Datasets: Adapting Salt Marsh Vulnerability Assessment Methodologies to Southeastern Salt Marshes

This document provides detailed information about three datasets that were generated through a 1 year Catalyst project titled *Adapting Salt Marsh Vulnerability Assessment Methodologies to Southeastern Salt Marshes.* This webpage provides information about the project. The project was supported by the National Estuarine Research Reserve System (NERRS) Science Collaborative, which is funded by the National Oceanic and Atmospheric Administration. All Science Collaborative supported projects that collect new data adhere to federal data sharing and archiving requirements.

About the Associated Project

Project page: https://nerrssciencecollaborative.org/project/Sanger23
Grant Type: Catalyst
Focus Area(s): Habitat Restoration
Keyword(s): habitat mapping, remote sensing, salt marsh

Reserve(s): ACE Basin, SC; North Inlet-Winyah Bay, SC

Project Duration: October 2023 - March 2025
Grant Amount: $119,322.00

Project Contacts:
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Project Description
Home to roughly one third of the Southeast's estuarine salt marsh acreage, South Carolina faces escalating local and state concerns over marsh vulnerability due to rising sea levels. In 2021, the ACE Basin and North Inlet – Winyah Bay (NI-WB) NERRs used capacity building funds to convene a community of managers, regulators, and scientists interested in identifying appropriate methods to assess salt marsh health in South Carolina. As part of this effort, participants expressed interest in exploring appropriate marsh vulnerability metrics – and the associated thresholds that inform decision making – as a possible first step toward understanding the impacts of increasing rates of sea level rise on marshes and developing appropriate restoration strategies.

While a variety of marsh vulnerability metrics have been developed nationally, their direct applicability to Southeastern marshes posed a knowledge gap, potentially due to the sparse vegetation densities that are common across the region. Knowing that several informative metrics could be derived from remotely sensed data, the team's approach utilized satellite and aerial imagery, unmanned aerial systems (UAS), and in situ observation to assess existing marsh vulnerability metrics at multiple spatial scales at the two South Carolina reserves. In exploring the applicability of the existing metrics and thresholds, the team found that the unique nature of South Carolina's salt marshes – largely Spartina alterniflora monocultures that vary spatially and temporally in terms of how sparsely vegetated or covered in water they are – result in higher Unvegetated to Vegetated Ratio (UVVR) thresholds, variability in Marsh Resilience to SLR (MARS), and variability in Normalized Difference Vegetation Index (NDVI) calculations. These findings have major implications for marsh management recommendations as decision makers use these metrics to estimate whether marshes are keeping pace with rates of sea level rise. In particular, the imagery and analyses produced through this project have demonstrated the unique nature of southeastern salt marshes which needs to be considered when evaluating South Carolina marshes.

Overview of Datasets

3 related datasets are described in this document:

- **UAS Imagery of ACE Basin NERR Wetlands and Water Levels:** This dataset has been archived with the NERRS Centralized Data Management Office and can be accessed here.

- **UAS Imagery of North Inlet-Winyah Bay NERR Wetlands and Water Levels:** This dataset has been archived with the NERRS Centralized Data Management Office and can be accessed here.

- **Marsh Metrics for ACE Basin and North Inlet-Winyah Bay NERRs:** This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).

Questions about these datasets can be directed to:
Denise Sanger, ACE NERR, sangerd@dnr.sc.gov

About the Project Datasets
Detailed dataset descriptions are provided below.

Dataset 1: UAS Imagery of ACE Basin NERR Wetlands and Water Levels

Data overview:
High resolution (~2 cm) imagery was collected using NI-WB NERRs DJI M300 RTK airframe and MicaSense Altum 5-band multispectral sensor unmanned aerial system (UAS). Imagery was processed using Pix4D photogrammetry software and ArcGIS Pro 3.2 for classification of vegetated and unvegetated salt marsh areas for use in calibrating lower resolution aerial and satellite imagery at the ACE NERRs Wetlands and Water Levels (WWL) monitoring site.

A 4 band orthomosaic (R G B NIR) is provided from which true color and NDVI layers can be achieved. Imagery is available for two marsh platforms (6.57 hectares) and three marsh platforms (15.9 hectares) for 2021 and 2023, respectively.

See metadata for additional details on sensor specifications.

Search Keywords:
NIR imagery, UAS, drone, RGB imagery, salt marsh, South Carolina

More about the data:

Data collection period:
September 14, 2021; August 9, 2023

Geographic extent:
ACE WWL - Edisto Island, SC
32.507265, -80.326031
32.503944, -80.329900
32.498227, -80.324124
32.500774, -80.320638

File format:
Data are maintained as georeferenced image files (> 20 mb, .tif). SCDNR and USC will also await guidance on listing file names. These are georeferenced .tif and as such contain several associated files (.prj, .tft, .tif, .tif.ovr, and .xml).

File name(s):

2021 ACE
ACE_BASIN_09142021_swmp1_index_red.tif

ACE_BASIN_09142021_swmp1_index_green.tif
ACE_BASIN_09142021_swmp1_index_blue.tif
ACE_BASIN_09142021_swmp1_index_ndvi.tif
ACE_BASIN_09142021_swmp_2_index_red.tif
ACE_BASIN_09142021_swmp_2_index_green.tif
ACE_BASIN_09142021_swmp_2_index_blue.tif
ACE_BASIN_09142021_swmp_2_index_ndvi.tif

2023 ACE
Altum_ACE1_08092023_transparent_reflectance_red.tif
Altum_ACE1_08092023_transparent_reflectance_green.tif
Altum_ACE1_08092023_transparent_reflectance_blue.tif
Altum_ACE1_08092023_transparent_reflectance_ndvi.tif
Altum_ACE2_08092023_transparent_reflectance_red.tif
Altum_ACE2_08092023_transparent_reflectance_green.tif
Altum_ACE2_08092023_transparent_reflectance_blue.tif
Altum_ACE2_08092023_transparent_reflectance_ndvi.tif
Altum_ACE3_08092023v2_transparent_reflectance_red.tif
Altum_ACE3_08092023v2_transparent_reflectance_green.tif
Altum_ACE3_08092023v2_transparent_reflectance_blue.tif
Altum_ACE3_08092023v2_index_ndvi.tif

Data access and archival:
This dataset has been archived with the NERRS Centralized Data Management Office and can be [accessed here](#).

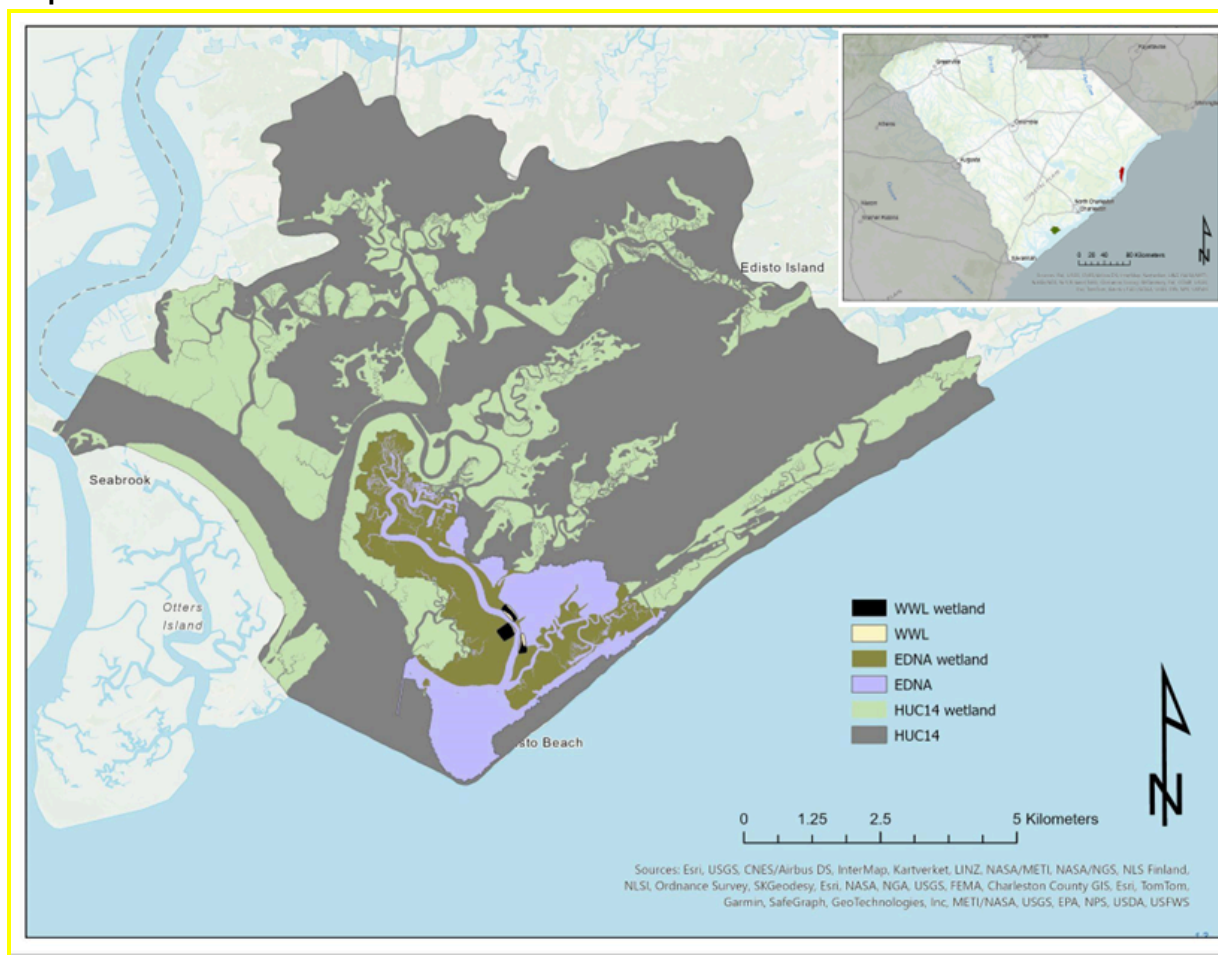**Maps and schematics for data collection:**

Figure 1. Map of the state of South Carolina with the NI-WB (garnet) and ACE (green) HUC14 locations identified. Maps showing the HUC14, EDNA, and WWL boundaries for each area of interest in ACE.

Dataset 2: UAS Imagery of North Inlet-Winyah Bay NERR Wetlands and Water Levels

Data overview
High resolution (~2 cm) imagery was collected using NI-WB NERRs DJI M300 RTK airframe and MicaSense Altum 5-band multispectral sensor unmanned aerial system (UAS). Imagery was processed using Pix4D photogrammetry software and ArcGIS Pro 3.2 for classification of vegetated and unvegetated salt marsh areas for use in calibrating lower resolution aerial and satellite imagery at the NI-WB NERRs Wetlands and Water Levels (WWL) monitoring site.

A 4 band orthomosaic (R G B NIR) is provided from which true color and NDVI layers can be achieved. Imagery is available for two marsh platforms (18.4 hectares).

See metadata for additional details on sensor specifications.

More about the data:

Data collection period:
July 16/30, 2021, July 24/25, 2023

Geographic extent:
NI-WB WWL – Georgetown, SC
33.351292, -79.193855
33.349708, -79.189179
33.337956, -79.206615
33.336296, -79.201798

File format:
Data are maintained as georeferenced image files (> 20 mb, .tif). SCDNR and USC will also await guidance on listing file names. These are georeferenced .tif and as such contain several associated files (.prj, .tft, .tif, .tif.ovr, and .xml).

File name(s):

2021 NI-WB
Altum_SegA_07302021_transparent_reflectance_red.tif
Altum_SegA_07302021_transparent_reflectance_green.tif
Altum_SegA_07302021_transparent_reflectance_blue.tif
Altum_SegA_07302021_index_ndvi.tif
Altum_SegB_07162021_transparent_reflectance_red.tif
Altum_SegB_07162021_transparent_reflectance_green.tif
Altum_SegB_07162021_transparent_reflectance_blue.tif
Altum_SegB_07162021_index_ndvi.tif

2023 NI-WB
AltumPT_SegA_07252023_transparent_reflectance_red.tif
AltumPT_SegA_07252023_transparent_reflectance_green.tif
AltumPT_SegA_07252023_transparent_reflectance_blue.tif
AltumPT_SegA_07252023_index_ndvi.tif
AltumPT_SegB_07242023_transparent_reflectance_red.tif
AltumPT_SegB_07242023_transparent_reflectance_green.tif
AltumPT_SegB_07242023_transparent_reflectance_blue.tif
AltumPT_SegB_07242023_index_ndvi.tif

Data access and archival:
This dataset has been archived with the NERRS Centralized Data Management Office and can be accessed here.

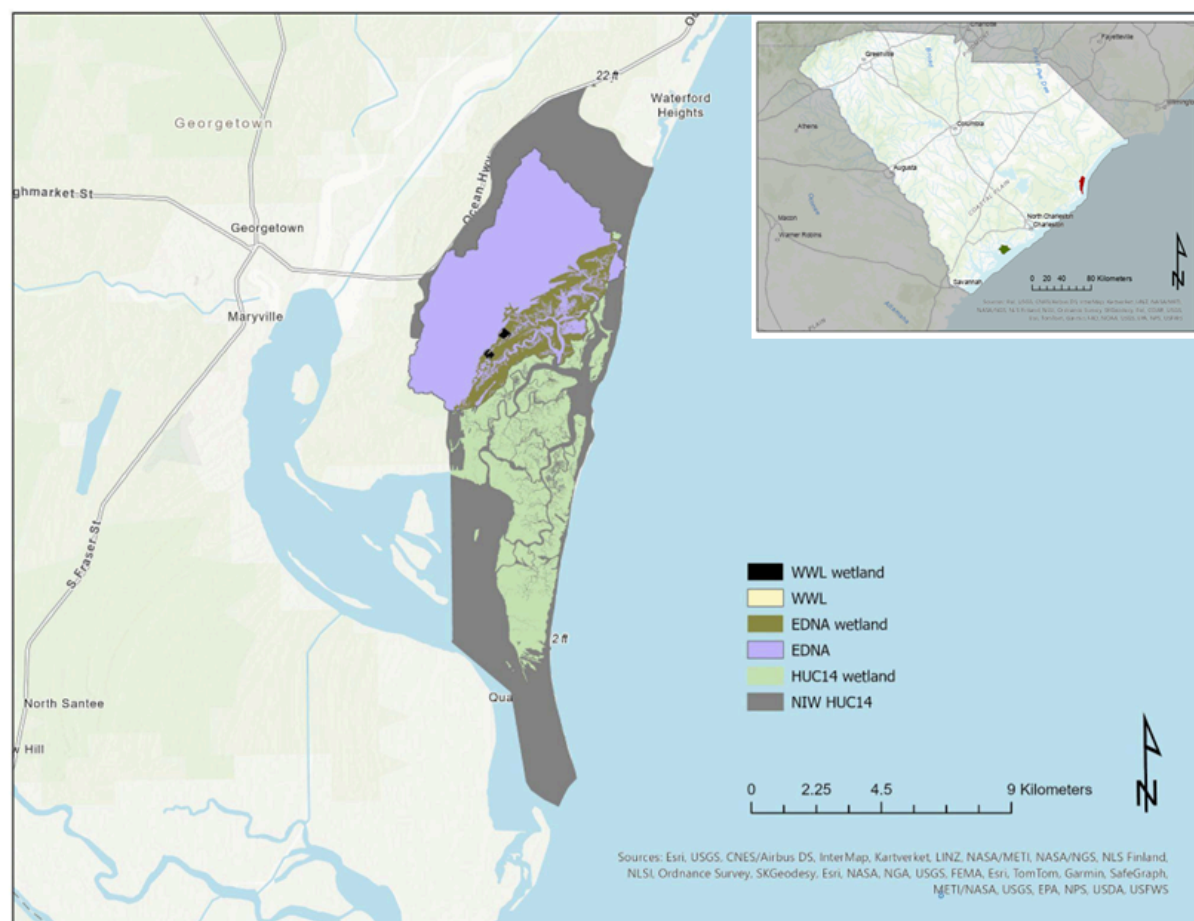**Maps and schematics for data collection:**

Figure 2. Map of the state of South Carolina with the NI-WB (garnet) and ACE (green) HUC14 locations identified. Maps showing the HUC14, EDNA, and WWL boundaries for each area of interest in NI-WB.

Dataset 3: Marsh Metrics for ACE Basin and North Inlet-Winyah Bay NERRs

Data overview
A finalized project approach was developed based on outcomes of the initial project workshop. The following imagery with varying resolutions were included: 1) UAS (<5 cm, dependent on flight height), NAIP (0.6 m), Planet Scope (3 m), and Landsat (30 m, UVVR National Product resolution). NAIP, Planet Scope, and UVVR imagery/layers are publicly available. The marsh metrics below were evaluated (origins in parentheses). Some metrics were developed for each scale (e.g., UVVR NP, percent of marsh below MHW) and others were calculated constants applied across the three scales (e.g., turbidity average, elevation change, tide range).

- Average (MARS) and differential flood-ebb (UVVR) for turbidity in 2021 and 2023
- Directional change of unvegetated to vegetated from percent cover plots (NAMASTE)
- Elevation change from SETs (MARS)
- Percent of marsh below MHW (MARS)
- Percent of marsh in lowest third of the tidal frame (MARS)
- Skewness of marsh elevation distribution (MARS)
- Long term SLR rate (MARS)
- Short term SLR (MARS)
- Tidal range (MARS)
- UVVR National Product % of area below thresholds (UVVR, 30 m pixel resolution)
- Percent of vegetated marsh National Product (UVVR)
- UVVR National Product based on subtraction from percent of vegetated marsh
- UVVR Local % of area below threshold for Planet Scope (PS) and NAIP - 2021 and 2023 (Project Developed using UVVR NP methods)
- Percent of vegetated marsh from UAS to Planet Scope and NAIP – 2021 and 2023 (Project Developed using UVVR NP methods)
- NDVI from various imagery

Metadata is included in the Microsoft Excel file.

Search keywords:
metrics, UAS, drone, UVVR, MARS, salt marsh, South Carolina

Data collection period:
2021 and 2023

Geographic extent:
ACE WWL - Edisto Island, SC
32.507265, -80.326031
32.503944, -80.329900
32.498227, -80.324124
32.500774, -80.320638

NI-WB WWL – Georgetown, SC
33.351292, -79.193855
33.349708, -79.189179

33.337956, -79.206615
33.336296, -79.201798

File format:
Microsoft Excel .xslx

File name(s):
ACE_MarshMetrics_20250601.xlsx
NIWB_MarshMetrics_20250601.xlsx

Data access and archival:
This dataset will be made publicly available within two years of project completion or upon publication of the associated manuscript, whichever is sooner. Data will be archived in the interim with the NERRS Centralized Data Management Office (CDMO).

Maps and schematics for data collection
See UAS imagery for maps of the area(s).