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Making Restoration Work in Texas
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Poster Abstracts

Reemts, C.
The Nature Conservancy

Can prairie restoration make your drinking water cleaner?

The large cities of north/east Texas (Dallas, Fort Worth, and Houston) use mainly surface water sources for drinking water. Current reservoirs are threatened by siltation, caused in part by erosion from abandoned cottonfields and poorly managed pasture. We are investigating the potential of prairie restoration to address soil erosion from degraded sites. Since 2014, we have monitored rainfall and runoff from three small watersheds (1-3 acres) on unplowed tallgrass prairie, restored prairie (~20 years after restoration), and former cropland. The unplowed and restored prairies are dominated by native perennial grasses and forbs, and are managed with prescribed fire and occasional grazing. The third site is used as a pasture and is dominated (90% cover) by a non-native perennial grass. Initial runoff results suggested that, when soils are saturated, tallgrass prairie produces the most runoff and the degraded site produces the least. We hypothesize that the clayey soil in the degraded site dries out faster and produces large cracks. More recent sedimentation sampling shows that all sites lose very little soil, even during heavy rain events; tallgrass prairie may lose the least soil. Preliminary soil moisture results also suggest differences among the sites in infiltration. If we can show that restoring degraded sites reduces erosion, grassland restoration can be promoted across the region to improve water quality.

Ramos, M.
Foy H. Moody High School

Oyster Reef Restoration: A Living Shoreline Approach For Sustainable Shorelines

Shorelines along the coast are among the most degraded and threatened habitats due to their sensitivity to erosion, sea level rise, storms, and increased human utilization. The living shoreline approach is one that integrates natural infrastructure to stabilize estuarine or ocean coastlines. The eastern oyster (Crassostrea virginica) is an ecosystem engineer that creates complex three-dimensional structure that serves as a natural buffer to reduce wave energies. The presence of oyster reef also improves water clarity by reducing turbidity, allowing for increased light attenuation which can benefit seagrasses or submerged aquatic vegetation (SAV). In July of 2017, approximately 600 linear meters of oyster reef were restored using recycled oyster shells in St. Charles Bay, TX. Ecological monitoring has been conducted before and after restoration to quantify the effects of restoration efforts on shoreline flora and erosion. All samples, measurements, and hydrological variables are collected quarterly. Our hypothesis is that the restored oyster reef will protect the adjacent shoreline and facilitate the seaward growth of marsh vegetation over time. Preliminary assessments of the flora samples indicate increasing trends in above-ground biomass when comparing sites pre- and post-restoration. There is variability in seaward growth of vegetation dependent on site locations, and the dominant species are a mixture of shrub-like perennials and salt grasses. Results will help us better understand the ecological influence of restored oyster reefs on shoreline dynamics.

Fierro-Cabo, A.
University of Texas - Rio Grande Valley

Successful dune restoration using foundation species: case study of South Padre Island, Texas

One approach to enhance coastal resilience is through dune restoration. A continuing effort to restore beach dunes was initiated by the City of South Padre Island, TX in 2010 consisting primarily of plantings of two native foundation dune species, Sea Oats (Uniola paniculata) and Bitter Panicum (Panicum amarum), with annual planting events thereafter. It was assumed that the original dune ecosystem would recover and resemble that of undisturbed dunes. We evaluated selected metrics of ecosystem structure and function in restoration plots ranging in age from 2 to 5 years, and compared them to reference sites. Plant and animal communities were examined using a combination of quadrat sampling, funnel traps, pit-falls and sweep nets. Soil organic content and soil electric conductivity were also measured. Dune volumes and heights were calculated using a 2013 Lidar DEM. Plant communities were similar across 2 and 4 year old plots but differed markedly among 2 and 5 year plots and among all restoration plots and undisturbed reference sites. Animal communities followed a similar trend in which all restoration plots differed from the reference sites with the exception of 5 year old plots which were similar. Soil organic matter content in restored dunes remained about three times lower compared to reference sites. A significant correlation between plot age and dune height exists. These results suggest that native dune plant restorations as implemented by the City of South Padre Island from 2010-2015 are successful in initiating plant and animal community succession and potentially increasing coastal resiliency.

Narvaez, M.
Texas A&M - San Antonio

Microbial analysis in plant-soil interaction between Sideoats grama and Bermuda grass

Native plants are plants that have populated a region over time. However, these native species have been decreasing in habitat establishment and biodiversity due to invasive plant species. The goal is to understand how microbial populations can affect native plant soils where invasive plant soils occur. The first prediction states that soils from an area with native plants will have a more diverse microbial population compared to soils from an area where invasive species occur. The second prediction states that plants microbes from the natural soil will increase in biomass production compared to plants exposed to soil microbes where invasive plants occur. The results show that Sideoats has a more diverse microbial population than Bermuda. The results from the plant data shows that Sideoats and Bermuda did grow better in biomass under their own natural soils. Also, Bermuda showed poor growth under Sideoats soil. Interestingly, Sideoats grew better under Bermuda soil compared under to Sideoats when it's under its own soil. However, Sideoats native habitat is widely distributed in various regions. Plants that have a wide distribution like that tend to be compatible with a broad range of microbes. This experiment suggests that Sideoats is a good candidate for reestablishing the native population where Bermuda grass dominates.

Locke, H.
University of Houston

The influence of belowground biotic symbionts and aboveground herbivory on plant regrowth rates, recovery, and reproductive fitness

Seedling establishment is a crucial stage in prairie restoration, yet seedlings may be disproportionately affected by herbivory due to limited belowground resources. Promoting tolerance to herbivory may be a novel way to securing seedling establishment. Tolerance is a plant's ability to regrow tissue lost due to herbivory. Current research suggests that some plant species may demonstrate higher growth rates or reproductive capacity with herbivory than without herbivory. Little is known, however, about the role of belowground microbial symbionts. Common soil symbionts, such arbuscular mycorrhizal (AM) fungi, may promote plant tolerance to herbivory through enhanced regrowth rates and reproductive fitness. In order to test this hypothesis, I manipulated the soil environment (Sterile, Single AMF Species, Multiple AMF Species) and aboveground herbivory (No Herbivores, Herbivores Included, and Manual Clipping) of Solidago altissima, a common prairie forb, in a full factorial experiment in Summer 2018. We conducted this experiment at UH Coastal Center utilizing Paroxya atlantica as our herbivore. To quantify tolerance, we tracked plant compensatory regrowth rates and have begun assessing reproductive fitness. Preliminary results suggest the S. altissima plants recover slower from natural herbivory than from manual clipping, indicating that S. altissima may be more tolerant of manual clipping than natural herbivory ($p=0.0004$). Thus far, preliminary analysis has yielded no significant effects of soil microbial treatment on plant regrowth capacity ($p=0.22$). Given that tolerance metrics in perennial plants such as S. altissima may manifest themselves in subsequent growing seasons, I will continue to track possible tolerance metrics through a second season.

Woodard, R.
St. Edward's University

Fitness response of Asclepias asperula, antelope horns milkweed, with the inoculation of arbuscular mycorrhizal fungi

Asclepias asperula is a species of milkweed that has been difficult to propagate and grow at prairie restoration sites throughout central Texas. These sites are typically disturbed and may lack a viable population of mycorrhizal fungi, resulting in decreased productivity of natives. The stress from transplantation may also contribute to declines in productivity or eventually lead to the plant's death. Arbuscular mycorrhizal fungi (AMF) living within the rhizosphere promote growth that decreases the severity of stress from transplantation. This study is seeking to test the hypothesis that A. asperula establishment success and productivity will be increased with the addition of AMF in prairie restoration sites. To test this hypothesis, I planted milkweed plugs with and without AMF inoculation in a prairie site outside of Austin, TX, and am measuring above ground biomass, plant height, vigor, and insect presence to compare establishment success. Preliminary results will be presented.

Brom, A.
St. Edward's University

Response of insect diversity to prairie restoration at Commons Ford Metropark in Austin, TX

Native Texas prairies once harbored a vast diversity of plant and animal species, but have experienced severe declines due to urbanization, development, and agriculture. Remnant patches near Austin, TX, are now largely dominated by invasive grasses and mesquite. In 2011, a 40-acre restoration project was initiated to control invasive grasses and reintroduce native prairie plants. Vegetation surveys conducted before and after treatments showed great success in terms of plant response. We wanted to measure response of arthropods and bees to see whether and to what degree their diversity and abundance increased with restoration treatments. Since no pre-treatment data existed, we chose a reference site in the same park, dominated by invasive KR bluestem, prickly pear cactus, and mesquite, to compare with the restored site. We set out bee bowls and arthropod pitfall traps at 5 sites in each meadow and sampled weekly in the fall of 2018. Vegetation data, sampled along transects in the spring of 2018, indicated that native pollinator-friendly plants were almost three times more abundant and about 50% more diverse in the restored meadow. We expect to find that insect and bee diversity are higher in the restored meadow in response to increased floral resources. Our preliminary results will be presented.

Brooks, J.
St. Edward's University

Changes in plant and animal diversity and movement in response to shaded fuel break fire mitigation

Residents living in the Wildland-Urban Interface (WUI) deal with an increased risk of wildfire, as fuel loads are often high due to fire suppression. Land managers have employed a number of mitigation tactics aimed at minimizing the risk of fire spreading from residential neighborhoods into preserved wilderness and vice-versa. Shaded fuel breaks are used to reduce the understory fuel load and raise the base height of the canopy to prevent ground fires from leaping up into the canopy. Although this technique is commonly employed, little is known about its non-target effects. We took advantage of an existing fire mitigation treatment along the border of Wild Basin Wilderness Preserve in Austin, TX, to measure the impacts on plant and mammal diversity and abundance using a before-after-control-impact design. To measure changes in mammal movements, abundance, and diversity we set up 8 game cameras (4 in control, 4 in mitigated areas), all of which are along the fenced border of Wild Basin. We surveyed overstory vegetation (DBH, species composition) using fixed area plots (225m2), canopy cover (3 points per plot), and understory shrub cover (3 circular 5-m diameter subplots) at each of the 8 sites. Fuels treatments will begin in Oct 2018, and we will measure post-treatment vegetation and mammal movement afterward. We anticipate that invasive species may become problematic based on their presence in pre-treatment plots, and that animal movement will change in response to canopy openings. These results should be of broad interest to environmental managers working in central Texas.

Carranza, A.
St. Edward's University

Exploring Effects of an Urban Prairie Restoration Project on Public Engagement

Urban parks are often dominated by invasive species that provide little habitat or food for native animals. Restoration projects can greatly increase their ecological value for wildlife, but it is unclear whether or to what extent the public benefits from these projects, and if benefits are distributed unevenly across demographic groups. The goal of this study was to determine whether ecosystem restoration projects in urban parks affect public engagement with, and/or perspective of, green space, and if that varies based on demographic characteristics, including income, gender, age or ethnicity. We used a 13-question survey, administered in person at Commons Ford Metropolitan Park in Austin, Texas to address our objectives. At this site, a grassland was restored in 2010-2012 using prescribed fire and seeding with native grasses and wildflowers. Ecological surveys found that bird and plant diversity increased dramatically. However, due to the large costs of restoration and need for public buy-in, we wanted to also determine whether and how the public benefitted. Our results should be of broad interest to restoration practitioners and city officials.

Behr, W.
University of Texas - Austin

Changes in forb communities following prescribed fires

Prescribed fire is a common restoration practice in Texas. Much of the prescribed fire research has focused on its effects on woody plants and grasses, but less is known about how forb species respond. Forbs provide floral resources for pollinators, so understanding how forbs respond to fire can inform how to restore pollinator communities. If there are more flowers at burned plots, is this because the number of plants increased, the number of flowers per plant increased, or some combination of the two mechanisms?

Davidson, D.
Private Landowner
Solarization - a tool for soil restoration

Poster will illustrate with photographs the steps in using solarization for soil restoration as a precursor to invasive grass (KR bluestem) replacement with native grasses and forbs. The measured temperature profile as a function of depth and time will also be shown.

Andrews, M.
Stephen F. Austin

Biogeography and Citizen-Inclusive Restoration in an Urban East Texas Forest Preserve

This poster describes efforts to restore and monitor an urban forest habitat in East Texas. Banita Creek Preserve, located in Nacogdoches, Texas, is managed and owned by the Texas Land Conservancy based in Austin. Students in three previous offerings of a biogeography class set up and measured vegetation transects in the Preserve. Stream health was also measured using the Texas Rapid Assessment Method (TXRAM), while stand history was determined using county records. Students in the SFA Geography and Sustainable Community Development programs are working this fall to survey and involve Preserve neighbors in hands-on citizen restoration activities, including removal of non-native invasive species such as Chinese privet, expansion and maintenance of a pollinator garden, and monitoring of a game camera. Biogeography and restoration considerations include factors such as lower historical fire frequency in riparian settings, landscape context of understory songbird habitat, and community benefits of involving diverse local housing complexes in active learning about native habitats and species.

Carroll, K.
Trinity University

Vegetation Survey of North Central TX Urban Area Begins Long-term Documentation of Land Use Impacts on Biodiversity

We surveyed the vegetation of an urban property in western Fort Worth, TX ahead of planned development of part of the property. The property owner had concerns about potential species loss due to construction and wanted records of populations of tallgrass species, along with a full vegetation survey. A fence divided the property into two distinct sections: The western portion was undisturbed until summer 2018, when a construction easement running through the property was approved, while cattle had grazed the eastern portion for decades. To complete the survey, we ran 5 transects and recorded vegetation cover. We recorded 147 taxa in these transects and collected 110 voucher specimens of 84 distinct taxa (deposited at BRIT). We mounted, digitized, and made these voucher specimens publicly available via the Texas-Oklahoma Regional Consortium of Herbaria (TORCH) data portal (http://portal.torcherbaria.org). We also updated a 1998 survey of the area by Roger W. Sanders and combined it with our results to create a checklist (Flora of All Saints' Episcopal School, Fort Worth) in the TORCH portal that records 285 total taxa. Looking forward, we designed our procedures to ensure that later groups of university or high school students could easily use them, so that our results could serve as the baseline for a long-term documentation of shifts in biodiversity caused by land use changes. Dan Caudle will lead another survey and round of voucher collections in fall 2018 and hopes to incentivize high school students to participate in the project into the future.

Graham, G.
University of North Texas

Stepping Stones for Conservation: Dragonfly diversity in Urban Ponds

The City of Denton, located in a semi-arid region of Texas, has over 200 man made ponds within its city limits. Many of these ponds, located in densely populated areas, are engineered to control storm water runoff. There is a general lack of recognition of the value these waters contribute to regional biodiversity and as green-spaces. This study, as part of a larger study of all benthic macro invertebrates, is monitoring habitat variables and odonate diversity in a series of ponds selected to represent a gradient of urban influences. The objective of this study is to identify the variables and stressors associated with the diversity. The study has determined that the storm water ponds have comparable levels of diversity, but differing odonate species composition. Also some environmental stressors may lead to morphological differences. The ponds contribute to the natural resources in the city by providing beautiful green spaces that act as stepping stones of suitable habitat for diverse taxa. Results of this study will be used to develop a conservation plan to maximize the aquatic health of the ponds and if implemented, contribute to the sustainable development in Denton.

Ceynar, K.
University of North Texas

An assessment of the morphometric techniques used to differentiate Empidonax flycatchers

The genus Empidonax, with cryptomorphic plumages and subsequent dubious identifications have led researchers to implement a variety of different formulaic strategies for the in-hand identification of flycatchers— formulas mostly developed from measurements taken on museum study skins rather than live birds. Our study employed statistical analyses to assess several proposed approaches for identifying Empidonax minimus, Empidonax virescens, Empidonax flaviventris, Empidonax alnorum, and Empidonax traillii, based on live bird morphometrics from north central Texas (n = 91) and northeast Arkansas (n = 109) taken over 5 and 10 years, respectively. K. Benson & R. Benson's approach, with separate formulae for each species, correctly identified the individuals in both datasets significantly less (AR 36.24% at $P < 0.01$, TX 76.87% at $P < 0.01$) often than originally reported (96% at $P < 0.05$). G. Seutin's formula, designed to differentiate sister species Empidonax alnorum and Empidonax traillii, was found to correctly identify more E. alnorum (87.5%/80%, $\chi^2(1, n = 16) = 0.5625$, $P = 0.4533$) and significantly fewer E. traillii (42.86%/70%, $\chi^2(1, n = 21) = 7.3673$, $P = 0.006642$) in the Texas dataset than was previously suggested. Our analysis found that Formula R proposed by P. Pyle was the most effective morphological approach for differentiation between E. alnorum and E. traillii ($F1,42 = 11.86$, $P < 0.01$). Given our findings, we tentatively recommend the use of Formula R to identify E. alnorum and E. traillii; although the accuracy of this identification approach needs to be further assessed with genetic analysis.

Hood, K.
Tarleton State University

Effects of single-season, high-stocking rate, short-duration grazing on Texas wintergrass (Nassella leucotricha)

The Cross Timbers and Rolling Plains ecoregions, once diverse grasslands, are succumbing to woody encroachment by honey mesquite (Prosopis glandulosa Torr.) and the concurrent herbaceous takeover by Texas wintergrass (Nassella leucotricha Trin. & Rupr.). Documentation of this problem is extensive with no clearly stated solution. Researchers hypothesize that the cattle industry has largely driven this encroachment via overgrazing and changing of historic usage of the land. Attempting to utilize the cause as a solution we will use an average stocking density associated with high-intensity grazing (approximately 33,600 kg • ha-1) to jumpstart the restoration to a balanced native vegetation. We propose that cattle, when managed correctly, can benefit ecosystem health. We will determine if a single defoliation event (via high stock grazing or mowing) opposed to repeated defoliation influences Texas wintergrass seed production, wildlife habitat structure, and herbaceous biomass and whether grazing affects soil health (bulk density, soil moisture, and nutrient composition) over the course of one growing season. Proposed benefits of this type of high-stock system include increased nutrient availability and forage yields via carefully timed defoliation events, in winter grazing we attempt to remove wintergrass overstory (to stress plants and reduce seed production) while increasing nutrients available (via cattle waste) to promote native warm season grasses and forbs. Restoring these ecosystems could create habitat diversity for many native bird species, including bobwhite quail (Colinus virginianus), as well as improved forage for cattle operations.

Cortez, J.
Texas A&M - Kingsville

Accelerating Growth of Ocelot Thornscrub Habitat

Loss of habitat is a major issue contributing to the declining number of ocelots (Leopardus pardalis) in the Lower Rio Grande Valley (LRGV). Ocelots within this region are limited to 2 breeding populations, located in Willacy and Cameron Counties, with large areas of land used for urban and agricultural development separating them. The objectives of this project are to test various management techniques on both 1) newly-planted seedlings and 2) established thornscrub saplings to identify treatments useful for growing high-quality thornscrub habitat as quickly as possible. The first phase of the project involves applying treatments to naturally growing thornscrub saplings, and recording their effects on growth and development over time. Treatments will simulate mechanical disturbance on individual plants of 3 species by either 1) clipping plants, 2) mulching plants, or 3) both clipping and mulch. Exclosures will also be placed around several plants of each species to determine the impact browsers have on growth and development. In the second phase we will plant seedlings of 7 species that are important components of ocelot habitat. Seedlings will receive similar clipping, mulching, or combination of treatments when planted. Results will allow us to determine effective treatments for enhancing the development of multi-stemmed habit of young thornscrub plants, and optimal timing of these treatments—at the time of planting or a few years later. Results will be used to develop protocols for future ocelot habitat restoration efforts.

K. Pride
San Antonio River Authority

The Mission Reach Avian Study – Urban Ecosystem Restoration

In 2013 the San Antonio River Authority (SARA) began its Mission Reach ecosystem restoration project. The objective was to transform an eight mile, 300 acre stretch of the channelized San Antonio river into a quality riparian ecosystem. The success of the project is highlighted by a multi-year avian study. In 2015 SARA enlisted the help of a renowned bird expert to conduct a comprehensive analysis of the bird species utilizing the various habitat types within Mission Reach. I, along with other SARA employees, was enlisted to assist in documenting the bird species using point count and incidental survey methods. We adapted many of our restoration practices to consider the effects of birds and other wildlife in the area. At the beginning of the project there were just 68 bird species documented and there are currently 186 species spotted on the Mission Reach trail – proof that large scale urban ecosystem restoration really works.