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11 *Evaluating ecosystem function and restoration success in restored marshes*¹

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Project Development

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Proponent(s)/District

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Ecosystem function and restoration success in restored marshes – evaluating trajectories through retrospective and current case studies¹

Research Need

This project focuses on how to determine restoration success in salt marshes created or restored using Beneficial Use (BU) of dredged material across the nation and identify potential early indicator metrics.

Existing tidal marshes are vulnerable to degradation due to sea level change, sediment reduction and other factors. In order to maintain marshes in areas where they are disappearing, beneficially used dredged material has been used to restore or create tidal marshes. Enough of these projects now exist to offer project-specific assessments of success, but there has been little synthesis of data across projects or phases of projects to synthesize trajectories of ecological outcomes within regions, much less across regions where climate and species vary.

Project Purpose & Objectives

The purpose of this project is to develop regional trajectories for multiple coasts and correlate early-indicator metrics with long-term metrics and marsh function, offering implications for adaptive management. This project focused on the following objectives:

- Review of the methods, statistical approaches and metrics used to establish restoration trajectories in salt marshes.
- Use of regional case studies to develop restoration trajectories. Two approaches were used to develop restoration trajectories in regional case studies:
 - Retrospective Single Site Trajectories
 - Composite Time Series Trajectories
- Testing novel metrics in Composite Time Series sites to identify metrics that might provide early indication of restoration success.
- Assessing linkages between trajectories of different ecological components (e.g., soils, plants, birds) to help give a clearer picture of the holistic restoration evolution.

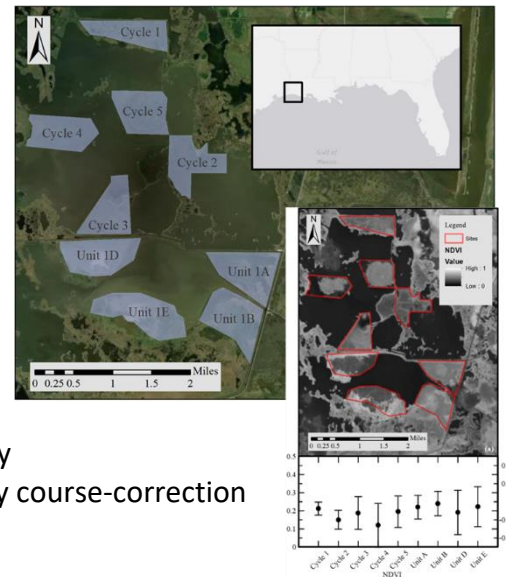


Value of Research and Development (Payoff)

This work provides science-based expectations for restorations of tidal salt marsh beneficially using dredged material in different parts of the country. By documenting and characterizing the rate of ecological function recovery at various trophic levels (e.g., soils, vegetation, birds) and showing interconnections, the success of individual restoration projects can be more effectively communicated.

Synthesis of regional trajectories across multiple projects or project phases provide science-based expectations for future tidal marsh restorations utilizing dredged material in different parts of the country. Finally, testing novel metrics may offer early indication of marsh restoration trajectories in order to allow early course-correction and adaptive management.

Documentation of these trajectories and early-indicator metrics will facilitate understanding by stakeholders, agencies, and regulators of realistic, science-based benefits of tidal marsh restoration utilizing BU dredged material.



Products

Journal Articles (JAs)

Murphy, N., Biber, P. and Altman S.A. (In Review). Comparison of vegetative community diversity, biomass, and sediment properties among constructed and reference salt marshes in the Northern Gulf of Mexico. *Estuaries and Coasts*.

Technical Reports (TRs)

Runion, K., Altman, S. and Murray E.O. (2022). Analytical methods for establishing restoration trajectories, ERDC/EL-SR-22-9. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi. <https://doi.org/10.21079/11681/45562>

Staver, L., Altman, S. et al. (In management review). Trajectories of Vegetative Parameters at Poplar Island Tidal Marsh Restoration Cells, FY2026-EL-F30-SR-##, Technical Report. U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Altman, S., Jafari, N., et al (In Preparation). Sabine NWR restoration trajectories, Technical Report. U.S. Army Engineer Research and Development Center.

Technical Notes (TNs)

Harris, B., Harris, K., Jafari, N., Bekkaye, J., Murray, E., and Altman, S., (2023). Selection of a time series of beneficial use wetland creation sites in the Sabine National Wildlife Refuge for use in restoration trajectory development. ERDC/TN EMRRP-ER-25, Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi. <http://dx.doi.org/10.21079/11681/47579>.

Cornwell, J., Staver, J., Murray, E., and Altman, S. (In editing). The Trajectory of Iron Sulfide Oxidation and Production in Marshes Created from Dredged Sediments at Poplar Island: Implications for Wetland Plant Establishment. ERDC TN-EMRRP-##, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Cornwell, J., Staver, L. et al. (In Editing) Iron Sulfide Oxidation and Production in Marshes Created From Dredged Materials at Poplar Island: Implications for Wetland Plant Establishment, Technical Note. U.S. Army Engineer Research and Development Center.

Conference Presentations/Webinars/Workshops

2024. National Conference on Ecosystem Restoration (NCER). Staver, L., Cornwall, J., Murray, E., Altman, S., Eilar, A., and Blanche, T. Restoration trajectories in created tidal marsh habitat – A case study from Poplar Island, MD, USA.

Eilar, A. et al. (2022). Restoration trajectories at wetland creation sites utilizing dredged material: Case studies as Poplar Island, MD and Sabine National Wildlife Refuge, Presentation. American Shore and Beach Preservation Association, Long Beach, California.

2021. Society of Ecological Restoration. Biber, P. Vegetative community and health assessment of a constructed Juncus-dominated salt marsh in the northern Gulf of Mexico.

Other

Murphy, N. & Biber, P. (2021). Vegetative community diversity assessment of a beneficial use salt marsh restoration. Research Square Preprint. DOI: 10.21203/rs.3.rs-507079/v1.

Murphy, N. (2020). Vegetative community and health Assessment of a constructed Juncus-dominated salt marsh in the northern Gulf Of Mexico. Master's Thesis. The University of Southern Mississippi, Graduate School.