

COASTAL MARSH HEALTH AND RESTORATION



Texas Chenier Plain coastal marsh vegetation dieback versus dredge material restoration on swamp gas emissions.

WHY NOW?

Coastal marshes sequester atmospheric carbon dioxide, but can also emit methane, a more potent greenhouse gas. Marshes of the Texas Chenier Plain experience inundation stress, vegetation dieback, and erosion, fragmenting land cover to open water. Relative sea level rise is a primary driver. Efforts to restore coastal marsh health involves dredge material placement to increase elevation. How vegetation dieback versus dredge material restoration impacts methane emissions was investigated.

WHAT WE DID

Both site-specific and landscape-scale approaches were performed in the J. D. Murphree W.M.A. Methane emission rates, sediment methane levels, and methanogen microbes were studied, at sites of vegetation dieback versus dredge material restoration and a healthy reference site to understand complex biogeochemical interactions. Continuous monitoring of carbon dioxide and methane fluxes across the marsh landscape used an eddy covariance approach, with our DOE Ameriflux program tower site located north of restored marsh and south of a dieback area. Unoccupied aerial vehicle surveys with LiDAR and multispectral sensors were used to define sediment elevation and vegetation health across this marsh landscape.

WHO WAS INVOLVED?

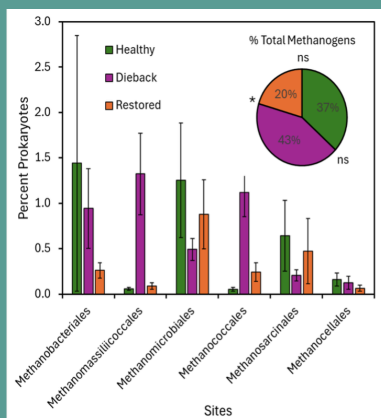
The project complements and draws from on-going efforts and expertise of the Salt Bayou Watershed Workgroup's effort to restore coastal marsh health in Jefferson County, TX. In addition to the county, members include individuals from Texas Parks and Wildlife, US Fish and Wildlife, TAMU-G and Lamar University.



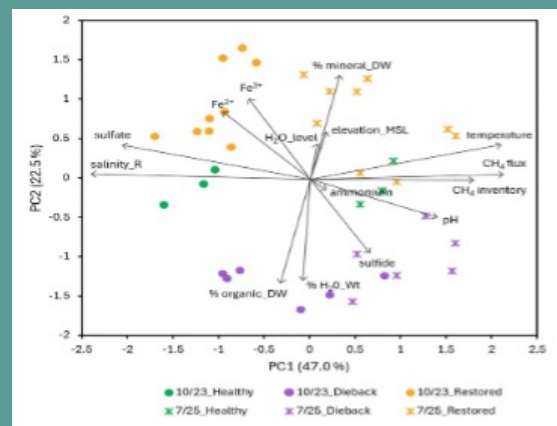
Continuous monitoring Ameriflux tower site.

FINDINGS

- Greatest emission rates were associated at dieback sites in the marsh interior. Dieback sites had lowest elevation, most waterlogged sediment with least mineral content, and phytotoxic levels of sulfide in the root zone.
- Dredge material restoration provides a mineral source of iron to bind sulfide, reducing its phytotoxicity to increasing microbial competition to reduce methane emission and methanogen composition.
- UAV (drone) flight have been performed with data being processed to maps, and future flights are planned. Ameriflux tower eddy covariance measurements and analyses are ongoing to Fall 2027.



Microbial differences observed in dieback areas, restored areas, and healthy areas.



PCA of site-specific biogeochemical parameters and methanogen composition.

MORE ABOUT SETX-UIFL

The Southeast Texas Urban Integrated Field Lab (SETX-UIFL) is one of four projects funded in 2022 by the U.S. Department of Energy to study how climate, environment, and urban changes affect cities. A team of over 80 researchers from UT, Lamar University, Texas A&M, Prairie View A&M, Oak Ridge National Lab, and Los Alamos National Lab has collected data and conducted modeling across hazards including flooding, hurricanes, heat stress, and air quality. Our Why: Southeast Texas faces numerous hazards, yet smaller communities like this one have often felt forgotten compared to larger cities. The SETX-UIFL was designed to explore the complex dynamics of disaster vulnerability for this economically and culturally vibrant region. We believe Southeast Texas is a bellwether for the entire Gulf Coast, and an exemplar for strategies that protect people and places. We hope this effort supports your path toward lasting resilience.



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