CONNECTICUT SEA GRANT PROJECT REPORT

Please complete this progress or final report form and return by the date indicated in the emailed progress report request from the Connecticut Sea Grant College Program. Fill in the requested information using your word processor (i.e., Microsoft Word), and e-mail the completed form to Syma Ebbin syma.ebbin@uconn.edu, Research Coordinator, Connecticut Sea Grant College Program. Do NOT mail or fax hard copies. Please try to address the specific sections below. If applicable, you can attach files of electronic publications when you return the form. If you have questions, please call Nancy Balcom at (860) 405-9107.

Please fill out all of the following that apply to your specific research or development project. Pay particular attention to goals, accomplishments, benefits, impacts and publications, where applicable.

Name of Submitter: Beth Lawrence

Date of Report submission: April 20, 2024

Project #: _ LI 00A00284 ___ Check one: [ ] Progress Report [X] Final report

Duration (dates) of entire project, including extensions: From [03/01/2021] to [02/28/2024].

Project Title or Topic: Evaluating thin layer placement in Long Island Sound marshes using a multi-scale approach

Principal Investigator(s) and Affiliation(s):

1. Beth Lawrence, Dept. of Natural Resources and the Environment, Center for Environmental Science and Engineering, University of Connecticut

2. Chris Elphick, Dept. of Ecology and Evolutionary Biology, Center for Biological Risk, University of Connecticut

3. Ashley Helton, Dept. of Natural Resources and the Environment, Center for Environmental Science and Engineering, University of Connecticut

4. Min Huang, Connecticut Department of Energy and Environmental Protection

A. COLLABORATORS AND PARTNERS: *(List any additional organizations or partners involved in the project.)*

- Roger Wolfe (CT DEEP)
- Jacob Isleib (Natural Resources Conservation Service)
- Jim Turek (NOAA- Restoration Center)
- Suzanne Paton (USFWS- Coastal Program)
- Rick Potvin & Kris Vagos (USFWS- Great Meadows Marsh)
- Natural Resources Conservation Academy (UConn)

- Guilford Yacht Club
- Ly Williams (Smithtown High School)

B. PROJECT GOALS AND OBJECTIVES:

Our overarching goal was to advance understanding of thin layer placement (TLP), an emerging restoration technique that builds elevation by placing sediment on submerging marshes and aims to promote coastal resilience. Specifically, our objectives were to:

Obj. 1: Test how sediment texture and tidal amplitude alter the effectiveness of Thin Layer Placement (TLP). We evaluated dredge material choice, reflecting the range of materials available in LIS (gravel to fine-textured silts), and the effects of tidal range. We conducted a comprehensive experimental manipulation by adding sediment to 150, 2.25-m^2 plots in low and high marsh habitats across three Connecticut (CT) marshes varying in tidal range.

Obj. 2: Evaluate whether small-scale TLP experiments are representative of management-scale applications. Working with agency partners (CT DEEP, NOAA, USFWS), we are examining whether experimental results from Obj. 1 reflect responses at the scale of ongoing or planned TLP implementation at three sites in coastal CT (Great Meadows Marsh (Stratford), Sluice Creek Marsh (Guilford), Bride Brook Marsh (East Lyme).

Obj. 3: Promote understanding of sea level rise, coastal wetlands, and TLP restoration to diverse stakeholders. To enhance coastal management, advance STEM education, and connect user groups in the LIS region, we provided research opportunities for students from diverse backgrounds; communicated our scientific findings to local, regional, and international audiences; promoted youth engagement via the Natural Resources Conservation Academy (NRCA) Conservation Ambassador Program; and developed an inquiry-based salt marsh restoration case study for high school teachers.

C. LISS CCMP IMPLEMENTATION ACTIONS: (*List the top 3 primary CCMP Implementation Actions that this project addresses. LISS CCMP Implementation Actions can be found at https://longislandsoundstudy.net/2021/01/ccmp-implementation-actions-supplemental-documents/)*

1) SM-26: Incorporate climate change-driven factors such as temperature, acidification, and sea level rise in model applications to assess factors that can influence future attainment of water quality standards and habitat protection and restoration goals.
2) HW-23: Collect and analyze data on LISS 12 targeted coastal habitat types in order to improve habitat assessment and adaptive management.
3) HW-2: Develop a list of current and new or innovative restoration techniques.

D. <u>PROGRESS</u>: (*Summarize progress relative to project goals and objectives. Highlight outstanding accomplishments, outreach and education efforts; describe problems encountered and explain any delays.)*

Obj 1: We successfully set up our logistically challenging field experiment in spring 2021. We stapled 720 meters of fiberglass screening to 600 oak stakes which were pounded into

150 plots across three CT marshes; we mixed, moved, and placed 26 cubic yards of sediment with the help of volunteers, UConn faculty graduate and undergraduate students, and CT DEEP.

During three growing seasons (2021-2023) we monitored a range of parameters to investigate how experimental sediment additions (silt-loam, loam, sand, cobble) altered plant and biogeochemical responses. We installed water-level loggers, quantified the elevation of our plots using a precise RTK GPS unit, quantified plant (% cover, stem density, stem height, biomass) and soil chemistry (surface and subsurface porewater: nutrients, Fe, sulfides, pH, electrical conductivity) responses, and greenhouse gas (CO_2, CH_4, N_2O) fluxes and dissolved concentrations. We also collaborated with a consulting firm who flew a high-resolution drone with LiDAR.

Obj 2: Within the three areas targeted for TLP placement by collaborating management agencies (NOAA, DEEP), we monitored pre-treatment conditions within randomized points. We worked with NRCS soil scientists to sample and characterize physical and chemical characteristics of the soil prior to large scale implementation; importantly, we ran the oxidized pH tests to determine whether soils were potential acid sulfate soils. At Great Meadows Marsh, we quantified pre-restoration elevation, vegetation, porewater chemistry and greenhouse gas fluxes in 2021. After sediment application during the 2021-22 winter, we measured vegetation, KCl-extractable soil nutrients and GHG fluxes during the 2022 and 2023 growing seasons. For Sluice Creek and Bride Brook Marshes, large-scale TLP management has not yet been implemented but is still being pursued by CT DEEP; we have collected a suite of pre-application data from these sites that will be valuable after application. In 2021, we collected vegetation and elevation data, and during the 2022 and 2023 growing seasons, we quantified vegetation, porewater chemistry and greenhouse gas fluxes.

Obj 3: We have engaged with diverse stakeholders during the three-year project period and have effectively communicated our preliminary findings. We had three outstanding PhD students, a talented project manager, and 2-4 undergraduate technicians each year involved in the project. One of the PhD students mentored a NRCA-associated high school student on a coastal conservation project during 2022-23. We communicated our preliminary findings to local, regional, and international audiences via 9 poster and 11oral presentations (see Section E below). We collaborated with a high school teacher to develop a restoration case-study for high school students that is nearly ready to be released to the public via the CT National Estuarine Research Reserve website.

E. PROJECT PUBLICATIONS, PRODUCTS, PRESENTATIONS AND PATENTS:

(Include published materials with complete references, as well as those which have been submitted but not yet published and those in press. Please attach electronic versions of any journal articles, reports, and abstracts not previously provided.)

Journal Articles (List URLs): NA

Conference Papers: NA

Proceedings or book chapters: NA

Web sites, Software, etc.: NA

Technical Reports/Other Publications: NA

Other Products (including popular articles):

- Lawrence, B., Williams, K. 2024. What's that smell?!: The case of the sinking saltmarsh. https://estuarineresearchreserve.center.uconn.edu/data-mysteries/
- UConn Today article: "Ph.D. Student Helps Protect Long Island Sound's Marshes" published June 22, 2023. https://today.uconn.edu/2023/06/uconn-ph-d-student-helps-protect-long-island-sounds-marshes/
- The Day article: "Salt Marsh Researchers" published September 21, 2022. https://www.theday.com/local-news/20220921/salt-marsh-researchers/

Publications planned / in progress:

- Meadows-McDonell et al. How does TLP sediment texture alter greenhouse gas dynamics? Target journal: Ecological Applications. Target submission date: December 2024
- Kollegger et al. Impacts of grain size and porewater chemistry on plant communities subject to thin layer placement. Target journal: Estuaries and Coasts. Target submission date: December 2024.
- Nelson et al. Interactions of sediment texture and fiddler crab activity on vegetation in an experimental salt marsh sediment addition experiment. Target journal: Journal of Applied Ecology. Target submission date: December 2024.
- Gigliotti et al. Biomass comparisons between allometric equations, destructive sampling and LiDAR. Target journal: Methods in Ecology and Evolution. Target submission date: December 2024

Patents: *(List those awarded or pending as a result of this project.)* NA

Presentations and Posters: *(Include name and date of the conference or meeting, whether it was a talk or poster, if it was invited, and who the presenter was.*)

*graduate/**undergraduate/***high school student associated with project

Invited talks

- Lawrence, B. Evaluating sediment addition as a strategy to keep submerging salt marshes afloat. Civil and Environmental Engineering Department Seminar. March 22, 2024. Storrs, CT (USA)
- Lawrence, B., Helton, A., Elphick, C., Huang, M. 2023. Quantifying how experimental sediment addition alters plant, water chemistry and greenhouse gas responses across Connecticut salt marshes. Long Island Sound Study, Science Technical Advisory Committee meeting. November 30, 2023. Zoom meeting.
- *M. Meadows-McDonnell, Lawrence, B. How does texture of added sediment affect carbon sequestration of restored coastal salt marshes? Society of Wetland Scientists New England Chapter Meeting. October 2023, Salem, Massachusetts (USA).

- Lawrence, B.A. Keeping salt marshes afloat: testing the effects of sediment addition on ecosystem processes. University of Auckland, School of Environment Seminar Series. May 3, 2023. Auckland, New Zealand.
- Lawrence, B.A., C. Elphick, F. Gigliotti, A. Helton, M. Huang, M. Kollegger, M. Meadows-McDonnell, N. Nelson, A. Puchkoff, A. Tienken. Evaluating thin layer placement in Long Island Sounds marshes using a multi-scale approach. Society of Wetland Scientists New England Chapter Meeting. October 29, 2022. University of New Hampshire, Durham N.H. USA

Oral presentations

- *Kollegger, M. et al. How sediment texture affects porewater chemistry and above ground plant biomass in salt marsh sediment additions. Long Island Sound Research Forum. May 15, 2024. Port Jefferson, NY USA.
- Lawrence, B., Williams, L. Graham, L, Kolleger, M. What's that smell?! A salt marsh restoration case study for educators. Long Island Sound Research Forum. May 15, 2024. Port Jefferson, NY USA.
- *Kolleger, M. Lawrence, B.A., C. Elphick, F. Gigliotti, A. Helton, M. Huang, M. Meadows-McDonnell, N. Nelson. Not Basic Enough: Soil Amendments to raise the pH of sediment used for thin layer placement. American Geophysical Union Conference. December 2023, San Francisco, CA (USA).
- *M. Meadows-McDonnell, Lawrence, B. How does texture of added sediment affect carbon sequestration of restored coastal salt marshes? RE3: Restore, Reclaim Rewild: Quebec City, Canada. June 13, 2023
- Lawrence, B.A., C. Elphick, F. Gigliotti, A. Helton, M. Huang, M. Kollegger, C. Mack, M. Meadows-McDonnell, N. Nelson. Quantifying how sediment placement in submerging salt marshes alters greenhouse gas emissions. ILEAPS-Oz Flux Joint Conference. Feb 1, 2023. Aukland, New Zealand.
- *Kollegger, M., Lawrence, B.A., C. Elphick, F. Gigliotti, A. Helton, M. Huang, M. Meadows-McDonnell, N. Nelson. How Does Sediment Addition at Great Meadows Marsh Alter Salt Marsh Vegetation, Porewater Chemistry and Greenhouse Gas Fluxes? Coastal and Estuarine Summit: Restore America's Estuaries. December 4-8, 2022. New Orleans, LA, USA.
- Lawrence, B., Williams, L., Cambrial, C. Translating climate science to high school audiences: a salt marsh teaching module. Connecticut Conference for Natural Resources. March 15, 2021. Storrs, CT USA.

Posters

- *Kollegger, M.P., Nelson, N., Huang, M., Elphick, C.S., Lawrence, B.L., Helton, A.M. Can soil amendments ameliorate acidity caused by sediment additions during salt marsh restoration? Long Island Sound Research Forum. May 2024.
- Nelson, N., Meadows-McDonnell, M., Kollegger, M., Gigliotti, F., Huang, M., Elphick, C., Helton, A., Lawrence, BA. Effects of thin layer placement restoration on plant growth in Long Island Sound salt marshes. Securing a Sustainable Environmental Future (Storrs, CT USA). October 2023
- **Arteaga-Payares, S., F. Gigliotti, A. Helton, C. Elphick, M. Kollegger, M. Meadows-McDonnell, N. Nelson, Lawrence, B.A..How does crab activity in sediment-amended salt

marsh restorations alter the flux rates of greenhouse gasses? Securing a Sustainable Environmental Future (Storrs, CT USA). October 2023

- **Mack, C., F. Gigliotti, A. Helton, M. Kollegger, M. Meadows-McDonnell, N. Nelson, Lawrence, B.A..How do sediment additions to submerging saltmarshes alter methane dynamics? UConn Frontiers in Undergraduate Research. April 15, 2023. Storrs, CT. USA
- **Arteaga-Payares, S., F. Gigliotti, A. Helton, C. Elphick, M. Kollegger, M. Meadows-McDonnell, N. Nelson, Lawrence, B.A..How does crab activity in sediment-amended salt marsh restorations alter the flux rates of greenhouse gasses? UConn Frontiers in Undergraduate Research. April 15, 2023. Storrs, CT. USA
- ***Hall, K., Meadows-McDonnell, M., Cane, C. How does burrow distribution of fiddler crabs in experimental TLP plots affect marsh vegetation growth? Youth in STEM: A Leadership & Changemaker Summit (Hartford, CT USA). April 1 2023.
- *Kollegger, M., Nelson, N., Meadows-McDonnell, M., Gigliotti, F., Huang, M., Elphick, C., Lawrence, BA, Helton A. Managing coastal marshes in the face of sea level rise: thin layer placement and soil pore water chemistry. Joint Aquatic Sciences Meeting (Grand Rapids, MI USA). May 2022
- Nelson, N., Meadows-McDonnell, M., Kollegger, M., Gigliotti, F., Huang, M., Elphick, C., Helton, A., Lawrence, BA. Effects of thin layer placement restoration on plant growth in Long Island Sound salt marshes. Joint Aquatic Sciences Meeting (Grand Rapids, MI USA). May 2022
- *Kollegger, M., Nelson, N., Meadows-McDonnell, M., Gigliotti, F., Huang, M., Elphick, C., Lawrence, BA, Helton A. Managing coastal marshes in the face of sea level rise: thin layer placement and soil pore water chemistry. New England Estuarine Research Society (Salem MA USA). June 2022. Award Winning

FUNDS LEVERAGED: *(If this Sea Grant funding facilitated the leveraging of additional funding for this or a related project, note the amount and source below.)*

- CT Sea Grant. $150,000. Leveraging sediment addition experiments across the Long Island Sound to examine medium-term ecosystem responses. B. Lawrence (PI), C. Elphick, A. Helton, M. Huang. 2024-2026.
- EPA Long Island Sound Study: Testing the effects of vegetation on saltmarsh ecology, services, and restoration success: from microbial ecology and biogeochemistry to wildlife conservation. $909,748. C. Elphick, B. Lawrence (Co-PI), A. Helton, B. Steven, M. Huang. March 2023- Feb 2025.
- *M. Meadows-McDonnell. Student Conference Travel Grant, The Wetland Foundation ($1,600). How does the texture of added sediment affect carbon sequestration of restored coastal salt marshes? Will present findings at the Ecological Society of America conference, August 2024.
- *M. Meadows-McDonnell. 2023 Student Research Grant, New England Chapter, Society of Wetland Scientists ($1,000). How does the texture of added sediment affect carbon sequestration of restored coastal salt marshes?

F. STUDENTS: ***(****Document the number and type of students supported by this project.)*
*Note: **"Supported"** means supported by Sea Grant through financial or other means, such as Sea Grant federal, match, state and other leveraged funds. "**New"** students are those who*

have <u>not</u> *worked on this project previously. "**<u>Continuing"</u>** students are those who **have** worked on this project previously. If a student volunteered time on this project, please use section G, below.*

Total number of **<u>new*</u>** K-12 students who worked with you: 1
Total number of **<u>new</u>** undergraduates who worked with you: 9
Total number of **<u>new</u>** Masters degree candidates who worked with you: 0
Total number of **<u>new</u>** Ph.D. candidates who worked with you: 1

Total number of **<u>continuing**</u>** K-12 students who worked with you: 0
Total number of **<u>continuing</u>** undergraduates who worked with you: 1
Total number of **<u>continuing</u>** Masters degree candidates who worked with you: 0
Total number of **<u>continuing</u>** Ph.D. candidates who worked with you: 2

Total number of volunteer hours: 80

*(Note: *<u>**New**</u> students are those who have <u>not</u> worked on this project previously.*
***<u>**Continuing**</u>** students are those who have worked on this project previously.)*

In the case of graduate students, please list student names, degree pursued, and thesis or dissertation titles related to this project.

Student Name: Franco Gigliotti
Degree Sought: Ph.D.
Thesis or Dissertation Title: Threats to avian tidal marsh communities of northeastern USA and implications for conservation and restoration
Date of thesis <u>completion:</u> May 2025
Expected date of graduation: May 2025

Student Name: Madeline Kollegger
Degree Sought: Ph.D.
Thesis or Dissertation Title: Managing coastal marshes in the face of sea level rise: Thin layer placement and soil pore water chemistry
Date of thesis <u>completion:</u> May 2025
Expected date of graduation: May 2025

Student Name: Madeleine Meadows-McDonnell
Degree Sought: Ph.D.
Thesis or Dissertation Title: Human impacts on plant species dominance and carbon cycling in salt marshes
Date of thesis <u>completion:</u> December 2024
Expected date of graduation: December 2024

G. <u>VOLUNTEER HOURS:</u>

(List the number of hours provided to the project by volunteers, i.e., individuals who were not compensated in any way or for whom involvement is not part of their paid occupation. This could be students or citizens. What was their contribution?)

- Student volunteers assisted with experimental setup of sediment addition plots. We had 15 student volunteers who helped three days, ~8 hours per day, for a total of 120 volunteer hours. Volunteers helped shovel soil into buckets, move buckets from the staging ground to the marsh, place sediment in the experimental plots, and smooth added sediment with rakes.
- We recruited volunteer graduate students to help us during our experimental plot monitoring of vegetation, water and GHG sample collection. We estimate that we had an additional 80 hours of student volunteer support

H. PICTORIAL: Please provide high resolution images/photos of personnel at work, in the field or laboratory, equipment being used, field sites, organism(s) of study. Attach images as separate files (do not embed). Include links to websites associated with the research project. Please include proper photo credits and a caption with date, location, names of people, and activity. These images are useful to document your project in future CTSG publications, websites and presentations.

I. HONORS AND AWARDS: *(List any honors or awards received during the reporting period, for anyone working on the project. This can be for best paper or poster, university awards, etc.*) Specify:

1) Beth Lawrence, Excellence in Teaching Award; University of Connecticut, College of Agriculture Health and Natural Resources Alumni (UCAHNRA); March 2023
2) Beth Lawrence, Outstanding Educator Award; Society for Wetland Scientists; June 2022
3) Beth Lawrence, Mentorship Excellence Award, UConn Office of Undergraduate Research, Excellence in undergraduate research mentorship, Date: March 2021
4) Ashley Helton, Mentorship Excellence Award, UConn Office of Undergraduate Research, Excellence in undergraduate research mentorship, Date: March 2024
5) Ashley Helton, Excellence in Research Award, UConn, College of Agriculture, Health and Natural Resources; March 2024
6) *Madeline Kollegger, Honorable Mention for the Dean Prize for Best Graduate Student Poster Presentation at the New England Estuarine Research Symposium; November 2022.

J. DATA MANAGEMENT PLANS: Proposals funded in 2014-2016 and later cycles are required to have a data management plan in place. All environmental data and information collected and/or created must be made visible, accessible, and independently understandable to general users, free of charge or at minimal cost, in a timely manner (typically no later than two years after the data are collected or created). This is a reminder that your CTSG funded research data needs to be archived and accessible as outlined in the data management plan you submitted with your proposal. If there have been any modifications, adjustments or new information available regarding the location, timing, type, formatting and metadata standards, content, sharing, stewardship, archiving, accessibility, publication or security of the data produced please elaborate here.

FOR FINAL DEVELOPMENT AND RESEARCH GRANT REPORTS, PLEASE COMPLETE THIS SECTION:

K. PROJECT OUTCOMES AND IMPACTS

RELEVANCE OF PROJECT: *(Describe briefly the issue/problem / identified need(s) that led to this work.)*

Rising seas and limits to marsh migration pose serious threats to remaining Long Island Sound (LIS) tidal marshes and the services they provide, with up to 97% of high elevation salt marsh projected to be lost by 2100. Implementing restoration techniques that build elevation capital and promote coastal resilience, such as thin layer placement (TLP), is key to tidal marsh maintenance and a high priority for regional managers. However, we lack well-tested guidelines for TLP implementation in LIS and along the broader northeastern Atlantic coast.

RESPONSE: *(Describe briefly what key elements were undertaken to address the issue, problem or need, and who is/are the target audience(s) for the work.)*

Our research directly addresses this critical need by implementing a multi-site field experiment examining how sediment texture and tidal range alter the effectiveness of TLP application. We measured sediment, plant, and greenhouse gas flux responses to our experimental treatments over three growing seasons and are leveraging our agency partnerships to compare responses from management scale TLP applications in the same three marshes. Our work will increase the ability for managers to make informed decisions, increase science-directed management of the region, and ultimately enhance coastal resiliency. Leveraging this research, we received a CTSG grant to continue monitoring these experimental plots in 2024 and 2025, as well as convene a workshop for LIS coastal managers on the opportunities and challenges associated with adding sediment to submerging marshes (planned September 23, 2024). We also advanced STEM engagement in the region by providing research opportunities for undergraduate and graduate students, involving youth in coastal conservation projects, and developing an interactive TLP restoration case study for high school teachers.

RESULTS: *(Summarize findings and significant achievements in terms of the research and any related education or outreach component; cite benefits, applications, and uses stemming from this project, including those expected in the future. Include qualitative and quantitative results.)*

Consider the following as they apply to your research and any related outreach/education.

- What are the environmental benefits of this work? Have policies been changed? How has conservation (of ecosystems, habitats or species) been improved?
    - Our research advances understanding of how sediment textures representative of LIS dredge types affect TLP outcomes in LIS coastal marshes. Our preliminary findings suggest that sediment addition responses vary among sites with different tidal ranges and site histories, and that complex interactions among the sediment, flora and fauna exist. We observed greater aboveground biomass responses in high than low marsh habitats, but not consistent differences among texture types. A nitrogen-rich fine, textured dredge can promote aboveground biomass and crab activity, but exceeding

threshold levels of crab activity can reduce plant biomass. Sediment texture does not appear to have a strong affect on porewater chemistry or carbon gas fluxes, though adding sediment of any texture may mitigate methane emissions by reducing the frequency of inundation.
    - We are developing best management practices to increase capacity of LIS coastal managers to effectively use TLP in marshes with different dredge sources, tidal ranges, and target habitats to improve coastal resilience. We will be convening a workshop for ~50 coastal managers in September 2024 to discuss the challenges and opportunities for this restoration technique.
    - Our work will ultimately promote the climate resilience of LIS coastal marshes by quantifying responses to various TLP approaches implemented across a range of sites and two important coastal habitats (low and high salt marsh).

- What are the social payoffs of this work? Who has benefited from this work? Have attitudes / behaviors of target audience changed? Elaborate. Have policies been changed?
    - We provided meaningful experiential learning opportunities for a high school student, 10 undergraduates, and 3 graduate students to promote environmental stewardship, engagement and professional development in STEM fields. Together, we have given 20 (11 oral presentations, 9 posters) presentations on our preliminary findings to diverse audiences including local, regional and international audiences.
    - We are increasing the capacity of regional educators to engage high school students in a regionally relevant case study on salt marsh restoration. This case study was developed with an award-winning regional high school teacher and is in the final stages of polishing before being publicly disseminated via the CT National Estuarine Research Reserve website: https://estuarineresearchreserve.center.uconn.edu/data-mysteries/

- What are the economic implications / impacts of this work? (Where possible, please quantify.) Have new businesses been created /or existing businesses retained as a result of this research? Have new jobs been created or retained? Are new businesses or jobs anticipated?
    - We are unaware of any direct economic implications of this work, though as sediment addition becomes more widely implemented, we anticipate higher ecosystem service provisioning by restored tidal marshes which are highly valued.

J. Stakeholder Summary (This is an abstract of your research and findings written for a lay audience)

Thin layer placement is the application of sediment to wetlands vulnerable to sea level rise to increase elevation and decrease inundation frequency. Although there is broad enthusiasm for the beneficial reuse of dredge material to restore drowning marshes, we lack well-tested guidelines for how to implement this management approach in the Long Island Sound region. We combined *in situ* experimental sediment addition manipulations and field surveys of planned larger-scaled projects to explicitly address aspects relevant to coastal managers. We tested how five different sediment textures (no amendment control, silt-loam, loam, sand, cobble) placed ~7 cm deep on top of the existing marsh surface (low vs high marsh) at three marshes across coastal Connecticut (Stratford, Guilford, East Lyme) in a full factorial design (five-fold replication, total of 150

experimental plots). We monitored a suite of ecosystem responses (vegetation, water and sediment chemistry, greenhouse gas fluxes) over the first three growing seasons (2021-2023). We observed diverse plant responses across sites, habitats, and texture treatments. At our most frequently inundated site, a fine-textured dredge increased aboveground biomass more than our sand treatment. Moderate levels of fiddler crab activity promotes plant growth, but beyond a threshold of 200 burrows per m^2 reduces plant abundance. Preliminarily, sediment texture does not appear to have a strong effect on porewater chemistry or carbon gas fluxes, though adding sediment of any texture may mitigate methane emissions by reducing the frequency of inundation. Together, our preliminary findings suggest that the texture of applied sediment can have important consequences on vegetation responses, but physiochemical responses appear less sensitive to different textures. Our continued monitoring of this experiment will inform TLP best management practices regarding sediment texture types in the region.