Environmental Research Project Updates

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Kiawah Conservancy Research Projects

Groundwater Table Study (TOKI funded)

Begin investigating the groundwater table on Kiawah Island and establish a long-term monitoring effort. Cooperative effort with Dr. Tim Callahan, Chair, College of Charleston's Geology Department. Currently in Phase II.

Marsh Vulnerability Study (TOKI funded)

Investigate changes in marsh vegetated shoreline position over time and produce maps to plan restoration efforts. Cooperative effort with Dr. Norm Levine, Director, College of Charleston's Santee Cooper GIS and Lowcountry Hazards Lab. Currently in Phase II.

Resilience Project (NFWF ECRF 2019)

Community engagement and environmental planning project focused on obtaining consensus on the future use of nature-based solutions on Kiawah Island. Funded by the National Fish and Wildlife Foundation to pave the way for future restoration projects.

Groundwater Table Study

Objectives

Phase I (2020)

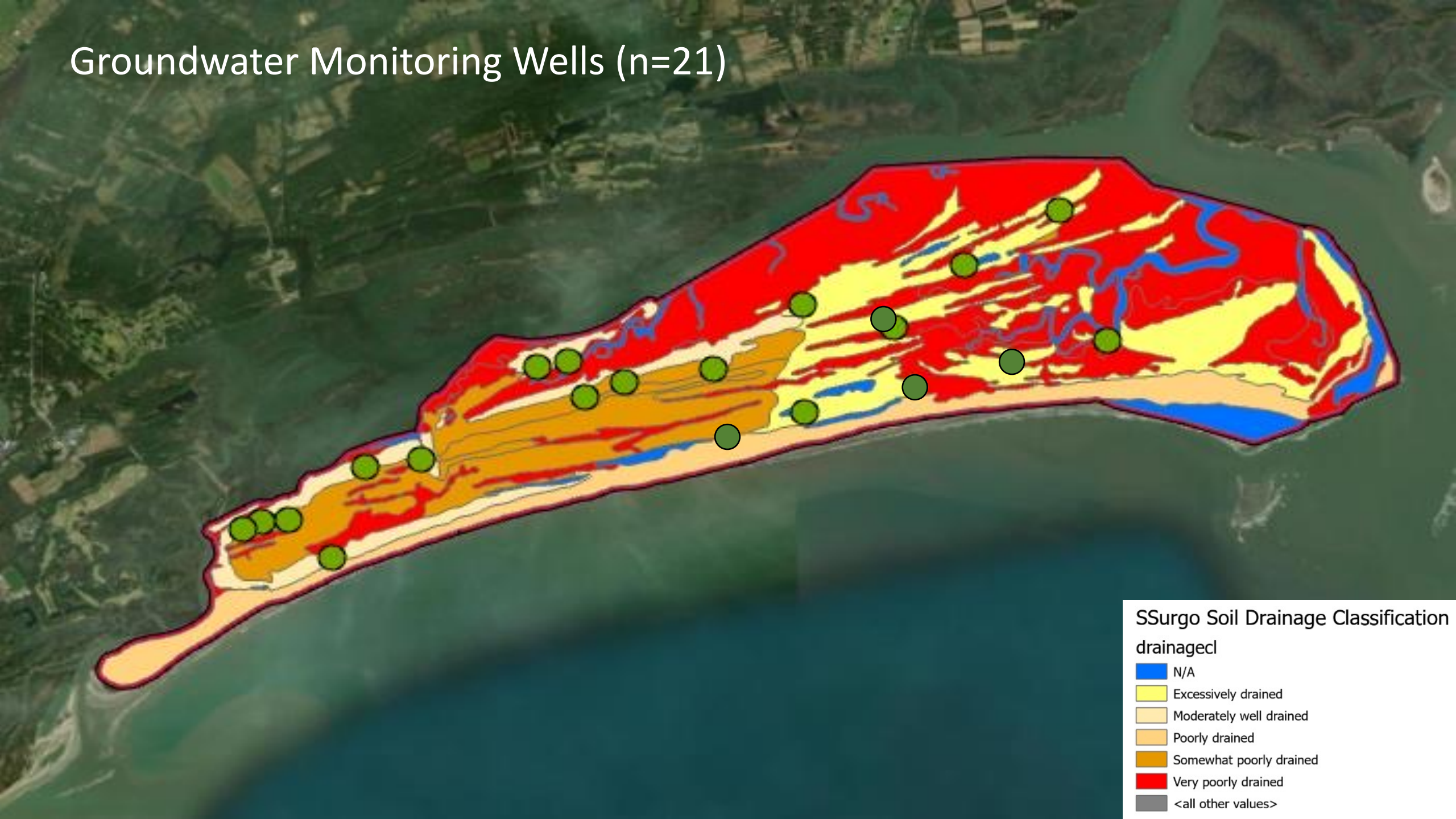
- Establish a series of monitoring wells (21) for long-term studies on groundwater
- Collect data on groundwater elevation and salinity

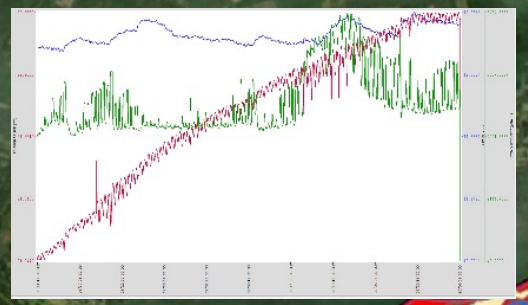
Phase II (2021)

- Continue monitoring efforts
- Investigate contributions to salinity
- Study relationship between ponds and groundwater

Purpose: water resources planning / water budget, monitoring of maritime forest resources

Groundwater Monitoring Wells (n=21)

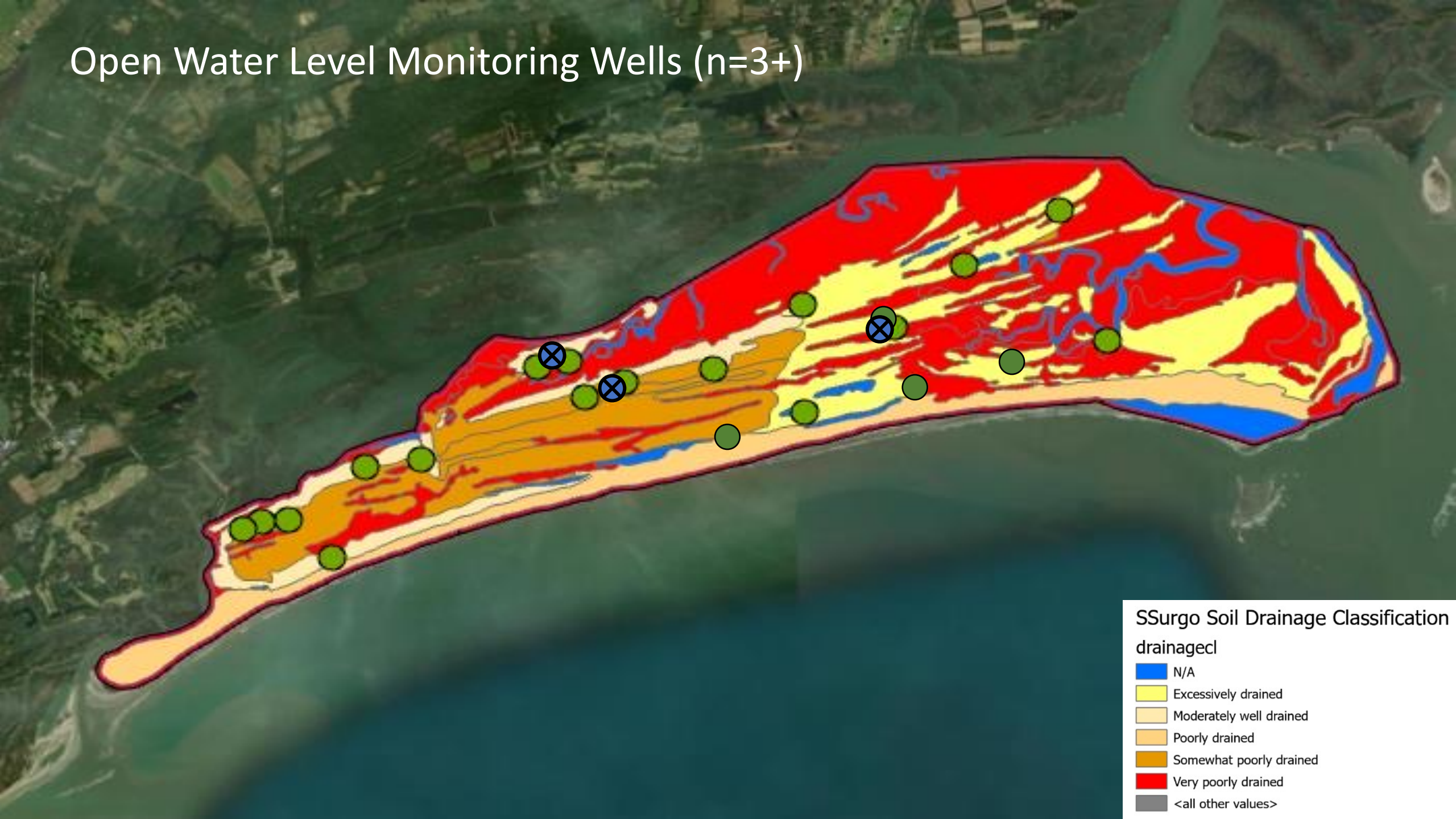


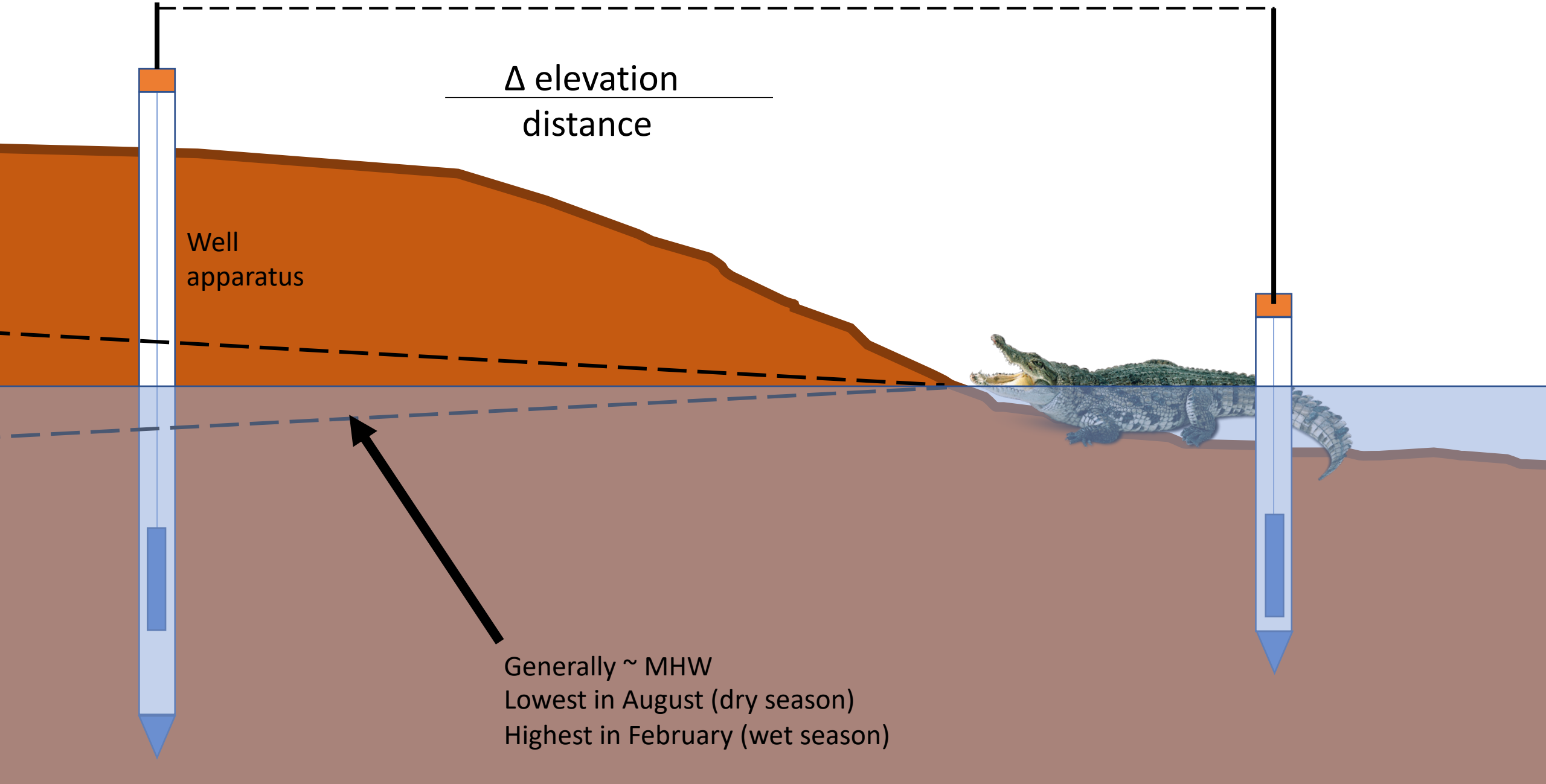


SSurgo Soil Drainage Class
drainagecl
N/A
Excessively drained
Moderately well drained
Poorly drained
Somewhat poorly drained
Very poorly drained
<all other values>

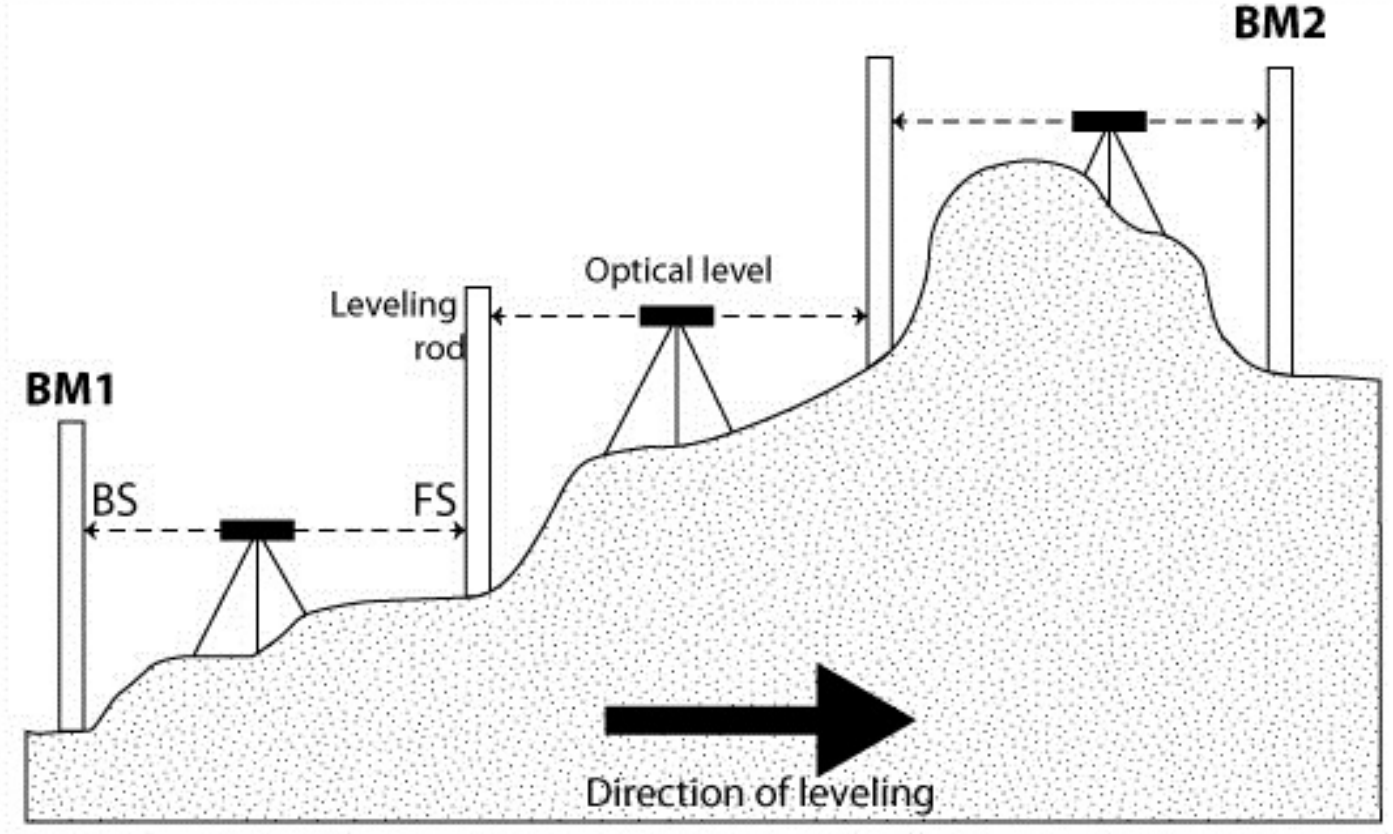
Full Groundwater Model
Depth to Water table
≤0.228667
≤0.41698
≤0.55149
≤0.686
≤0.82051
≤1.008824
≤2.19251
≤2.562235
≤2.811255
≤3.43
Ocean, Pond and Well Points

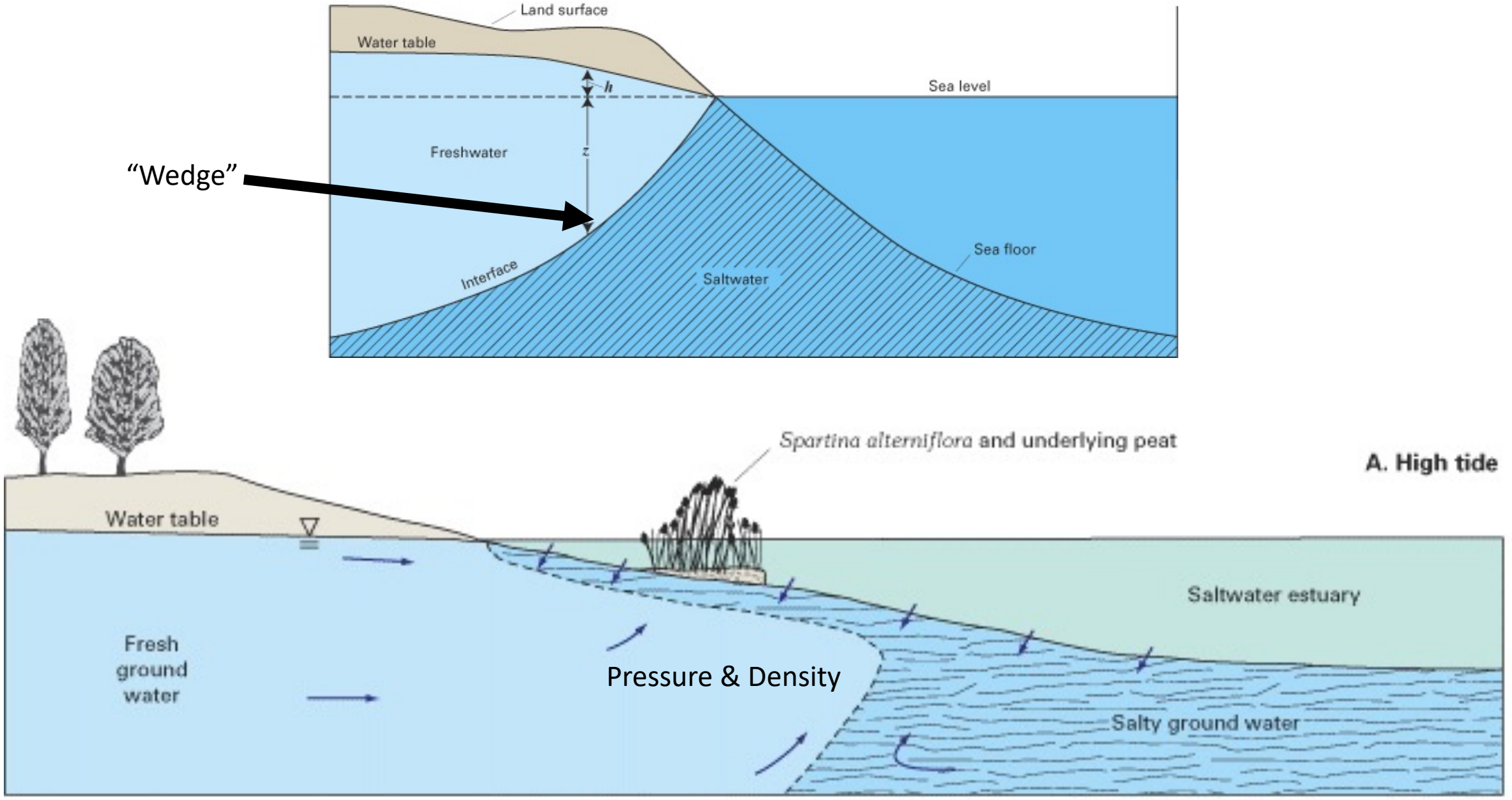
Open Water Level Monitoring Wells (n=3+)




Δ elevation
distance
Well
apparatus
Generally ~ MHW
Lowest in August (dry season)
Highest in February (wet season)

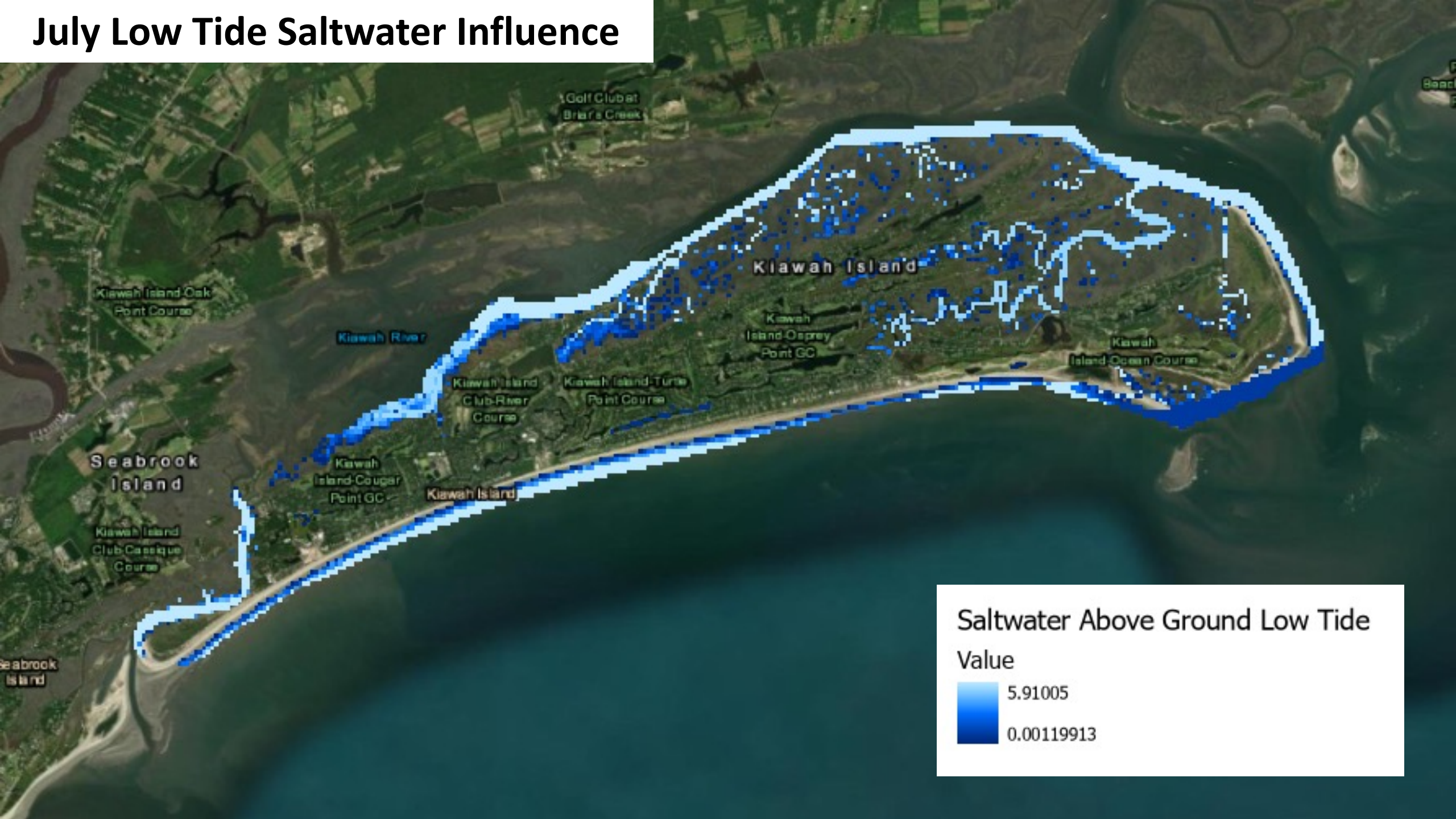
Differential Leveling



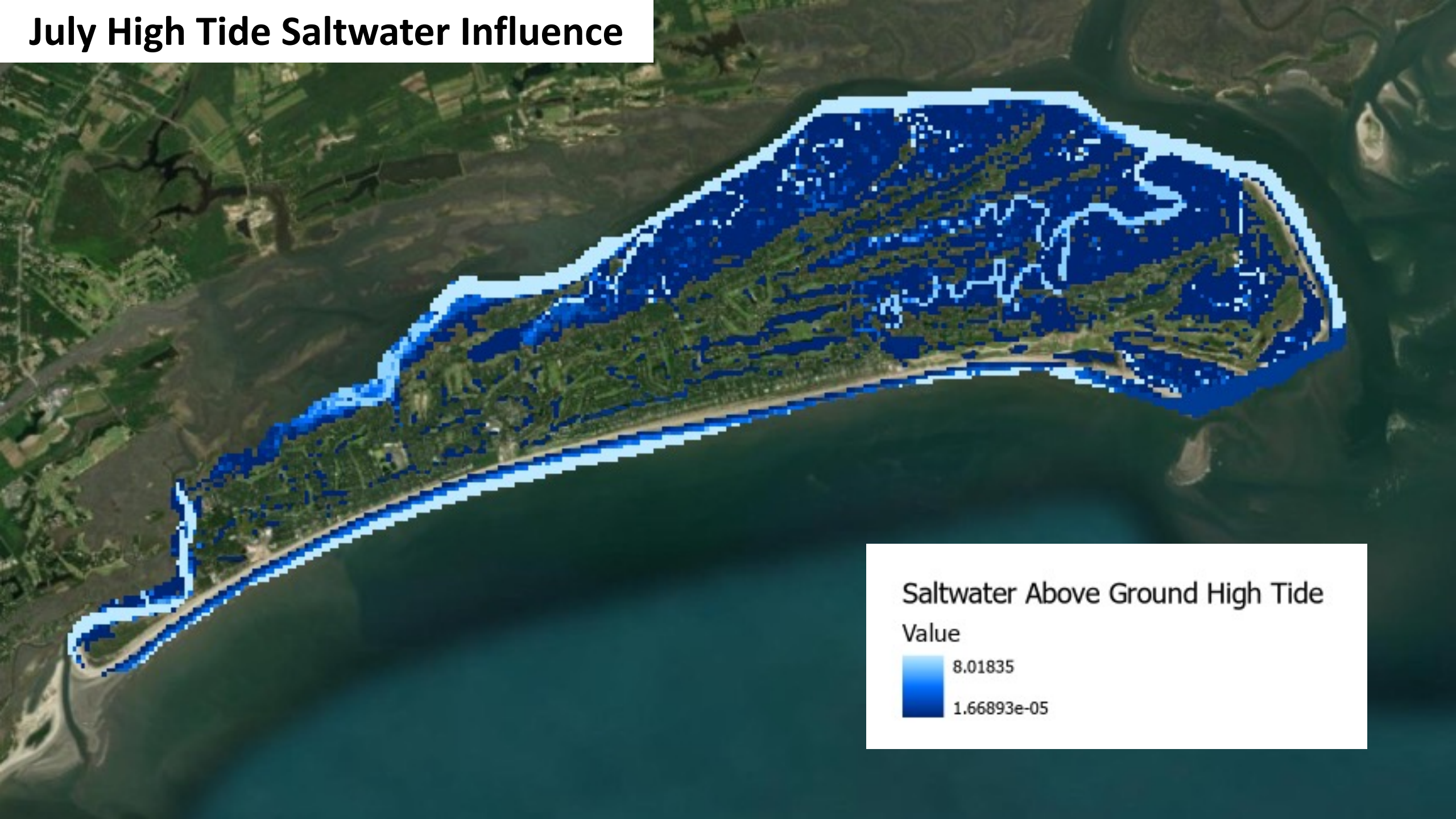


Figures B-1 (top) & 62c (bottom) from USGS Circular 1262 (Barlow, 2003)

July Low Tide Saltwater Influence



July High Tide Saltwater Influence



Site	Settled Salinity mg/L (NO^{-3}; Cl^{-})	Unsettled Salinity mg/L (NO^{-3}; Cl^{-})	General Salinity
Otter Island	209.93 (0.27%; 99.73%)	264.54 (0.26%; 99.74%)	0.2 ppt
168 Bluebill	1,287.12 (0.26%; 99.74%)	1,283.77 (0.30%; 99.70%)	1.3 ppt
74 Blue Heron*	19,854.03 (0.06%; 99.94%)	20,021.55 (0.06%; 99.94%)	20 ppt
119 Ocean Course	2,658.23 (0.08%; 99.92%)	4,020.37 (0.06%; 99.94%)	3.3 ppt
579 Oyster Rake	816.87 (0.22%; 99.78%)	928.02 (0.21%; 99.79%)	0.9 ppt
77 New Settlement	3,646.08 (0.09%; 99.91%)	3,619.22 (0.11%; 99.89%)	3.6 ppt
765 Curlew Ct	1,401.13 (0.15%; 99.85%)	1,483.28 (0.15%; 99.85%)	1.4 ppt
225 Sea Marsh	468.88 (0.18%; 99.82%)	450.47 (0.23%; 99.77%)	0.5 ppt
108 Flyway	215.37 (0.56%; 99.44%)	195.19 (0.98%; 99.02%)	0.2 ppt
132 Halona	1,775.93 (0.17%; 99.83%)	1,937.72 (0.16%; 99.84%)	1.8 ppt
107 Marsh Elder	4,607.01 (0.07%; 99.93%)	3,439.29 (0.10%; 99.90%)	4.0 ppt
6 Eugenia	293.78 (0.47%; 99.53%)	223.92 (0.71%; 99.29%)	0.3 ppt

Marsh Vulnerability Study

Objectives

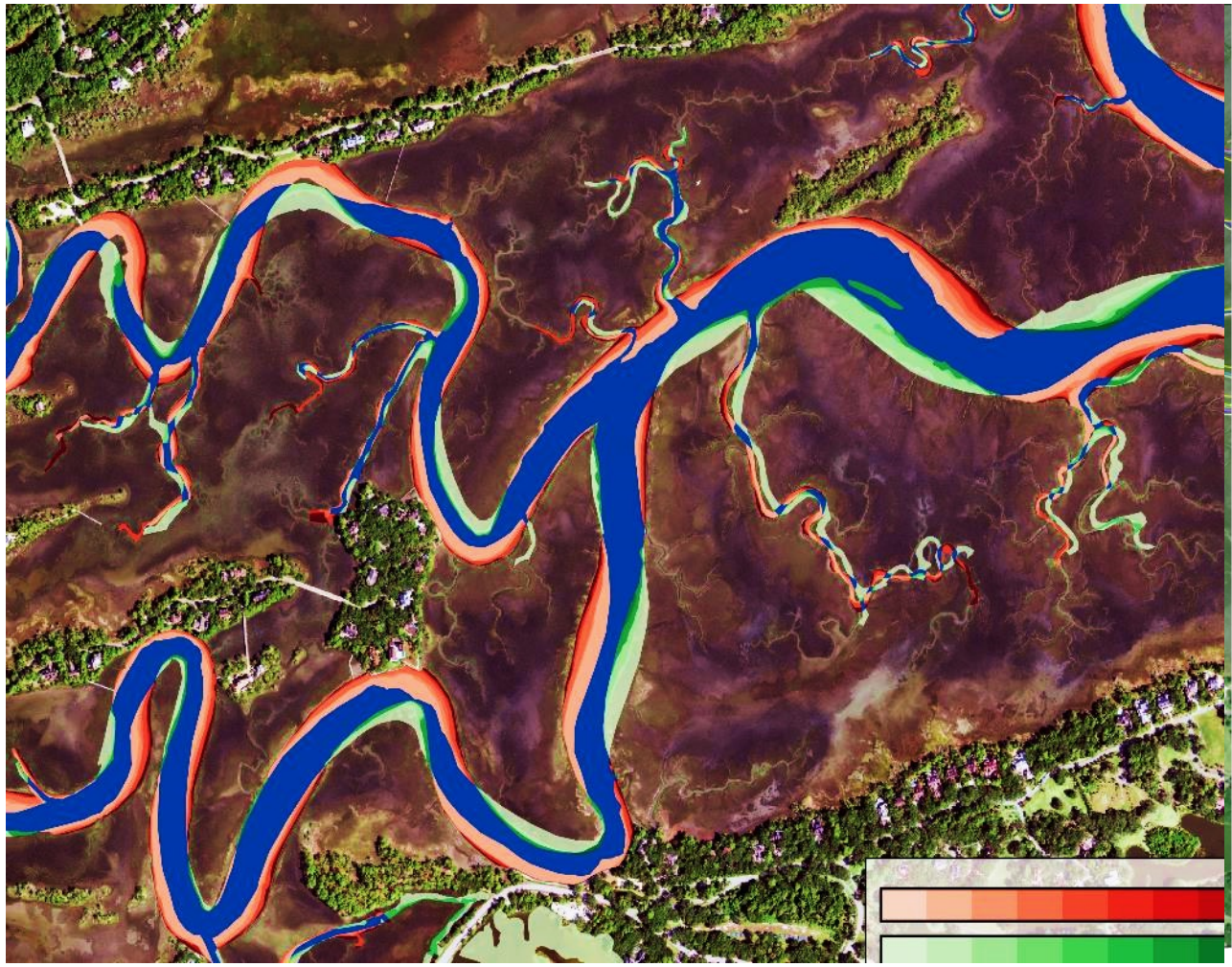
Phase I (2020)

- Understand historical changes to the marsh
- Catalogue structures near marsh (bridges, docks, bulkheads, etc.)

Phase II (2021)

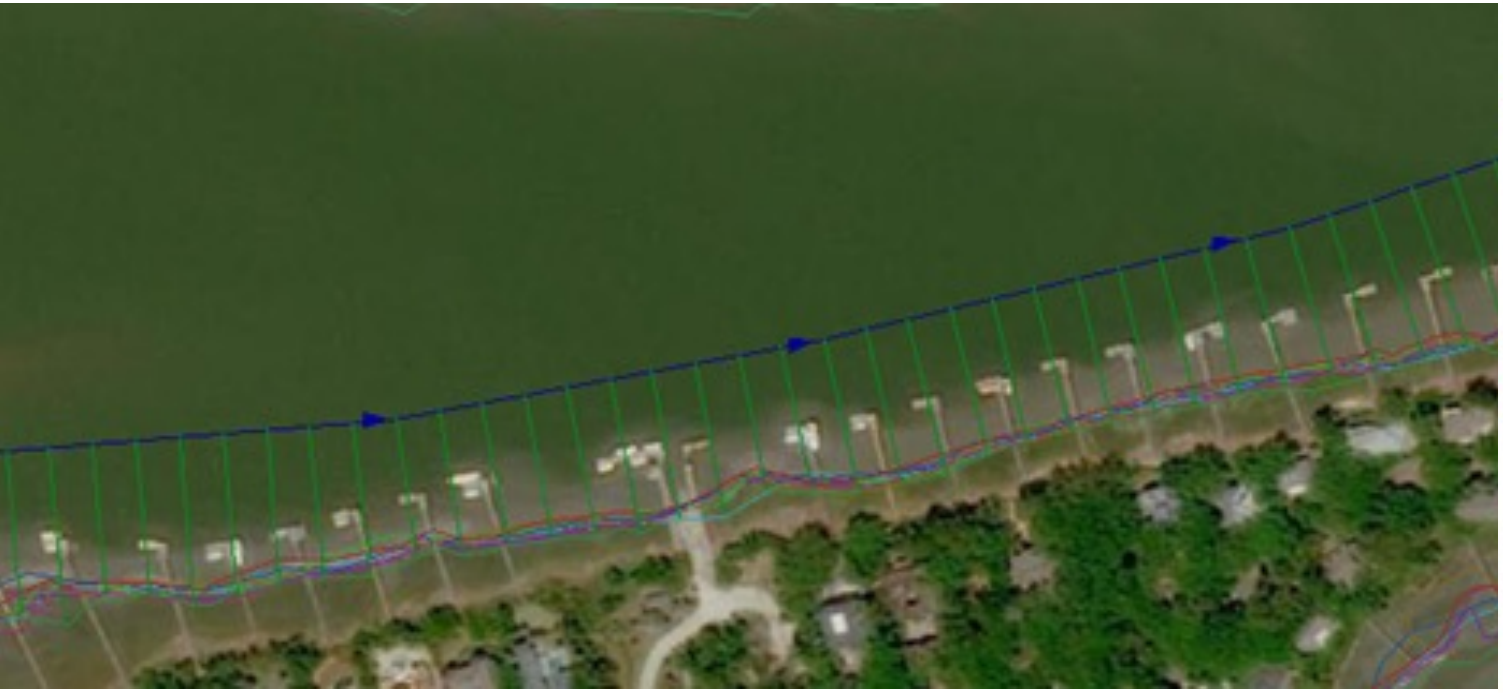
- Capture current conditions within the marsh
- Conduct vulnerability analysis (UVVR)
- Map marsh vegetative communities

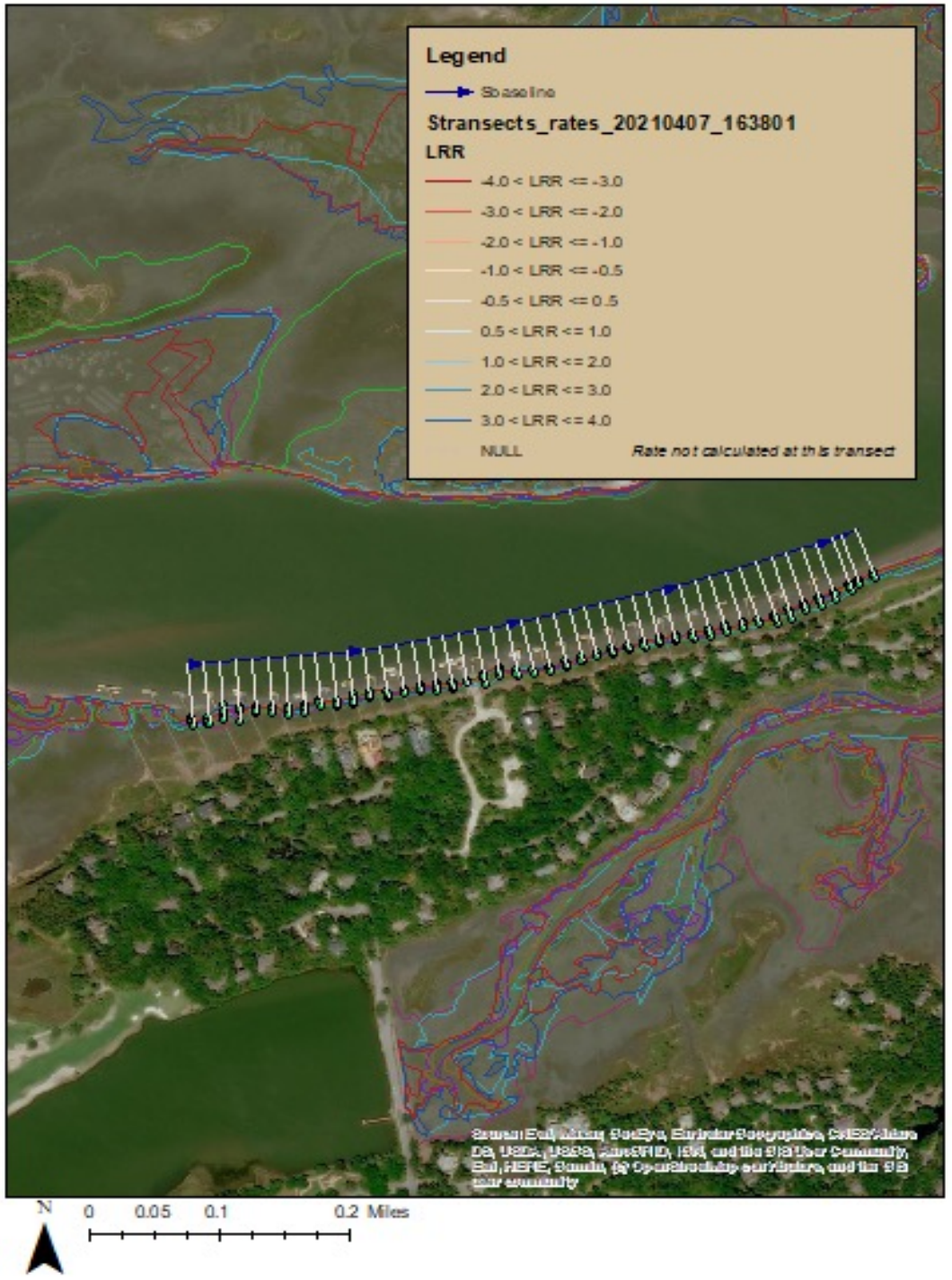
Purpose: vulnerability analysis, restoration planning, data for Marsh Management Plan



Digital Shoreline Analysis System DSAS (USGS)*

Comparison of shoreline changes over time from reference using DSAS, a similar process to using AMBUR**





* Thieler, et al. (2009). (No. 2008-1278). US Geological Survey.
** Jackson et al. (2012). *Computers & Geosciences*, *41*, 199-207.

Phase II products

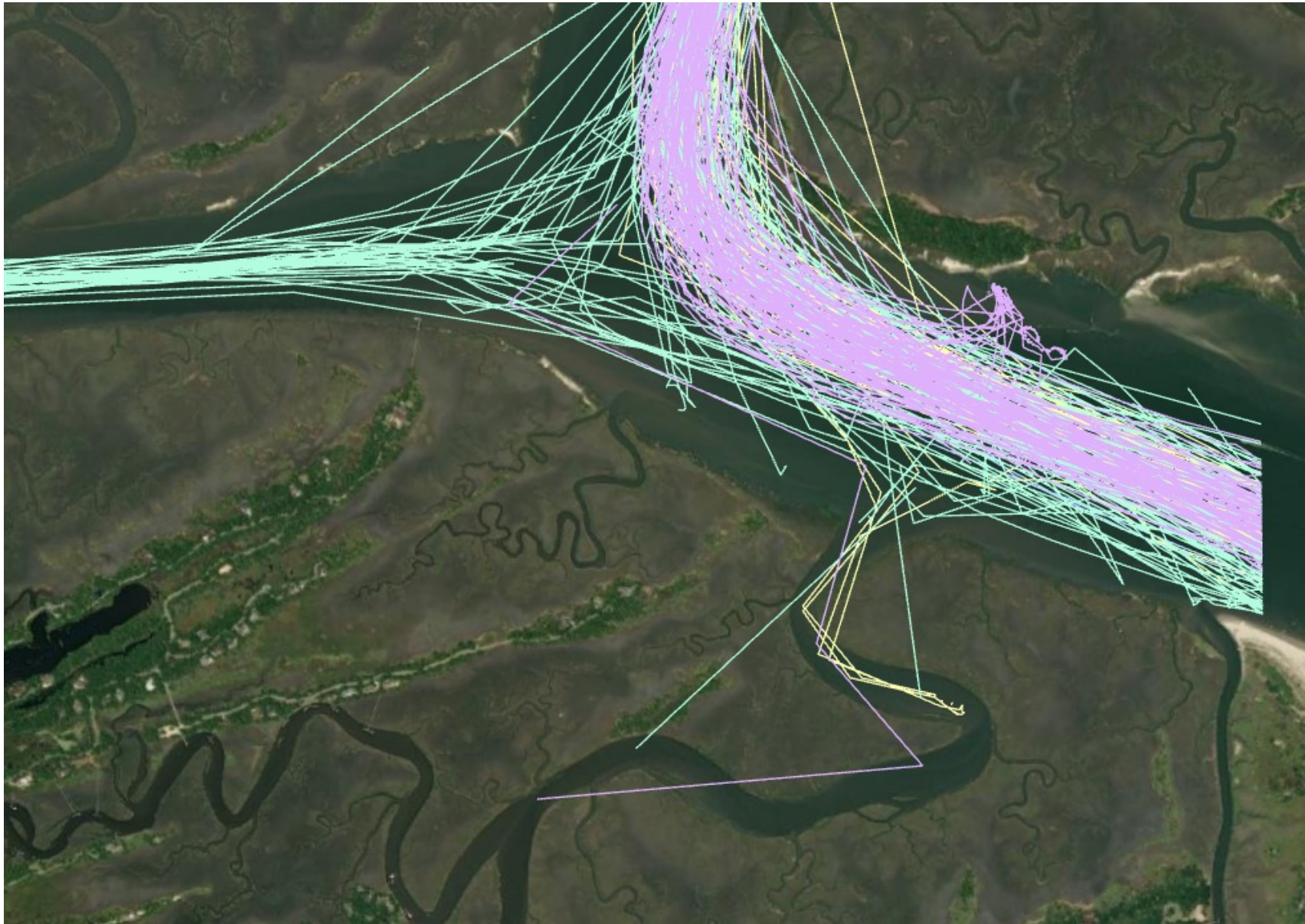
- Mapping of conditions recommended by SCDNR
- Landcover (1x1m resolution)
- Unvegetated-vegetated Marsh Ration (UVVR)

Aerial Imagery over Marsh Island Park

Vessel Traffic – Automatic Identification System (AIS)

Assess the intensity of wave action on marsh vegetated shorelines

Recommended by SCDNR* to assess boat traffic and its affect on shoreline erosion



* Sanger, D et al. (2015).

Vessel Traffic – Automatic Identification System (AIS)

Assess the intensity of wave action on marsh vegetated shorelines

Recommended by SCDNR* to assess boat traffic and its affect on shoreline erosion

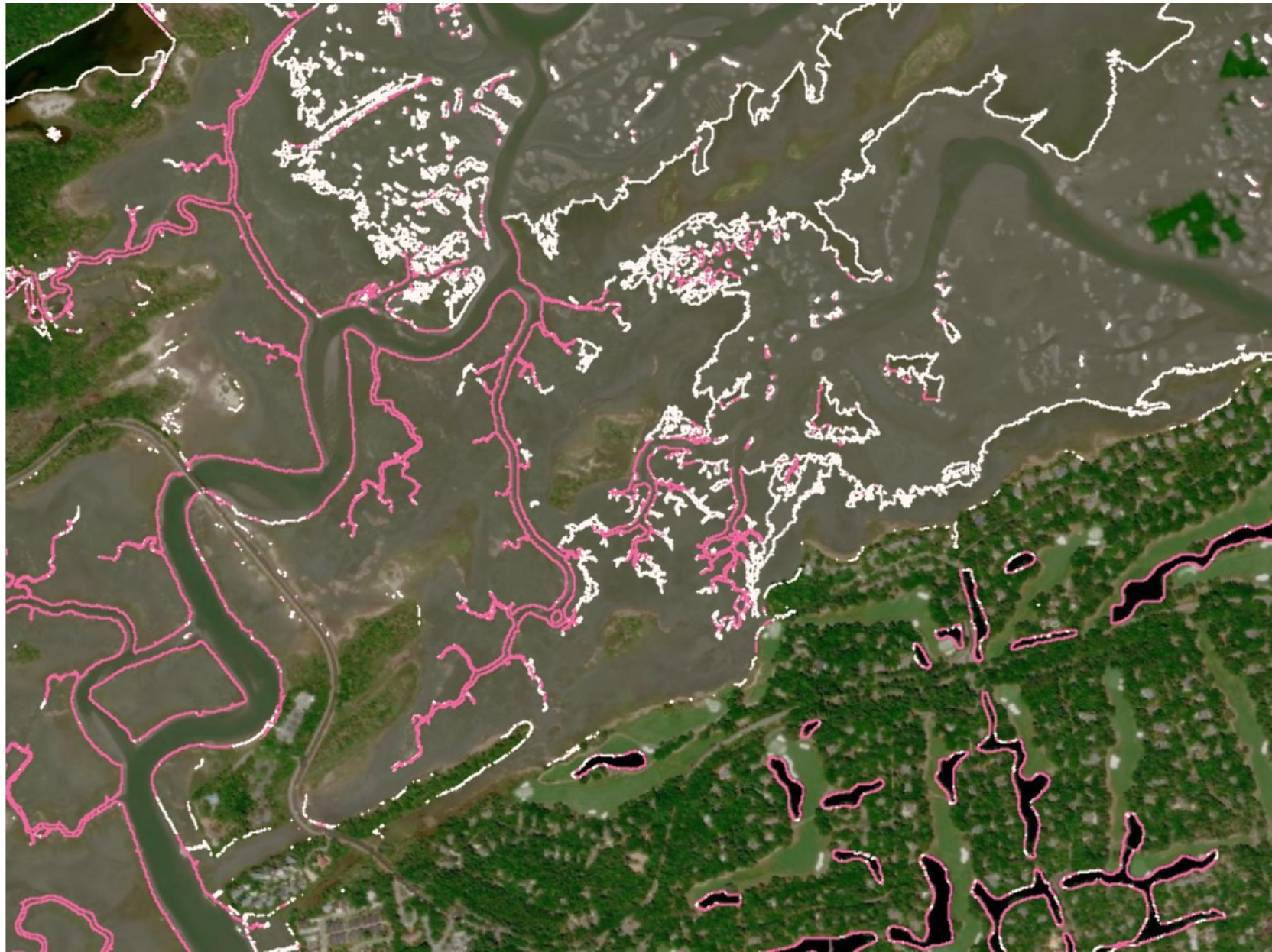
Boat Wake Energy
- High
- Medium
- Low

* Sanger, D et al. (2015).

Escarpment Height

Understand the physical conditions of creek shorelines, as recommended by SCDNR*

Developed using the 2017 DEM from SCDNR

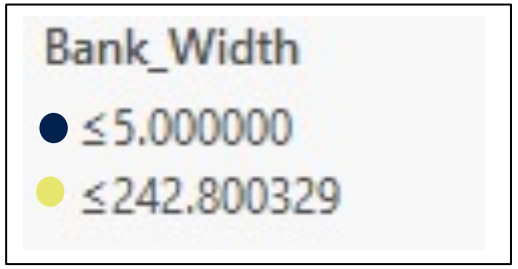


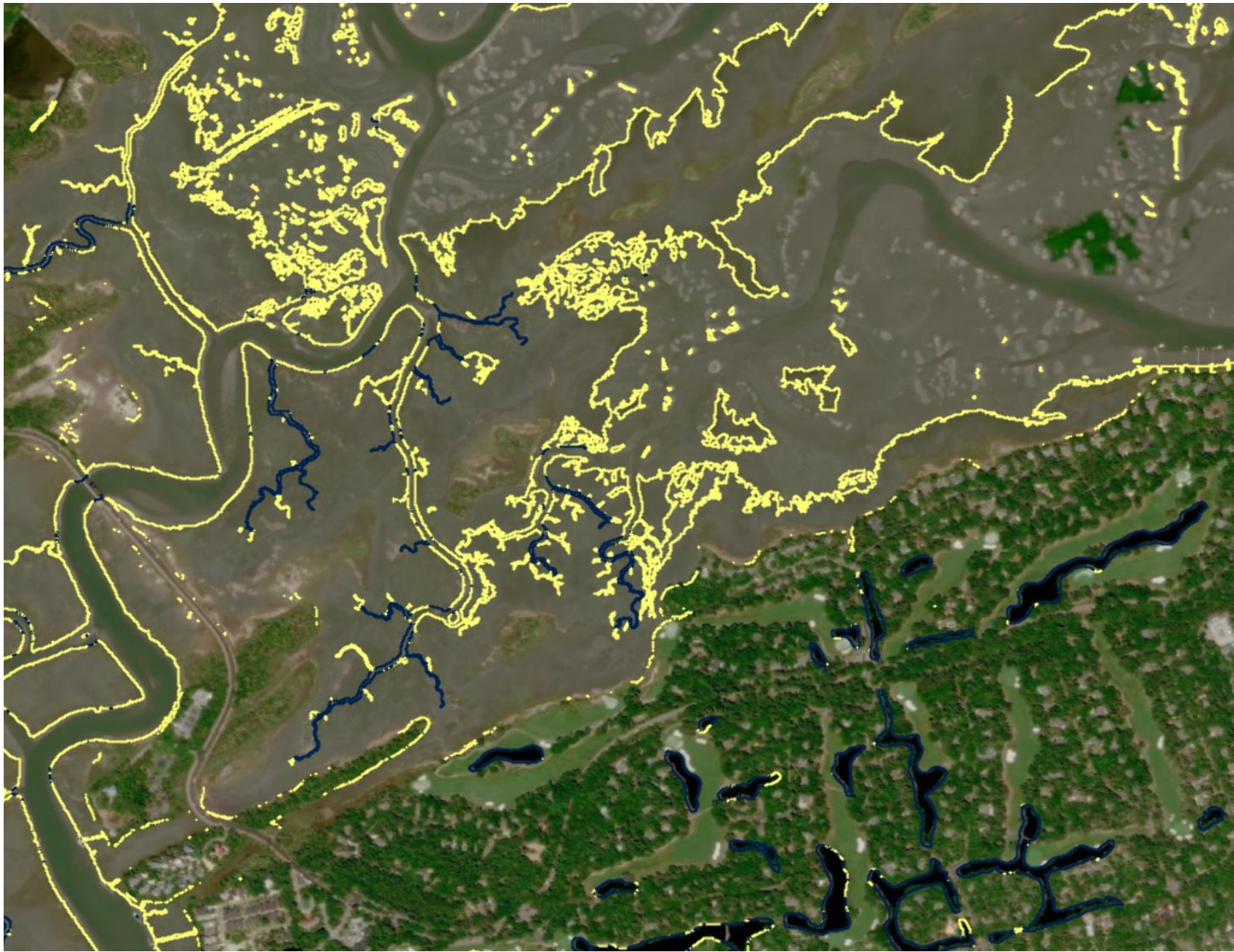
* Sanger, D et al. (2015).

Creek Bank Width

Understand the physical conditions of creek shorelines, as recommended by SCDNR*

Developed using the 2017 DEM from SCDNR





* Sanger, D et al. (2015).

Mean Bank Slope

Understand the physical conditions of creek shorelines, as recommended by SCDNR*

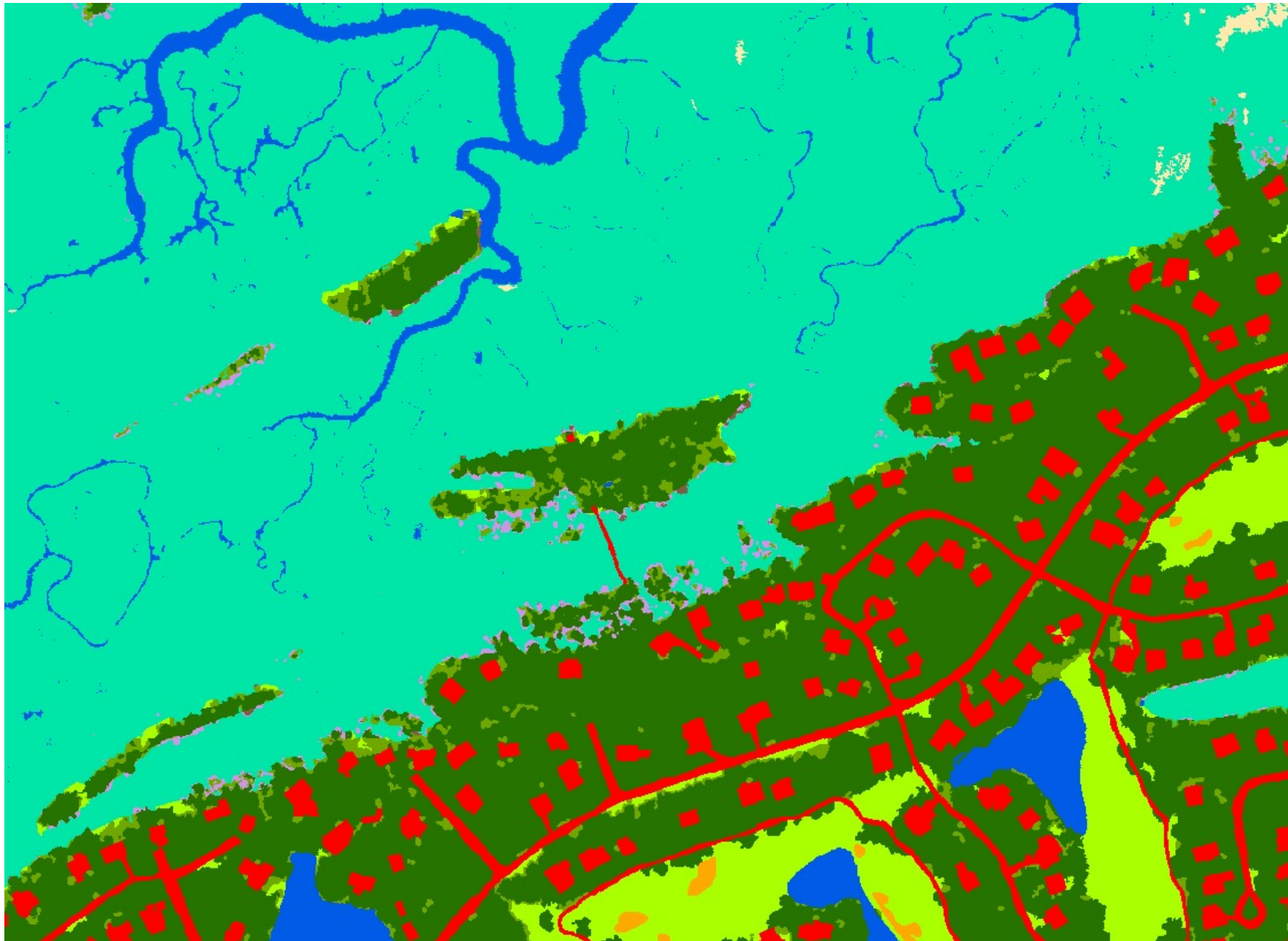
Developed using the 2017 DEM from SCDNR

* Sanger, D et al. (2015).

Aerial Landcover

1 x 1 meter resolution

Differentiate habitat types and vegetative communities



Aerial Landcover

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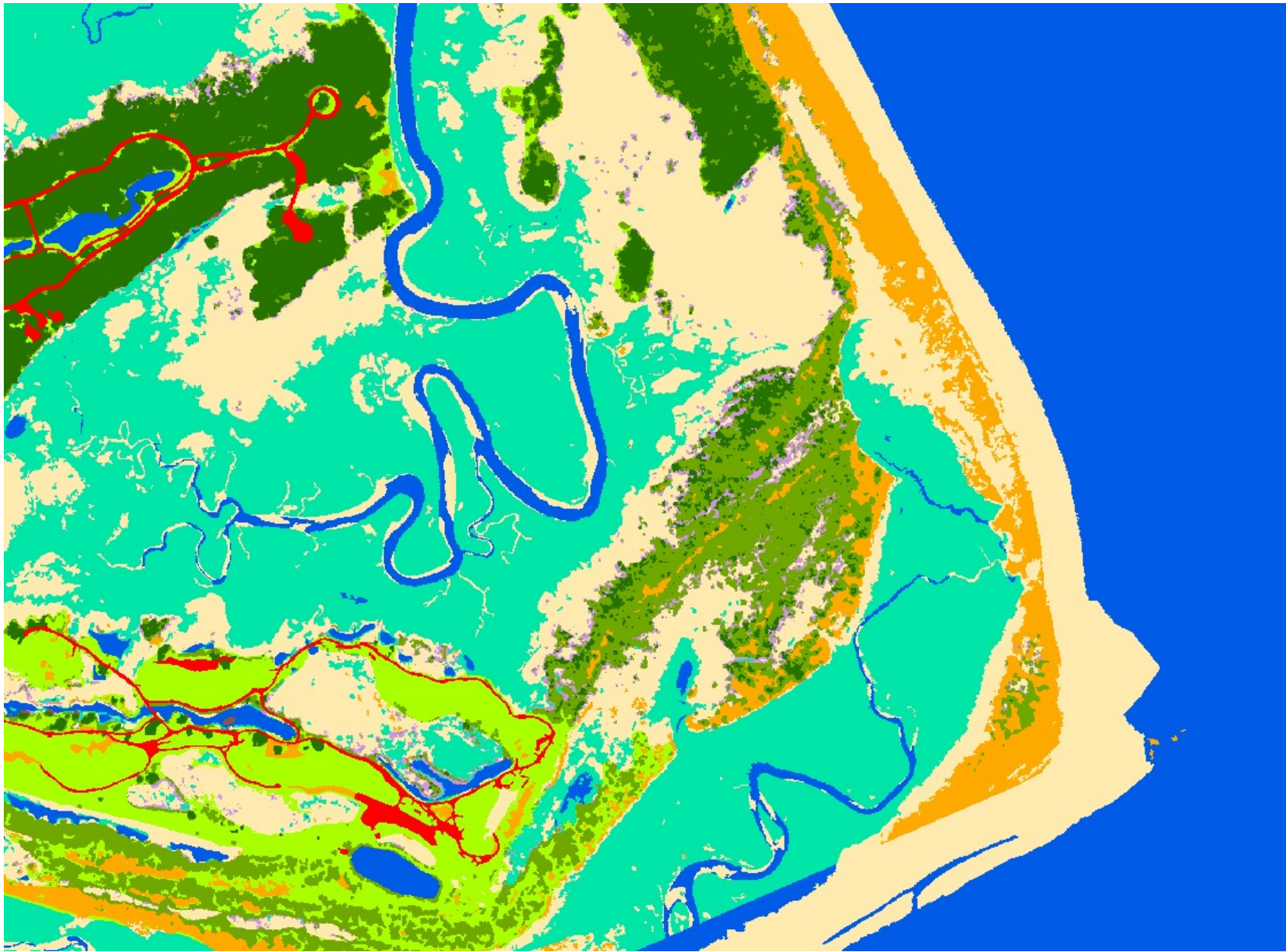
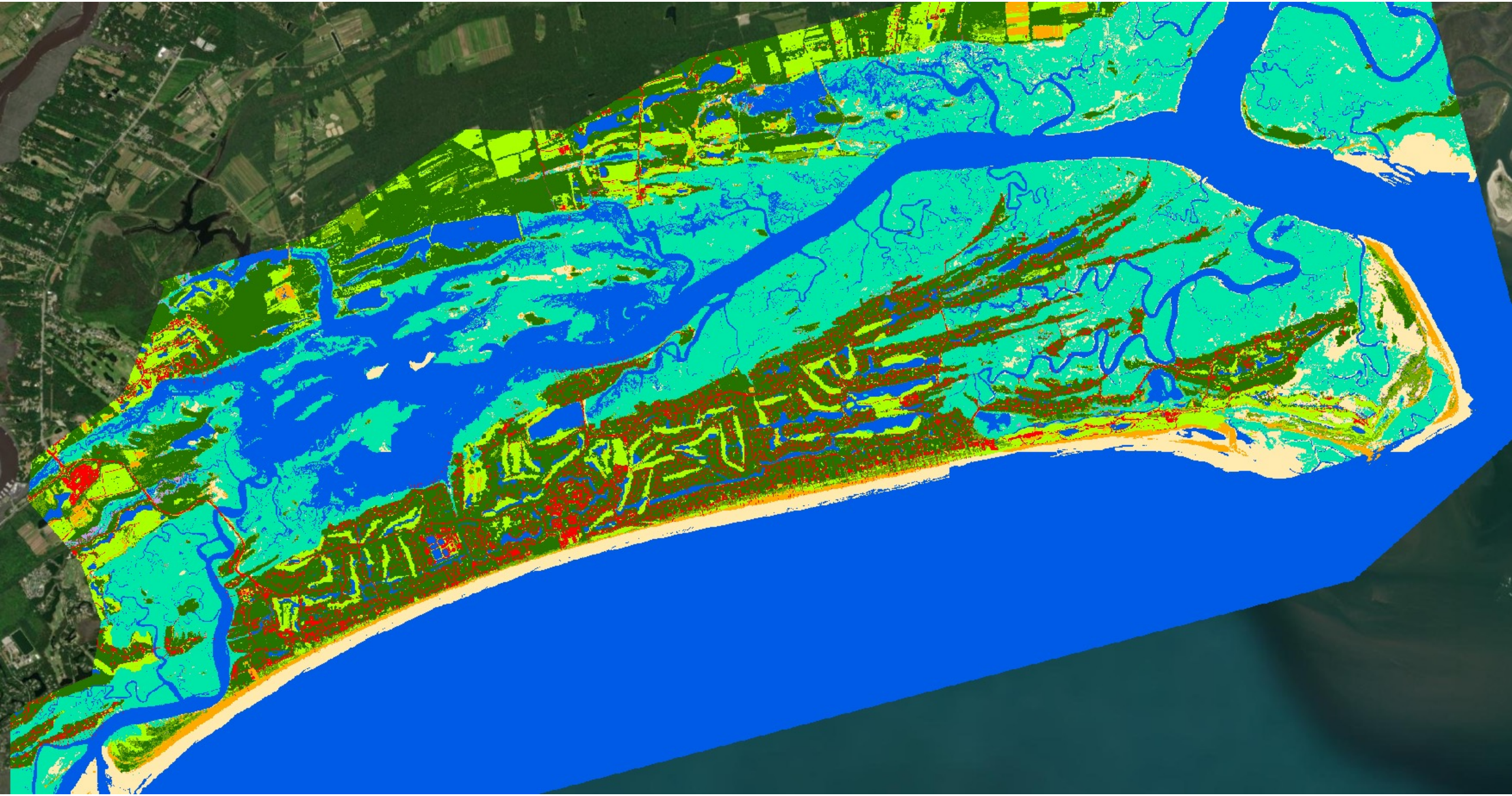
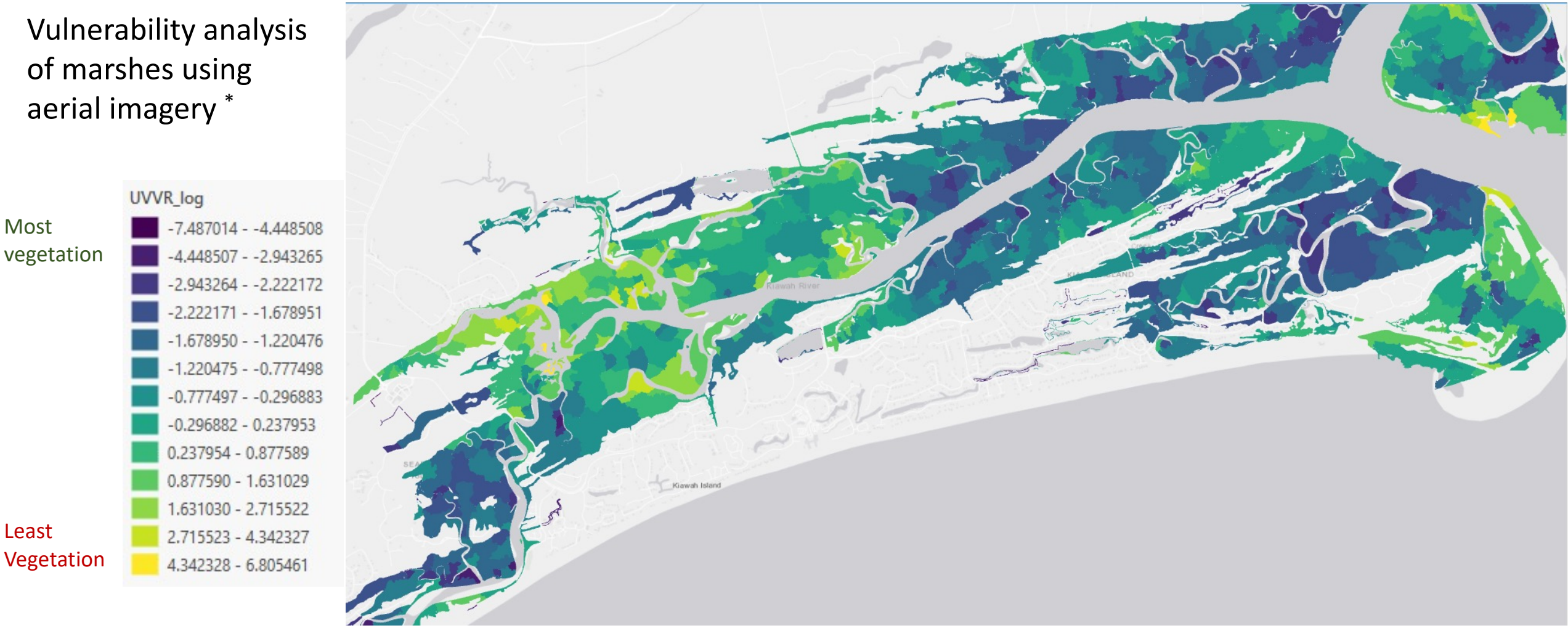




Unvegetated-Vegetated Marsh Ratio (UVVR)

Vulnerability analysis of marshes using aerial imagery *



* Ganju, et al. (2017). *Nature communications*, *8*(1), 1-7.

Unvegetated-Vegetated Marsh Ratio (UVVR)

Vulnerability analysis of marshes using aerial imagery *

Most vegetation

Least Vegetation

UVVR_log

-7.487014 - -4.448508
-4.448507 - -2.943265
-2.943264 - -2.222172
-2.222171 - -1.678951
-1.678950 - -1.220476
-1.220475 - -0.777498
-0.777497 - -0.296883
-0.296882 - 0.237953
0.237954 - 0.877589
0.877590 - 1.631029
1.631030 - 2.715522
2.715523 - 4.342327
4.342328 - 6.805461

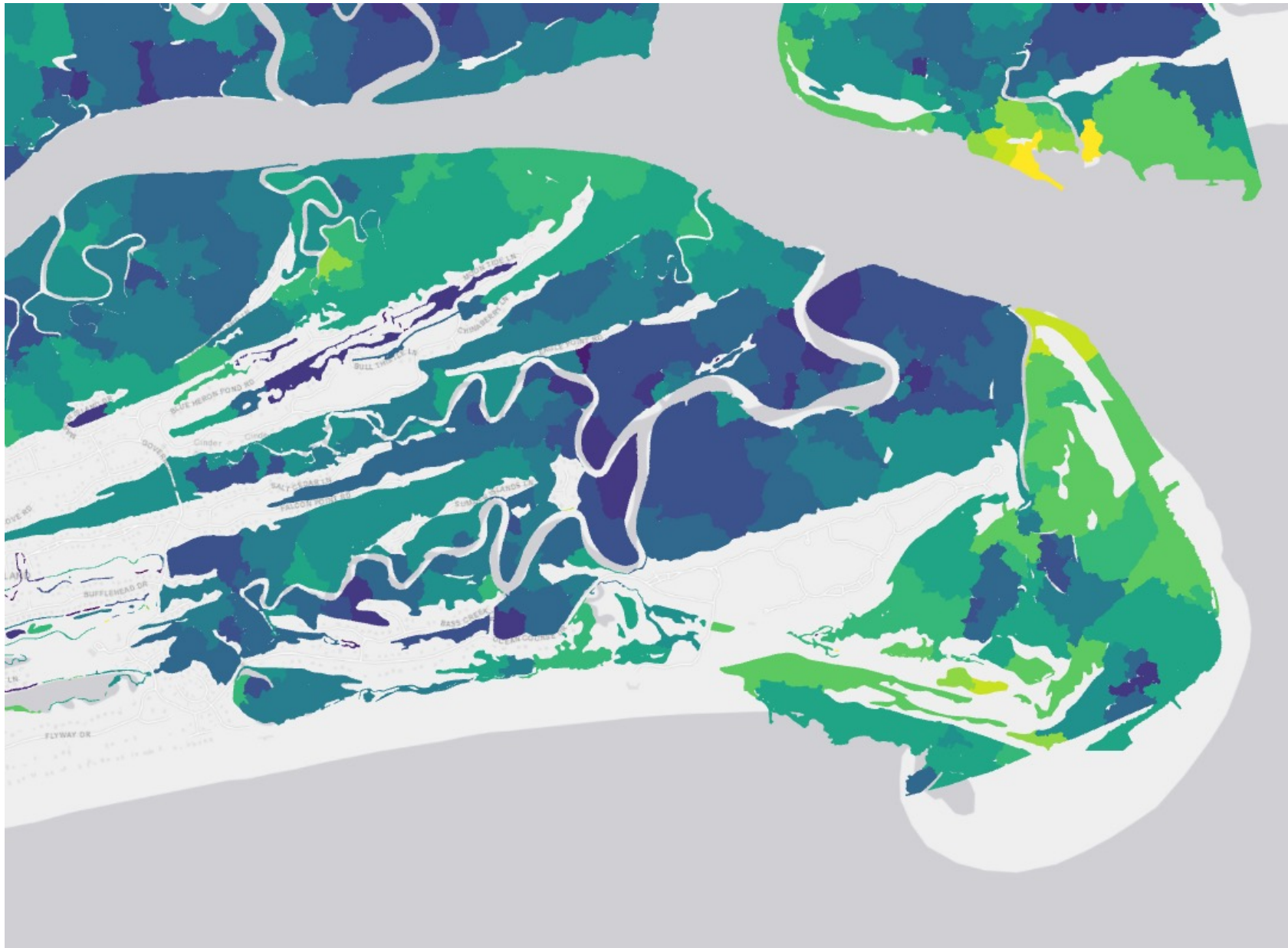
* Ganju, et al. (2017). *Nature communications*, *8*(1), 1-7.

Unvegetated-Vegetated Marsh Ratio (UVVR)

Vulnerability analysis of marshes using aerial imagery *

Most vegetation

Least Vegetation



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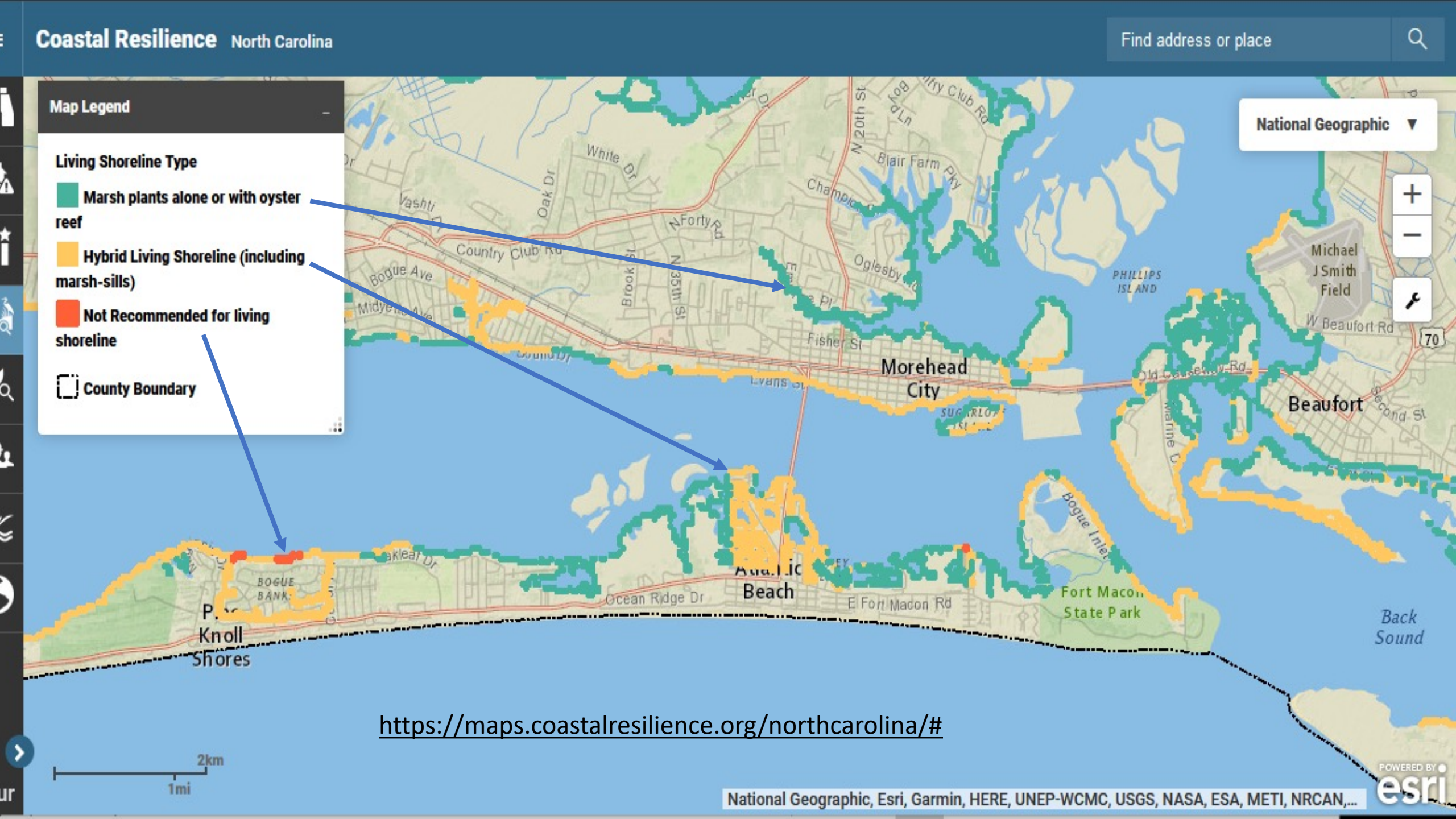


https://maps.coastalresilience.org/northcarolina/#

Resilience Project (NFWF)

Objectives

Community project to **Address Barriers to Coastal Resilience**

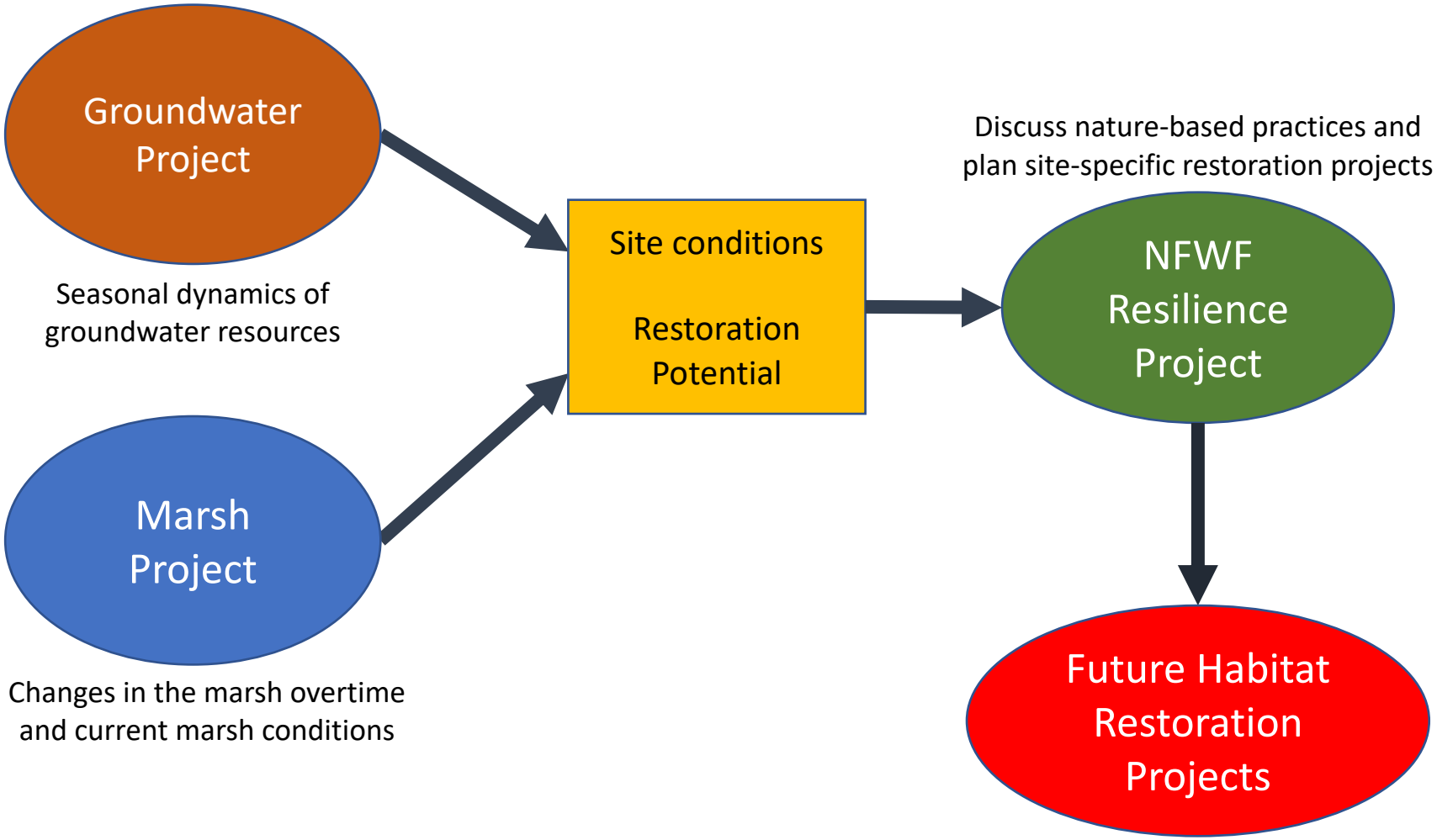
Collaboration with stakeholders on Kiawah Island to strategize and prioritize resilience projects

Develop a document outlining nature-based solutions for Kiawah Island

Phase I – Interviews with staff from key stakeholder organizations

Phase II & III – continued discussions and review of potential nature-based solutions

Comprehensive Approach



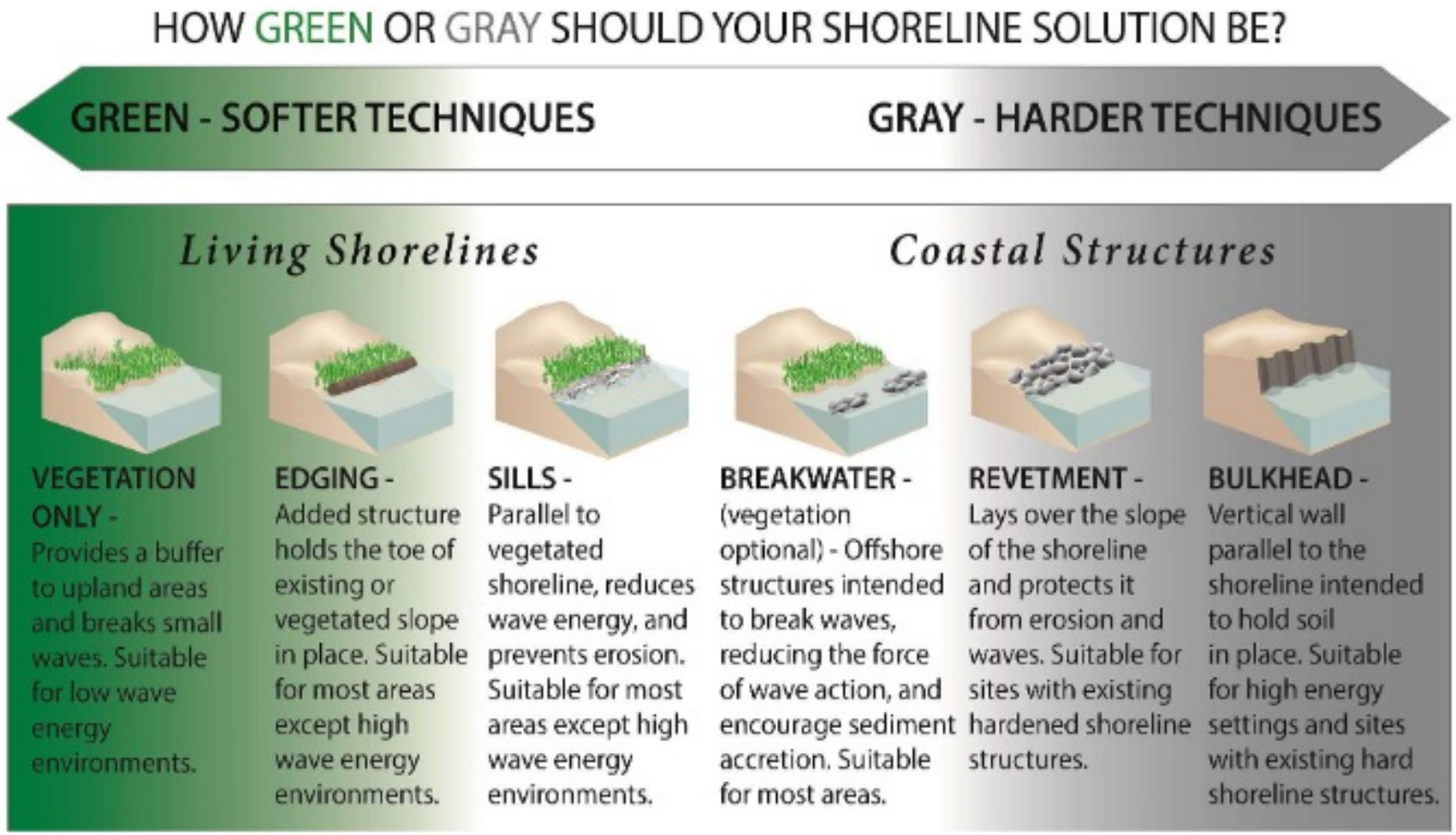


Figure 1.1. NOAA's "Coastal Shoreline Continuum and Typical Living Shorelines Treatments" (https://www.fisheries.noaa.gov/insight/understanding-living-shorelines).

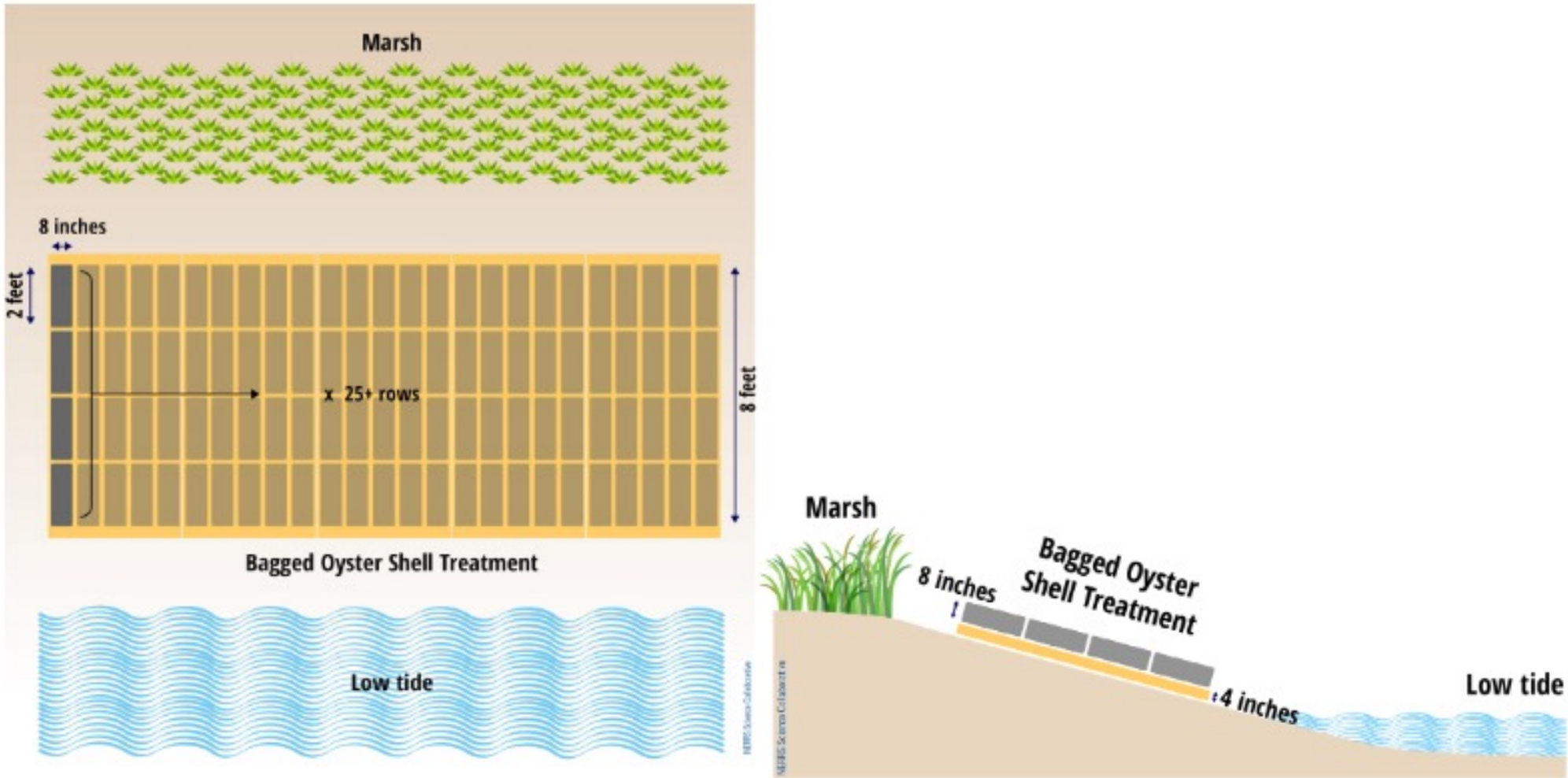


Figure 3.3. Overhead (left) and cross section (right) of a typical bagged oyster shell reef design with shell bags placed atop wood pallets.