Central Texas Restoration Reunion
Poster Abstracts

Amphibian biodiversity measurements using eDNA and recorded calls in Houston wetlands

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Located in the Gulf Coast Plains, the city of Houston is experiencing the consequences of replacing wetlands with large scale infrastructure. In order to regain lost ecosystem services including flood mitigation, detoxification, and carbon sequestration, efforts are being made around the city to restore and repair wetlands. However, much is still unknown about how to best maximize wetland restoration efficiency. In order to bridge this gap in knowledge, it is necessary to monitor the health of these systems over time. This study looks at two methods of estimating wetland health by using amphibian biodiversity as a biological indicator. The first method examines environmental DNA taken from water samples of each wetland. The second analyzes auditory calls that were recorded overnight at each location. This study reveals limitations of both methods and suggests a trade-off exists between sampling effort and efficiency for small wetland areas. Based on the time and resource constraints of a restoration effort, people can determine which method of monitoring to use. Either way, continuous monitoring is necessary to generate a more complete understanding of wetland health. The information gained from this monitoring could help groups make the more efficient decisions regarding wetland restoration moving forward.

Feeding on the abaxial leaf surface has negative consequences for caterpillars

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To defend against herbivory, plants have evolved physical and chemical defense mechanisms, including trichomes (hair like appendages on leaves and stem) being one of them. Caterpillars, a major group of insect herbivores are generally found to occupy the abaxial (underside) leaf surface, considered as an avoidance mechanism from biotic and abiotic stresses. Since trichomes are a first line of defense, we examined the correlation between abaxial vs adaxial (above side) trichomes and caterpillar feeding, behavior, and growth. A combination of field, lab and microscopy experiments were performed using tobacco hornworm, Manduca sexta (Lepidoptera: Sphingidae), a Solanaceae specialist caterpillar, and multiple host species. We found that M. sexta caterpillars overwhelmingly preferred to stay and feed on the abaxial leaf surface, but the abaxial leaf surface also had significantly more trichomes, and consequently, caterpillars took significantly longer to commence

feeding. In addition, lab-based diet experiment containing shaved trichomes showed that feeding on the abaxial leaf surface with more trichomes also affected caterpillar growth. Taken together, our study shows that although caterpillars prefer to feed on the abaxial leaf surface, they accrue feeding delays and developmental constraints, indicating tradeoffs affecting performance, and exposure to predation and abiotic stressors.

Measuring Grassland Ecosystem Productivity: Assessing Effects of Invasive vs Native Grass and Forb Dominance in the Texas Hill Country

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Native prairies in Central Texas once harbored a vast diversity of plants and animals, but many have experienced declines due to exotic species invasion and woody encroachment. Prescribed fire and seeding treatments are being used on private and public land in the Texas Hill Country to restore grassland communities. Ecosystem services and functions, such as productivity, disturbance regulation, nutrient cycling, and soil erosion control can be improved through restoration efforts, but these functional responses have not yet been quantified at many sites. We measured aboveground productivity in grassland sites dominated by the invasive grass King Ranch bluestem (Bothriochloa ischaemum) and nearby restored grassland sites dominated by little bluestem (Schizachyrium scoparium). Paired restored and invaded sites were located on three soil types at Commons Ford Metropark, Cemetery field at Spicewood Ranch, and West Winding field at Spicewood Ranch. We collected aboveground biomass at 4 plots per site (n=24), in three 20 X 50 cm2 quadrats per plot in Spring (May-June) and Fall (Oct) of 2022. Our restored plots were dominated by native species (92% native on average) whereas the invasive plots were 78% introduced or invasive species. Although we found a lot of variability in productivity by plot, on average, restored sites were twice as productive as invasive-dominated sites, at 305 ± 161 g m2 compared to 150.55 ± 54 g m2 . We are still analyzing our fall season data, but we anticipate patterns to be similar, providing another reason to restore native prairies.

Monarch Butterfly Habitat Restoration in North Texas

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Texas is an important part of the monarch butterflies' migratory pathway, as the monarchs pass through Texas both in the spring and in the fall, during which they feed on both milkweed and nectar plants. In recent years, however, the monarch butterfly population has decreased significantly. Because of this, TNC has put forth an effort to increase the growth of milkweed and promote plant diversity in the Clymer Meadow and Tridens preserves, in an attempt to restore Monarch butterfly habitats. Methods of restoration include controlled burns, brush removal, and limited application of herbicides to invasive plant species. Data collected from these preserves includes information such as number of milkweed stems, plant diversity, woody cover, and rainfall data. From this data, we found that between 2017 and 2018, although the average height of the milkweed varied significantly, the count of milkweed stems among the preserves did not change significantly between the two years. We plan to further analyze the effect of the treatments and rainfall on the preserves, as well as the plant diversity present.

Plant-fungal interactions of two recombinant inbred lines in Sorghum bicolor on the sugarcane aphid, Melanaphis sacchari (Hemiptera: Aphididae)

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Plant growth and development are aided by beneficial plant–microbe interactions in the rhizosphere. A prominent category of these microorganisms is arbuscular mycorrhizal fungus (AMF). AMF has been discovered to promote plant fitness through mycorrhizal symbiosis. Despite extensive study and documentation within a variety of systems, only a few of these studies have examined the effects of AMF on other cascading traits of which include plant insect interactions. To examine this, 2 of 10 inbred lines have been chosen for their variation in phenotypic attributes with one displaying a resistant trait to herbivory with the other displaying susceptibility. This study aims to examine a sorghum sugarcane aphid, Melanaphis sacchari, system. Extensive genetic variation in sorghum offers unique opportunities to explore, especially in systems involving different classes of herbivores. As of recent, a nested association mapping panel (NAM) with 10 recombinants inbred line populations have been developed in sorghum for the dissection and analyzation of their varying traits. Although the NAM population has been phenotype to dissect several sorghum adaptive traits these lines have not been used to dissect the genetic variation in resistance to insect pests. It is hypothesized that AMF would enhance Plant growth as well as influence resistance in both lines due to the possible alteration within plant defense pathways within these two inbred lines.

Root Endophyte Diversity Among Texas Grasses

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Fungal endophytes, which live inside plants intercellularly, play important ecological roles in most plant communities. Dark septate endophytes (DSE) are a polyphyletic group of ascomycota fungi found in almost all vascular plants and nearly every ecosystem. While their ubiquity and wide variety of niches suggests that DSE play an important part in plant community dynamics, their ecology is not well understood; knowing their identities and understanding their diversity can lead to valuable insights as to how certain species become invasive, and potentially provide new tools for habitat restoration. In this study, we aimed to identify and compare patterns in the endophyte diversity between native and invasive grass species. Our research focused on six native grasses, Schizachyrium scoparium (little bluestem), Bothriochloa saccharoides (silver bluestem), Nassella leucotricha (Texas wintergrass), Aristida purpurea (purple three awn), Bouteloua curtipendula (sideoats grama), and Sorghastrum nutans (yellow indiangrass) as well as the invasive Bothriochloa ischaemum (King Ranch bluestem). Root and leaf samples from each species were collected throughout the Edwards Plateau region in Central Texas. Fungal endophytes were cultured from the roots on MEA/antibacterial agar and isolated based on morphotype. To complement this, microscopy was used to determine the density of fungal colonisation in each species. As we learn more about the community composition of fungal endophytes, we can begin to better understand what specific roles they play in grassland ecosystems.

The effects of invasive Bothriochloa ischaemum on native grassland systems and their ability to sequester carbon in the Texas Hill Country

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Exotic species invasion poses one of the greatest threats to native ecosystems, often resulting in major losses of biodiversity and changes in ecosystem functioning. This is a prevalent issue in the Texas Hill Country as many of the remnant grasslands have been converted to homogeneous stands of invasive grasses. Vegetation cover is known to directly influence the content, quality, and depth distribution of soil carbon (C), as it is directly responsible for organic matter input into the soil below. As invasive species move into healthy prairie ecosystems, root structure and depth may change as well, impacting soil carbon storage. This would be detrimental because with climate change, we need to get more C stored in terrestrial ecosystems, and prairies are a promising place to do that. We compared soil carbon storage under one of the most prevalent invasive species of Central Texas prairies, King Ranch bluestem (Bothriochloa ischaemum), to the co-occurring native grass, little bluestem (Schizachyrium scoparium) at five sites across Central Texas. We collected surface and deeper soils at each site, up to 1m deep, which we then analyzed for SOM using the loss-on-ignition method. We are still processing samples to determine how vegetation cover affects C, however our preliminary findings show that %SOM at the surface is relatively high, averaging 3.94 ∓1.19, and even at 1m deep, we still found substantial organic matter present (2.3 ∓ 0.78 %) at all sites. These results should be of broad interest to environmental policy makers and land managers in Central TX.

Variation of Heritable Symbionts in Heterogeneous Populations Potentially Explained by Environmental Factors

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Fungal endophytes are microorganism that have successfully colonized vascular plant tissue. Within their host plants, they employ a symbiotic plant-fungus interaction in which symbionts siphon nutrients from their host plant, while contributing significant benefits to their host. There is an expectation that heritable and beneficial symbionts should be at a high frequency in host populations. However, earlier experiments examining populations of grasses across the southern Great Plains concluded substantial variability in symbiont prevalence within host populations. I examined drivers of symbiont prevalence by surveying three natural populations of Elymus virginicus, a native North American cool-season grass species that harbors intermediate to high frequencies of fungal endophytes and is known to confer host fitness benefits. I hypothesized environmental factors such as soil water content and sun exposure would be correlated with endophyte occurrence explaining endophyte variability within a single population. Measurements of the volumetric soil water content, soil pH, and sun exposure of 150 individuals were taken and aniline blue seed assays were used to determine endophyte occurrence within individuals. Visualizing endophyte occurrence against environmental factors revealed a correlation between soil water content and endophyte occurrence. Minute differences in the environment of individual plants could explain the presence of both endophyte negative and positive individuals within a population, broad scale patterns of endophyte prevalence across environmental gradients, and the impact of endophytes on the geographic range limit of species.