine Habitats and Coastal Fisheries Center[2]

Flooding stress in Louisiana's coastal marshes: consequences and indicators

Spartina patens is a critical species for coastal marshes throughout the Atlantic and Gulf Coasts of North America because it stabilizes marsh soil and provides habitat for other species. As the most common species in coastal Louisiana, managing conditions to maintain productivity of this grass is essential to slowing marsh loss. To improve restoration practices managers need a tool to quantify how variations in flooding affect plants in coastal wetlands. To examine the effects of flooding stress in *Spartina patens*, we modified a recently developed field-based technique. This technique employs devices, termed "marsh organs," that create six levels of flooding stress ranging from 46 cm above to 30 cm below local marsh elevation and subjects plants to natural variations in water level. We installed marsh organs at two refuges (total = 4 marsh organs, 144 pots): one refuge near river inflows and one refuge far from riverine influences. At each refuge, we installed one marsh organ in a relatively saline location, and one in a relatively fresh location. A previous study found that flooding stimulates above-ground growth in *S. alterniflora* on the Atlantic coast, and thereby contributed to marsh stability. We found that flooding reduced above- and below-ground production in *S. patens* on the Gulf of Mexico coast. However, there was a trade-off between increased plant production and loss of soil elevation in the least flooded pots. Preliminary results from an inexpensive and widely-available elemental analysis suggest that elemental concentrations in leaf tissue may be used as an indicator for flooding stress in *S. patens*.

Webb, E.B.[1], Smith, L.M[2], Vrtiska, M.P.[3], Lagrange, T.G.[3]; Arkansas Tech University[1], Oklahoma State University[2], Nebraska Game and Parks Commission[3]

Community structure of wetland birds during spring migration through the Rainwater Basin

Staging areas and migratory stopovers of wetland birds have the potential to function as geographic bottlenecks; entire populations within a flyway may be affected by the quality and quantity of available wetland habitat at stopover sites. Although approximately 90% of playa wetlands in the Rainwater Basin (RWB) region of south-central Nebraska have been destroyed, the area still provides essential stopover habitat for over 10 million waterfowl each spring. We evaluated

community patterns and species associations to assess importance of assembly rules in structuring wetland bird communities during migration and better facilitate multi-species conservation and management strategies. We surveyed 36-40 playas twice weekly in the RWB and observed approximately 1.6 million individual migratory wetland birds representing 72 species during 3 spring migrations 2002-2004. Spatial and temporal species co-occurrence patterns of geese, dabbling ducks, diving ducks, and shorebirds were evaluated using null model analysis. Goose species co-occurrerence scores did not differ from random in all years of the study, suggesting that goose species frequently use the same habitats during migration. Co-occurrence patterns among dabbling ducks were not different than expected by chance in all years; however, when evaluated at a weekly scale, dabbling ducks co-occurred less often than expected during weeks of peak migration (high abundance), indicating that dabbling duck species spatially segregated at high densities. Diving ducks co-occurrence patterns did not differ from random in any year, suggesting that diving duck species used the same habitat during migration. Shorebird species co-occurred less often than expected in all years, implying that shorebirds were spatially segregated during migration, regardless of wetland availability. The majority of association values among lesser snow geese (*Chen caerulescens*) and dabbling duck species were positive, indicating that dabbling ducks did not avoid wetlands with snow geese, a concern for waterfowl managers. However, we frequently observed snow geese and dabbling ducks using different microhabitats within a wetland, which indicate species associations and co-occurrence patterns may have occurred at a finer spatial scale than measured in this study. This approach of co-occurrence analysis will allow agencies charged with multi-species management to make informed conservation decisions based on community structure rather than historic single-species approaches.