



Fifth Annual Roseau Cane Research Summit

LSU Hilltop Arboretum

Thursday January 12th, 2023; 8:30 am Central Time

SUMMARIES FOR PRESENTATIONS

Microbes

Vinson Doyle and Aaron DeVries, LSU AgCenter: Microbial communities associated with Roseau Cane do not appear to be primary drivers of dieback in the MRD, but there are unique communities of microbes that make their way into the plant roots and underground stems (rhizomes) from the surrounding soils. Field experiments indicate the microbes from soils play an important role in *Phragmites* growth as soil sterilization improved growth for plants in both sterilized healthy and dieback soil, but data thus far do not implicate the presence of pathogenic or beneficial microbes unique to either soil type. Fungi that have been recovered from roots and rhizomes are being screened for their ability to improve establishment and survival of Roseau Cane. While no fungi that strongly influence growth have been identified, only a small subset of those fungi recovered from Roseau Cane have been screened. Ongoing experiments will determine how these microbes may enhance stress tolerance in the MRD.

Plant defenses

Jonathan Richards, LSU AgCenter: Population genetic analyses using samples collected in the 2022 coastwide survey revealed patterns of genetic diversity and differentiation that varied by lineage and site. The EU lineage samples were genetically distant from the Delta or Gulf lineage samples and were largely clonal within a single stand. However, several multi-locus genotypes were detected within Delta lineage stands which may reflect differences in reproduction or timing of stand establishment.

Amanda Lee, Undergraduate student with James Cronin, LSU Biology: We are very interested in the natural chemical plant defenses of *Phragmites australis*, and we are looking to find out if certain lineages or conditions increase these chemical plant defenses known as protease inhibitors. We are developing a biochemical assay to determine the amount of protease inhibitors in the leaf tissues.

James Cronin, LSU Biology: Elevated CO₂ and Nitrogen Pollution: Effects on Above- and Belowground Interactions in *Phragmites australis*. A main avenue of research by the *Phragmites* team has been to explore the role of climate change in causing *Phragmites* dieback in the Mississippi River Delta. In collaboration with researchers at the Smithsonian Institute's Environmental Research Center, we investigated the effects of elevated CO₂ and nitrogen runoff on *Phragmites* defensive chemistry and

interaction with belowground microbes and aboveground herbivores. Analyses of these data are currently underway.

Andrea Glassmire, Postdoctoral Associate with James Cronin, LSU Biology: In March 2022, a factorial experiment was conducted at the Louisiana State University greenhouse facilities to test how soil biota and nutrients influence nutritional and chemical defense traits in *Phragmites australis*. Individual rhizomes from the introduced Delta or invasive European lineages were randomly established in one of three different soil types collected from the Mississippi River Delta (Delta healthy, Delta die-off, invaded *Taro*) in the presence or absence of beneficial fungi. Results from this experiment will help us determine which chemical traits benefit these lineages (Delta vs. European) from the stress of die-off soils and infestation by the Roseau cane scale.

Ecological interactions: inundation, salinity, other species

Austin Lynn, Postdoctoral Associate with Tracy Quirk, LSU College of the Coast and Environment: During the growing seasons of 2021 and 2022, we placed marsh organs in the Rockefeller Wildlife Refuge and Delta National Wildlife Refuge. The marsh organs are PVC pipe structures that allow us to place soil and plants at five different elevations in the marsh so that some are more flooded than others. The results from this experiment suggest that increased flooding and the naturally produced soil water toxins associated with flooding such as acetic acid and sulfide may contribute to *Phragmites australis* dieback in the Mississippi River Delta.

Olivia Hurley, undergraduate student with Tracy Quirk, LSU College of the Coast and Environment: Preliminary biomass analysis results from the 2022 coastwide survey show a trend of great range in aboveground and belowground biomass in the Mississippi River Delta Roseau Cane. In the Roseau Cane water chemistry analysis, we found we found high salinity, potassium, sodium, sulfur, and calcium in Rockefeller Wildlife Refuge due to large amount of seawater brought to the area from recent storm events. There is still ongoing research being done with data from this survey such as analysis of leaf tissue chemistry, finalizing biomass analysis, and further examining relationships across sites.

Tracy Quirk, LSU College of the Coast and Environment: Using a 15-year dataset at the Coastwide Reference Monitoring System stations in the Mississippi River Delta, we determined that the Roseau cane die-off began after the prolonged drought causing low river discharge and high salinities in summer 2012 exacerbated by Hurricane Issac on August 29, 2012. Recovery has been variable and dependent on subsequent subsidence and flooding as well as salinity spikes.

Joe Johnston, PhD student with James Cronin, LSU Biology: The Mississippi River Delta (MRD) is an ecosystem dominated by Roseau cane. In the last decade, it has overly changed as the dieback occurred, and other vegetation appears to be colonizing and replacing Roseau cane. Monitoring the vegetation coverage since 2016 has shown that *Colocasia esculenta* (known as Elephant Ear) is abundant, thus altering the MRD landscape. The root structures between these two plants are drastically different, Roseau cane with an extensive web of rhizomes compared to Elephant Ear with a large potato-like tuber. The implications of Roseau cane not being able to reestablish could lead to greater sedimentation loss with the colonization of Elephant Ear. Current research is looking at the two species competition under dieback conditions.

Restoration efforts

Josh Snook , Research Associate with Rodrigo Diaz, LSU AgCenter: Controlled field experiments and field surveys have shown that the invasive scale insect can decrease Phragmites below ground rhizome biomass by 45%. With Reduced energy reserves the plants have less resources for new growth in the spring making them more susceptible to other natural stressors like water depth, salinity, and storm damage. I have also been testing restoration techniques using cut stems to propagate phragmites in areas of decline and where new sediment is being deposited. We tested various densities and arrangements of stems and found that four stems planted in a clump only a few centimeters apart to be the most efficient treatment yielding approximately 50 new stems only 6 months later. This method of propagation reduces transportation and rearing time by simply cutting some stems from a nearby healthy stand and pushing them into the soil at the new location. The area where stems were cut from regrows new stems in a few months and is undistinguishable from uncut areas. Duck hunters have been doing this for ages to create temporary blinds to hide their boats, these stems take root and often become new stands that persist for years to come. This method provides some hope for prolonging phragmites presence in the MRD and increases the land building potential of the system.

Yadong Qi, Southern University: Southern University has recently joined the LSU multidisciplinary team to expand research on Roseau cane focusing on restoration efforts. Several mesocosm studies will be conducted to evaluate establishment of cane cuttings under biotic and abiotic stressors. In addition, planting techniques will be examined in a small-scale setting to increase cane establishment. We expect to develop more effective strategies to improve restoration of Roseau cane stands at the MRD.

Impact on River Hydrology

Andrew Nyman, LSU AgCenter: Dredging the Bird Foot Delta to keep the ports of Plaquemines, New Orleans, South Louisiana, and Baton Rouge open to oceangoing vessels costs ~\$75 million/year. Roseau Cane Dieback along distributary channels in the Bird Foot Delta probably will increase sedimentation in the navigation channel there. Vegetation currently is excluded from models used to plan dredging and restoration in the Bird Foot Delta because local vegetation/flow data are lacking. Our goal is simulation models that account for differences in the way different plant species channelize flow. This project, started in the fall of 2022 will provide a 2nd, small step towards that goal.

Matt Hiatt, LSU College of the Coast and Environment: Our project aims to understand the impacts of Roseau cane die off on water and sediment movement in the Mississippi River Birdsfoot delta. We will assess how water and sediment flow interact with Roseau cane in various stages of die off throughout the growing and non-growing seasons. These analyses will help us better understand the long-term implications of Roseau cane die off for the stability of the birdsfoot delta and evaluate strategies for maintaining navigability in the shipping channel.

Remote Sensing

Shelley Meng, LSU Geography and Anthropology

- Contrary to land loss expectations
 - The growing season Landsat images showed an increasing trend of vegetated areas from 2005 and 2021 in the lower Mississippi River Delta (MRD), which was partly due to water and sediment supply from the delta and wetland restoration effort.
- How significant is Roseau cane in lower MRD?
 - In lower MRD, Roseau cane occupied 49.7% of the vegetated areas in 2010 and 41.8% in 2019 based on assessment from Landsat imagery with 30m resolution. The overall wetland die-back accounted for 11% of the vegetated areas and nearly 65% of the dieback was from Roseau cane, which indicated that Roseau cane suffered more damage than other wetland marshes in lower MRD.
- Wetland disturbance and resilience
 - A drone monitory study based on site in Pass-A-Loutre of Lower MRD proved a fast wetland recovery and high resiliency from historical event of Hurricane Ida that delta Roseau cane led the first phase of recovery reclaiming around 21% of dead vegetation and other marsh grass soon expanded to around 64% of the dead vegetation area. Within seven months from September 2021 to April 2022, wetland vegetation reclaimed around 97.8% of the dead vegetation area.

Roseau cane scale

Hannah Broadley, USDA-APHIS: Studies to evaluate the population dynamics of Roseau cane scale in its native range in East Asia have been conducted. The three parasitic wasps previously reported from the invasive populations of scale in Louisiana (*Astymachus lasallei*, *Neastymachus japonicus*, and *Boucekiella depressa*) are also common parasitoids of Roseau cane scale in its native population. Additionally, an *Aprostocetus* sp., a *Platencyrtus* sp., and an unknown encyrtid wasp were detected. From these collections *Aprostocetus* sp. is of particular interest due to its apparent prevalence and that, prior to this fall, it was not known to occur in the invasive population. However, this fall *Aprostocetus* sp. was detected adventively in the invasive population. The genetics of these wasps align with collections of *Aprostocetus* from China and South Korea. We are now evaluating its species identification, host specificity, and role in the invasive population.

Tanner Sparks, PhD student with Rodrigo Diaz, LSU AgCenter: Surveys performed this past year have found roseau cane scale has now spread into Alabama. The invasive scale can now be found on *Phragmites* stands from Port Arthur, TX, across coastal LA and MS, and into Bayou LaBatre, AL. Researchers speculate it may continue to spread eastward with its next move putting it in Mobile Bay. At the same time as this range expansion, a new parasitoid wasp from the genus *Aprostocetus* has appeared and is now attacking the scale. Interest is now focused on the effects this wasp will have on scale mortality.

Herbert Logan, Research Associate with Rodrigo Diaz, LSU AgCenter: Six years of field and lab data from surveys in the Mississippi River Delta were organized and made available to the researchers in the Roseau Cane Die-Off Project. Preliminary analysis of this dataset found that overall scale insect densities

in all four major Passes peaked between 2019 - 2020. There was a corresponding decline in Phragmites live stems and plant height observed during this period, with limited recovery occurring in only two of the four Passes. Further surveys and a more comprehensive analysis of the new dataset will help researchers understand the factors affecting Phragmites health in the Delta.

Rodrigo Diaz, LSU AgCenter: Field surveys along coastal Louisiana in 2022 demonstrated that Roseau cane stands in the Mississippi River Delta (MRD) had higher densities of scales compared to other regions. In addition, these higher scale densities were associated with lower plant cover and more yellowing of roseau cane at the MRD. The recent arrival of scales to Vermillion and Cameron Parishes suggests that it might take several years to observe similar stress levels on the cane as observed in the MRD.