

Initiation of Thin-Layer Sediment Augmentation on the Pacific Coast

QUARTERLY PROGRESS REPORT NO. 2

Date: January 1, 2016

Project Title: Initiation of Thin-Layer Sediment Augmentation on the Pacific Coast

Funding Sources:

U.S. Fish and Wildlife Service - 2015 Cooperative Recovery Initiative

Grantee: San Diego NWRC

Total Grant Amount Awarded: \$ \$502,425 Grant Term: September 30, 2018

California Department of Fish and Wildlife – Wetland Restoration for Greenhouse Gas Reduction

Grantee: U.S. Fish and Wildlife Service, San Diego NWRC (Grant No. P1496011 00)

Total Grant Amount Awarded: \$1,055,827 Grant Term: March 1, 2020

California State Coastal Conservancy

Grantee: Southwest Wetlands Interpretive Association (SWIA)

Total Grant Amount Awarded: \$632,500

Orange County, California - OC Parks

In-kind Contribution (sediment, application/contracting): \$1,064,550

U.S. Army Corps of Engineers - Ecosystem Management and Restoration Research Program

Total Funding Contribution: \$50,252

Activities Performed from October 1, 2015 - December 31, 2015:

- SWIA continues to work on contracts for carbon-related analysis, pre- and post-sediment augmentation monitoring, and aerial photography and photogrammetric mapping services, actions which will be funded with CDFW and/or California Coastal Conservancy grant funds.
- The Refuge Complex hired a term biologist (Rick Nye) for the Seal Beach NWR to assist in project monitoring and management during and after sediment augmentation. The funds for this position come from a USFWS Cooperative Recovery Initiative grant, which provides matching funds for the CDFW grant.
- On October 27, 2015, the Orange County Board of Supervisors awarded a contract to Curtin Maritime, Corp. for the Sunset/Huntington Harbour Maintenance Dredging and Waterline Installation project (which includes disposal of clean sediment onto the Refuge's sediment augmentation site).

- Refuge staff, representatives from Orange County (OC) Parks, and Curtin Maritime, Corp. attended several meetings with Navy and DOD personnel to coordinate the sediment augmentation process with Navy activities occurring in Anaheim Bay and to address Navy requirements for working in the area. All necessary leases, agreements, and approvals have now been received from the Navy for this project.
- USGS and Refuge Staff (Rick Nye, Wildlife Biologist) are finalizing turbidity monitoring protocol (using a handheld device) for monitoring around the sediment augmentation site during sediment application.
- Marine Taxonomic Services, Ltd. (MTS) performed preconstruction sonar and SCUBA surveys for eelgrass and *Caulerpa* within the study area and the reference area on October 15, 2015 and October 27, 2015. The side-scan sonar record was digitized to produce the eelgrass maps of the study and reference areas. The mapping identified 110,892 square meters of eelgrass and 160,233 square meters of eelgrass habitat within the 26.32 hectare study area. No *Caulerpa* was found at this site. A final report was issued on November 30, 2015) and delivered to NOAA NMFS on December 11, 2015; to the Corps and Coastal Commission on December 14, 2015, and to the Regional Board on December 31, 2015.
- The USFWS provided all researchers on the project with the opportunity to attend a Motorboat Operator Certification Course (MOCC) held December 15 – 17) to provide participants the first level of training required for the operation of motorboats while working on the Refuge. The course included classroom and on-the-water instruction covering vessel preparations and trip planning, legal requirements, operating techniques, navigation, emergency procedures (obstacle avoidance, visual distress signals, fire suppression, and rescue techniques), trailering, and trailer backing. There were practical exams requiring proficiency in close-quarters boat maneuvering, rescue techniques, knot tying, and trailer backing, and a written exam requiring a minimum grade of 70 percent.
- USGS (Sediment Flux) – USGS redeployed the two YSI 6600 EDS multiparameter sondes and one Nortek acoustic Doppler current profiler (ADCP) to their original locations in the tidal channels adjacent to the project site on October 12, 2015. The instruments had previously been removed for annual maintenance. Water samples were collected on October 13, 2015 in order to calibrate turbidity readings to suspended sediment concentration (SSC).

From December 5, 2015 through December 11, 2015, USGS worked at the site to download data, perform routine maintenance of the equipment, and demonstrate equipment to Seal Beach NWR collaborators. At the site visit, all instruments were removed from the field, cleaned, downloaded, calibrated, and redeployed in their original locations. USGS has encountered high levels of biofouling on YSI probes, possibly due to unusually warm fall water temperatures because of El Nino. More frequent site visits are being done to adequately maintain monitoring equipment under these conditions.

Preliminary time-series have been generated of water level, depth-averaged water speed, suspended sediment concentration (SSC), and flux per unit area of the creek cross-section at the ADCP site over the November 2014-June 2015 period. These time series will act as baseline data to assess what effect the augmentation will have on sediment dynamics.

A USGS and UCLA peer-reviewed publication (Rosencranz et al. 2015, *Estuaries and Coasts*) was released in December, 2015 that summarizes sediment flux baseline conditions for the Seal Beach NWR Refuge and an additional US Navy coastal installation.

- USGS (Marsh Plain Surface Elevations) - From October 21, 2015 through October 23, 2015 and December 1, 2015 through December 3, 2015, USGS took measurements at all 25 surface elevation tables (SETs) on the Refuge to establish pre augmentation conditions. At each reading,

sediment coverage of feldspar plots was assessed and marker horizon depth was measured at fully covered plots. Preliminary results for all 25 SETs have been generated. Original SETs installed during December of 2013, as part of a different study on the Refuge, provide a baseline dataset of elevation change for 726 days as of the most recent reading in December 2015. These data show cumulative elevation change of +2.78 mm over the time period.

The SETs installed in August of 2015 for the purpose of monitoring the sediment application project provided a preaugmentation baseline data of elevation change for 97 days as of the most recent reading in December 2015. These data show an average cumulative elevation change of +4.75 mm over this time period. The control site SETs showed an elevation change of +2.86 mm whereas the augmentation site showed an elevation change of +5.31 mm over the time period. A summary of this data is presented in Attachment 1. These data series will act as baseline data to assess elevation change with sediment application to the marsh surface.

- UCLA (Sediment Thickness, Bulk Density, Tidal Creek Geomorphology) - A total of 24 feldspar plots have been installed within the sediment augmentation area, each marked with PVC stakes at each corner. These plots are generally co-located (established approximately 3 meters away) from CSULB's plant/invertebrate plots. Another 14 feldspar plots were installed at the control site. These plots were also marked with PVC stakes at each corner and co-located with CSULB's plots.

UCLA established 8 creek cross-sections at the sediment augmentation site and 4 at the control site. Each cross-section was marked by a PVC stake on each creek bank approximately 3 meters from the bank, and was surveyed for the initial cross-section data.

Sediment stakes were installed at the sediment augmentation site on a 20m grid. The protocol originally envisioned a 40m grid, but when that grid was established it was determined that a finer grid would provide useful information about the variation in sediment thicknesses across the site. To avoid having too many stakes on the site that cannot be disturbed by the contractor, only the 40m grid sediment stakes were flagged with pin flags. The 20m grid stakes were not flagged so they might be disturbed during sediment addition, but any undisturbed stakes will be sampled in the future. Sediment stakes were also installed at the sediment depth test plots.

- Chapman College (Gas Flux) - Gas samples were collected at the project site from dark flux chambers on 7 November, 2015 and at the control site on 30 November, 2015. These were partial samplings to test methods and to determine logistics of larger sampling event at this site. A complete sampling event was conducted at the augmentation site from dark flux chambers on 6 December, 2015.

Researchers analyzed CO₂ and CH₄ in gas samples from all sampling events. The majority of these samples are highly linear ($r^2 > 0.90$) suggesting that the chambers are working well.

Porewater samples were collected from the augmentation site on 6 December, 2015 coincident with gas samples. These have been analyzed for salinity and frozen for future chemical analyses.

- CSULB (Biomass, Plant Physiology) – Plant parameters (e.g., total cover, species richness, heights) and abiotic data were collected on a quadrat basis within both the augmentation and control sites during November and December 2015. Plant physiology data was collected on augmentation plots (several field days throughout December 2015).

CSULB also assisted in the collection of deep sediment cores with UCLA. These cores are currently stored at UCLA and will be split for analysis in the upcoming quarter.

Fall 2015 invertebrate cores were collected from the augmentation, control, and threshold sites during several field days throughout December 2015. To date, 20 invertebrate cores from Spring 2015 have been processed (representing 9 cores in this quarter).

Stable isotope samples were collected on the augmentation and control sites during several field days throughout December 2015. In addition, fish, crab, and sediment samples were collected for food web analysis.

- UCLA (Sediment Coring) – Sediment coring has been completed in both the augmentation site and the control site for the purpose of assessing the current net sediment accretion rates and carbon accumulation rate (CAR). The data obtained from these cores will facilitate evaluation of the long-term storage and temporal scale of carbon storage at the site and will provide an estimate of current carbon stock and historic and current CAR. Once we have this data, we can provide information regarding project benefits.

During November 2015 researchers from UCLA took surface samples to characterize foraminifera and sediment conditions at various marsh elevations. A total of 20 surface samples were collected. High-resolution GPS data was also collected on locations and elevations at the core collection sites and pore water data was collected at each site.

On November 5th, 12th, and 20th, researchers from UCLA collected 6 sediment cores from the control site and 12 cores from augmentation sites. In total, cores were taken near vegetation plots set by CSULB researchers, exact GPS locations are presented in Attachment 5. All cores taken were at least 100 cm in depth and many reached 200 cm or slightly more.

Foraminifera analysis on all surface samples is underway. Cores from control and augmentation sites have been transferred to UCLA facilities where they are being stored at 4°C. Magnetic susceptibility has been performed and results are being processed.

- Shorebird surveys of the project area continued during the October to December quarter. Shorebird surveys are conducted twice monthly, once during a high tide and once during a low tide. The annual monitoring of Light-footed Ridgway's rail will begin in March, but Rick Nye, the project biologist, will be onsite during sediment augmentation to ensure that the site is free of rails and other birds during the augmentation process.
- A new partner, the U.S. Army Corps of Engineers Research and Development Center, has joined the team. The Corps has provided funding and staffing for a pre-sediment augmentation RTK survey of the project site. USGS and Corps staff (a team of 4) completed the ten-day RTK survey in mid-December after taking 13,068 RTK points. Data processing will be completed in January. This will provide very accurate elevation data for the site. The Coastal Conservancy will fund post augmentation aerial photography and photogrammetric mapping services for the site to establish site elevations immediately following the completion of sediment augmentation.
- Two field cameras, purchased with USFWS station funds, have been set up to capture changes at the augmentation site from pre-augmentation through the 5-year monitoring period. One camera is located to the south of the project boundary on the same marsh peninsula and the other has been placed directly west of the westernmost point of the site across the channel. Final checks are being made from each location. Images will be periodically downloaded and a video of the augmentation process will be prepared using the still photos. Subsequent videos will illustrate the changes in vegetation overtime.
- Sediment Augmentation – Noticing requirements, Navy approvals, and the holidays have resulted in a delay in the start of the sediment augmentation process. The Navy approved the layout site for constructing the required slurry pipeline on December 30, 2015. Sediment augmentation is expected to begin in the second week in January, with site preparation occurring in the first week of January.

The Refuge Manager conducted an Environmental Conditions Review with the sediment augmentation contracting team on December 22, 2015.

The contractor is currently assembling the slurry pipeline on adjacent Navy land and the sediment placement plan, prepared by the contractor, has been reviewed and approved by the Refuge Manager.

- Sediment Augmentation Team Conference Calls continue to be conducted regularly to ensure that all required activities are being conducted as proposed and on time. We also use this time to discuss any problems and catch up on new information. This quarter, these calls were held on October 27, November 19, and December 22, 2015.
- Outreach - Kirk, Evyan, and Vicki participated in a conference call on October 30, 2015 with others across the State interested or involved in thin-layer sediment augmentation project. A future call will be scheduled to discuss project monitoring efforts.

Kirk gave a project presentation to about 30 people at the 2015 Climate Summit, held on November 2 and 3, 2015, in Sacramento, California. The focus of the summit was *"Bridging the gap—from science to management action in climate adaptation."*

At the Coastal and Estuarine Research Federation 2015 Conference, held in Portland, Oregon on 8-12 November 2015, our Coastal Conservancy partner Evyan Borgnis prepared and presented a very informative poster about our sediment augmentation project. The event provided great outreach.

Karen Thorne (USGS) gave a talk at the American Geophysical Union (AGU) meeting in December in San Francisco regarding the benefit of researchers working with managers and used our project as a positive example. The talk, which was attended by several hundred people, was well received.

The Refuge is in the process of updating the project website.

Project Benefits and Results:

It is too early in the project to address project benefits and results. Once all the data is analyzed from the pre-sediment augmentation data collection effort conducted this past quarter, we will have a much clearer understanding of the carbon benefits currently being provided by the salt marsh habitat within the Refuge. Following sediment augmentation, we will once again collect data that overtime will provide information about the changes in carbon benefits associated with improving habitat quality in a southern California salt marsh.

List of Proposed Activities and Tasks for the Next Quarter:

Task 1 – Project Management and Administration

Continue to monitor the performance of subcontractors, monitor the sediment augmentation process (e.g., record effectiveness of application methods and sediment retention, prepare a narrative of the process as it proceeds), assist researchers in the field following sediment application, process invoices, prepare for the next quarterly report, and implement all other responsibilities that may be necessary to successfully complete the project.

Task 2 – Sediment Augmentation

Facilitate the sediment augmentation process, which is expected to begin the second week in January 2016. Coordinate with OC Parks, their dredging contractor, and the Navy to ensure that sediment augmentation is completed in compliance with all permitting requirements, safety requirements, and biological monitoring requirements. Provide biological monitoring at the site during augmentation. Work with the contractor to ensure that the sediment augmentation process is adaptively managed and actions taken to achieve the project goals are recorded and any lessons learned are captured and fully addressed.

Task 3 – Project Monitoring

Sediment augmentation – USFWS staff working with USGS and the sediment augmentation contractor will monitor turbidity levels in adjacent tidal channels during the augmentation process, routinely examine the slurry pipe line for potential leaks, monitor for the potential presence of rails and shorebirds on the project site, and monitor for the potential presence of sea turtles and marine mammals in adjacent subtidal areas. If any sensitive species are identified in proximity to the project site, USFWS will ensure that appropriate avoidance measures are implemented and any required contacts with NOAA regarding sea turtle or marine mammal observations are made in a timely manner. USFWS, working with the contractor, will document the sediment augmentation process to record methods used, problems encountered, and lessons learned.

Shorebird surveys will continue through the quarter and Refuge wide monitoring of light-footed Ridgway's rail will begin in late February/early March.

Post Augmentation - Implement a post augmentation eelgrass survey in accordance with NOAA NMFS standards.

At two months following the completion of sediment augmentation, UCLA will conduct the following activities:

1. Sampling the 24 feldspar plots in the sediment augmentation area (SAA). The thickness of the sediment over the feldspar will be measured and sediment samples will be taken for bulk density and carbon analyses. The distance from the top of the stakes marking the plots to the sediment will be measured.
2. Sampling the 14 feldspar plots in the control area (CA). The thickness of the sediment over the feldspar will be measured and sediment samples will be taken for bulk density and carbon analyses. The distance from the top of the stakes marking the plots to the sediment will be measured.
3. Conducting tidal creek cross-section surveys in the SAA. The distance from the top of the stakes marking the cross-section transect to the sediment will be measured.
4. Conducting tidal creek cross-section surveys in the CA. The distance from the top of the stakes marking the cross-section transect to the sediment will be measured.
5. Measuring distance to sediment from the top of the sediment stakes.
6. Laboratory analyses of bulk density, grain size, and carbon content (loss on ignition [LOI]).
7. Data entry and analysis.

UCLA researchers working on core dating will be coordinating with researchers at CSULB to process cores for belowground biomass. In January, sampling for ^{14}C , ^{137}Cs , and ^{210}Pb will take place. Radiocarbon samples will be processed at UC Irvine in the 1st week of February. Cesium and lead samples will be sent to USC. Following these processes, cores will be sub-sectioned in to 1cm depth intervals and LOI analysis of 1 cm³ from each (to the depth of 100cm) will be performed.

Post augmentation gas flux measurements at both the augmentation site and control site will be completed once the site is stable enough to allow access. Work will continue on refining the analytical method for N₂O analysis on the gas chromatograph and all samples collected to date will be analyzed.

CSULB will coordinate splitting of carbon sequestration cores with UCLA and process the cores for belowground biomass. Spring data collection will begin in April.

USGS will collect data from the YSIs and ADCP and conduct regular maintenance immediately following augmentation. Water samples will be collected to calibrate the instruments during data downloads. Reading of the SETs will be done immediately following augmentation.

Task 4 – Engineering Design/Environmental Documentation

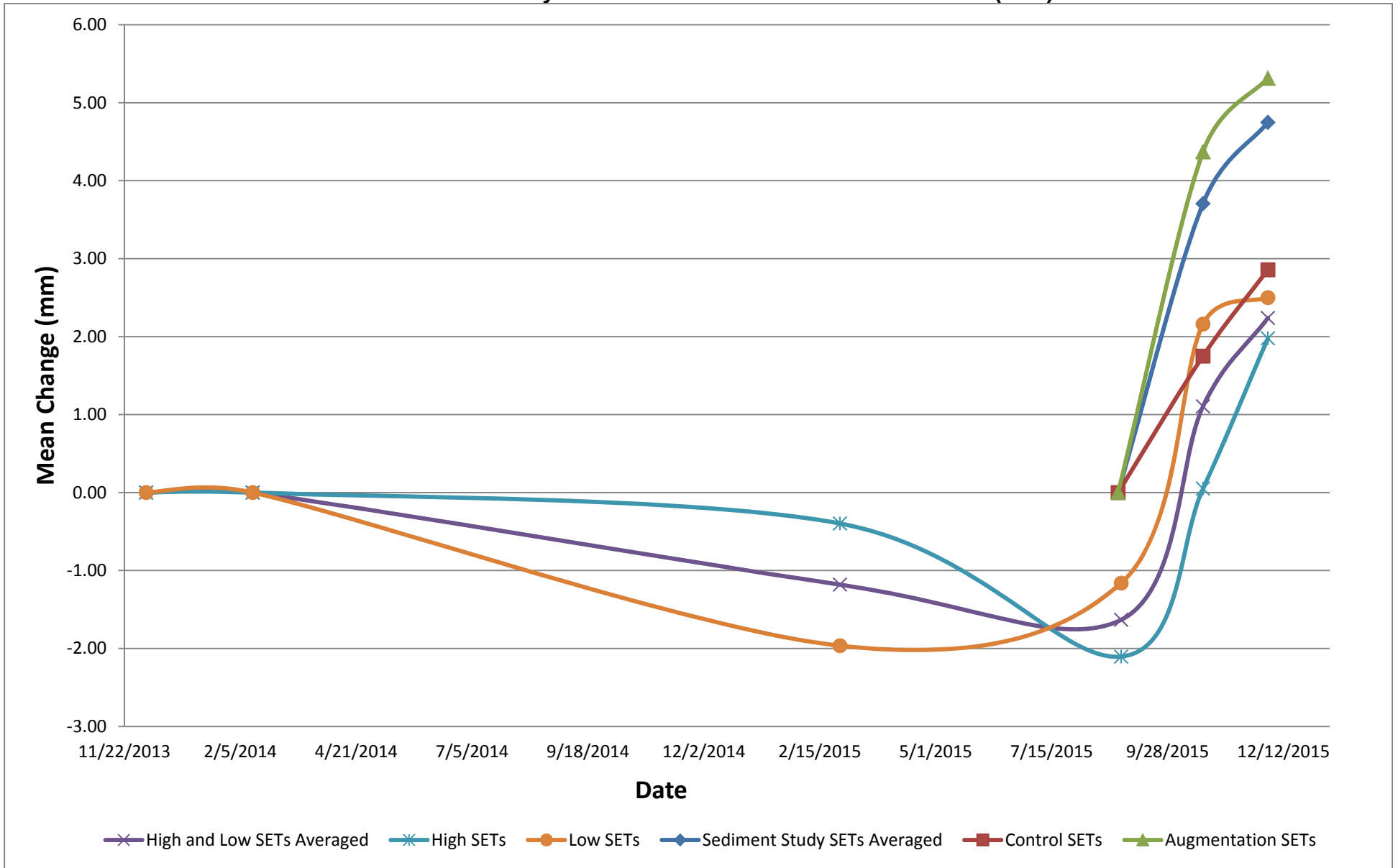
This task has been completed.

Task 5 – Public Participation/Presentations

A webpage has been developed and is being updated for the Seal Beach NWR website. Information about the sediment augmentation project will be posted and progress on the project will be updated as necessary. Acknowledgement of our funding partners will also be provided at that site.

A discussion of the project will be incorporated into a session on climate change adaptation to be presented at the 2016 TWS-Western Section annual meeting to be held in Pomona, CA from February 22 through 26, 2016.

Attachment 1 – Summary of USGS Initial Surface Elevation Table (SET) Data



Presented in this figure is surface elevation table (SET) data for all 25 SETs installed at Seal Beach NWR (cumulative change in millimeters). Increases in elevation (mm) could be a result of resuspension of sediment on the marsh surface from disturbance or settling of the instruments. But, the increases were consistent across all SETs.