Drones in the Coastal Zone (DITCZ)
Community of Practice (CoP)

Wednesday, November 2, 2022 – 10:30am - 12:00pm

Meeting Notes – 40 meeting participants

- **Steering Committee Update** – The Steering Committee is a group of volunteers. Anyone is welcome to join.
    - Website: SECOORA will host the DITCZ webpage. SECOORA is undergoing a redesign that will be launched in 2023. We will need volunteers to draft the content. Hoping to have new features to jazz up the webpage.
    - Listserv Guidelines: The DITCZ Steering Committee has developed listserv guidelines to ensure this listserv is a welcoming space and a useful networking tool. The guidelines will be sent to the listserv.
    - Student Competition: SECOORA has funding reserved for another student competition for the Drone UAS courses at Duke next year. Details will be sent to the listserv.
    - In-person Meeting: Considering hosting an in-person meeting in Beaufort, NC in 2023. The Steering Committee will discuss and get back to the group.
- **Presentation** (**see slides below**)**:** Monitoring experimental living shorelines with UAS - Gary Sundin, Wildlife Biologist-Shellfish Research Section, SC Department of Natural Resources Marine Resources Research Institute
    - SCDNR used approaches to create living shorelines in intertidal zone: loose shell bagged shell, wire reefs, repurposed crab traps, oyster castle, and coir logs. They have 480 installations at 220 sites. Purpose is protection of shoreline from erosion.
    - Drones are affordable to integrate into existing field work and are collecting high resolution data.
    - Collect annual imagery data when visit the living shoreline site. Use photogrammetry software into two products: orthomosaic and digital surface model.
    - 2018 first year started using drones to monitor the site. They use Analyzing Moving Boundaries using R (AMBUR) to cast transects across shorelines (at spacing of choosing) and create a transect of interconnected points. Software performs linear regressions. AMBUR can be used at small scale to monitor shoreline change.
        - There is uncertainty / error in the data (root mean square error). We use ground unit to ground control - RTK. Largest source of error is digitization error. The total error assigned to the shoreline is a combination of individual errors. In our case these errors are from the 1) RTK, 2) the georectification process, and 3) the digitizing process.

- Gary provided examples of using AMBUR and how they track sediment changes using drones.
- Q&A:
  - What program/how do you subtract one digital surface model (DSM) from another DSM?
    - ESRI products, Arc GIS or ARC Pro and raster calculator tool
  - Image reflects oyster castle structures that have increased in elevation. Is that indicative of oyster growth?
    - The materials are sinking and the oysters are growing. Personally believe the slight difference in elevation is due to growing oysters and error.
  - What do the oyster reefs look like at the Dawho Site? Are they fully functional and established oyster reefs?
    - They are established oyster reefs. They do well at recruiting oysters and need to position differently to get a better response to protect the marsh edge.
  - How low did you fly?
    - 60 - 80 feet.
  - Updates to AMBUR to integrate to ARC Pro?
    - Alexander Clark will find the answer.
  - Map non-living shorelines?
    - Yes - we do oyster mapping.
  - Resources shared, paper related to oyster ecological limitations and marsh protection: https://www.sciencedirect.com/science/article/pii/S0925857421000768

- **Group discussion questions**:
  - Is anyone using polarized filters for aquatic projects? Pros, cons, recommendations?
    - Allix North - Might have to use this method for a new test product POSH (Pervious Oyster Shell Habitat) that will be installed at the NERR
    - Gary Sundin - SCDNR has a circular polarized lens and tried it. It did not seem to provide benefit in our un-rigorous testing.
    - Jenny Davis - NOAA uses it to reduce glare. They just put it on and fly (no adjustments).
  - Neutral density filters for mapping?
    - Gary Sundin - uses it when trying to get video for mapping.
  - Asked to map mangrove, how would you consider this mission?
    - Gary Sundin - no trees or high canopy and looking at bare earth. Easy when using drones.
    - Alix - Jobos Bay NERR in Puerto Rico might have information; they have mapped mangroves as part of a research project. Allix uses a

multispectral camera and with a color infrared set up. Pops out a little better.

- Any experience with the use of “raised” vs. bare earth ground control points (GCPs) in marsh settings?
  - Brandon Puckett - GCPs on sediment surface and raised. Not analyzed to look at model accuracy, something interested in looking at.
  - Colby Peffer - Agree raised GCPS can be challenging.
  - Clark Alexander - we do it all the time at the Georgia Coastal Ecosystems Long Term Ecological Research site (GCE-LTER) around Sapleo Island. High enough so do not get inundated by the tide. Good success with using them.
  - Scott Eastman- Vegetation markers served as a base for GCPs.
  - Brandon Puckett - High Density Polyethylene (something like this offered in black and white sheets) have longevity. GCPs are set in rods in the marsh.
- Brandon Puckett - has anyone assessed changes in model accuracy on GCPs not in the same exact location?
  - Not tested by those on the call.
- What do you think are the best camera focus settings—autofocus or manual focus to infinity (or other settings including white balance, shutter/aperture priority or full manual settings, etc.)
  - Brandon Puckett - use auto settings
  - Daniel Bowling - I have done some in manual, but I have run into issues under changing light condition
  - Gary Sundin - always uses cloudy / sunny white balance. Never auto
  - Allix North - All auto with DJI. May have to change that when we switch to the Sony
  - Laura Carson - all auto with a DJI for me, sometimes I’ll bump down the EV if it's too bright
  - Scott Eastman - We had an issue at one point before, I believe it was related to auto white balance.
- What specific Pix4D settings are best for digital surface models (DSMs) in intertidal or marsh habitats? Does triangulation ever produce a better DSM than Inverse Distance Weighting (IDW)?
  - Brandon Puckett -
    - Generated a cookbook recipe document on best Pix4D settings: https://nerrssciencecollaborative.org/media/files/02_NERRS_drone_marsh_monitoring_SOP.pdf
    - In general, Inverse Distance Weighting (slower and recommended for a lot of elevation change) or Triangulation (faster and recommended for flatter surfaces) interpolation method.

- Any tips on smoothing/removing noise and error from DSMs post-production with GIS? Or any workflows for re-processing with better results when confronted with noisy DSMs?
    - Jenny Davis - use AgiSoft when doing side by side comparisons, that is the one thing AgiSoft does a better job of, filtering the point clouds.
    - John McCombs - median filter over the elevation model will help trim those extreme highs/lows from the data surface.
    - Daniel Bowling - I also use AgiSoft and adjust the data processing frame to remove extreme cloud points. You can manually select the points you want to delete, or you can adjust the entries X, Y, Z axis.
- Scott Eastman: Florida Geographic Information Office (FGIO) has posted a link to the Drones in the Coastal Zone report, provides notices about upcoming meetings and demos (including these meetings), UAV resources, and rulemaking notifications specific to Florida - https://www.floridagio.gov/pages/uav-resources
- Allix North: Fleet management and best practices across offices and programs. Thoughts on drone logbook and fleet management?
    - Jill Schmidt: I created a Survey123 and dashboard to keep track of our flights and battery use
    - Colby Peffer - Survey123 has a template for drone logs as well
    - Brandon Puckett - Kittyhawk which is now be Aloft. Not too bad but clunky (we used the beta version).
    - John Quinlan - https://www.dronelogbook.com/hp/1/index.html was mentioned in the Duke drone courses for fleet management.
- Marianna Coppola -Did anyone ever tried a Pix4D matic instead of mapper?
    - Quintin Bergman - We currently use Pix4D react but trying to convince my leadership to purchase Mapper.
    - Claudia Venherm - same here, tried once, but not as good as mapper

- **Action items & wrap up**
    - Next CoP meeting in February 2023. Whitney will send a meeting poll to the listserv to schedule.
    - Please consider signing up for networking time at the next meeting.

Monitoring Experimental Living Shorelines with sUAS

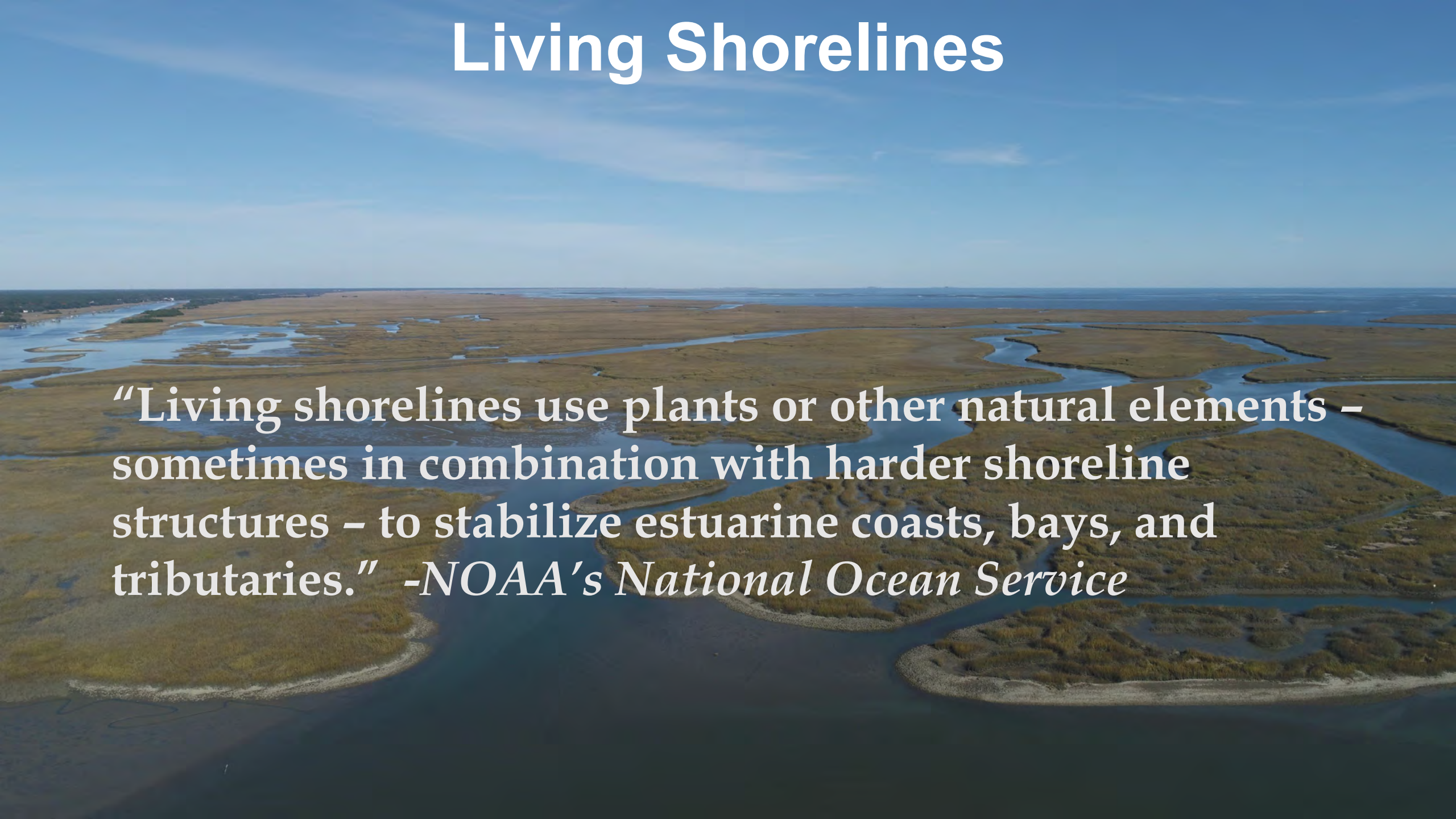
Dr. Peter Kingsley-Smith Graham Wagner Lauren Faulk
Greg Rothman Gary Sundin

Gary Sundin
South Carolina Department of Natural Resources
sunding@dnr.sc.gov

Drones in the Coastal Zone Community of Practice
Quarterly Meeting
November 2, 2022

THANK YOU!

Living Shorelines



"Living shorelines use plants or other natural elements – sometimes in combination with harder shoreline structures – to stabilize estuarine coasts, bays, and tributaries." *-NOAA's National Ocean Service*


Loose shell

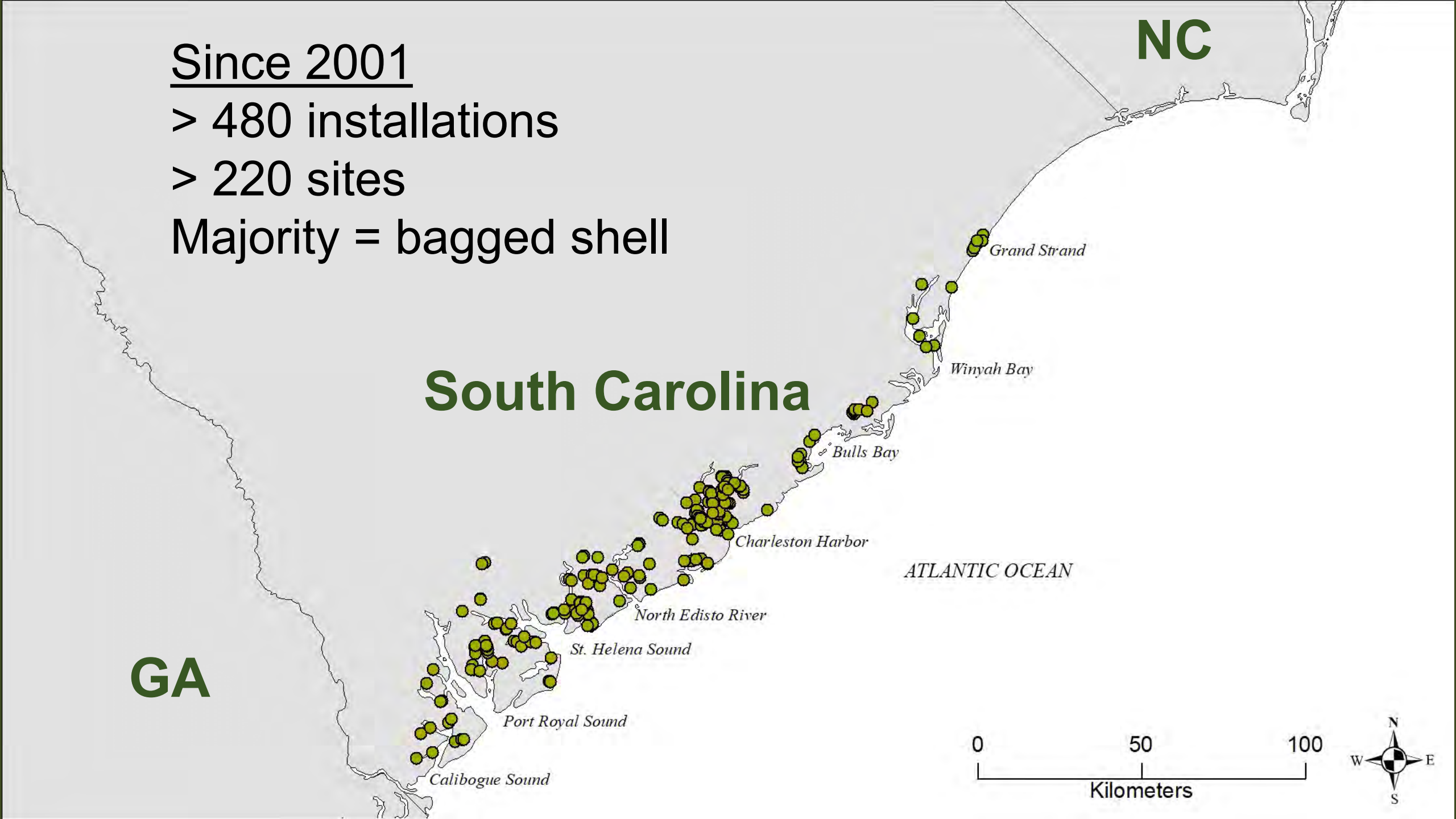

Bagged shell


Manufactured wire reefs
(MWR)


Repurposed crab traps


Oyster castles


Coir logs


Since 2001
> 480 installations
> 220 sites
Majority = bagged shell
NC
South Carolina
GA
Grand Strand
Winyah Bay
Bulls Bay
Charleston Harbor
ATLANTIC OCEAN
North Edisto River
St. Helena Sound
Port Royal Sound
Calibogue Sound
0
50
100
Kilometers
N
W
E
S

NERRS Science Collaborative project (2015-2019)

Available:

NERRS

www.nerrssciencecollaborative.org/resource/summary-living-shoreline-research-inform-regulatory-decision-making-south-carolina

National Estuarine Research Reserve System Science Collaborative

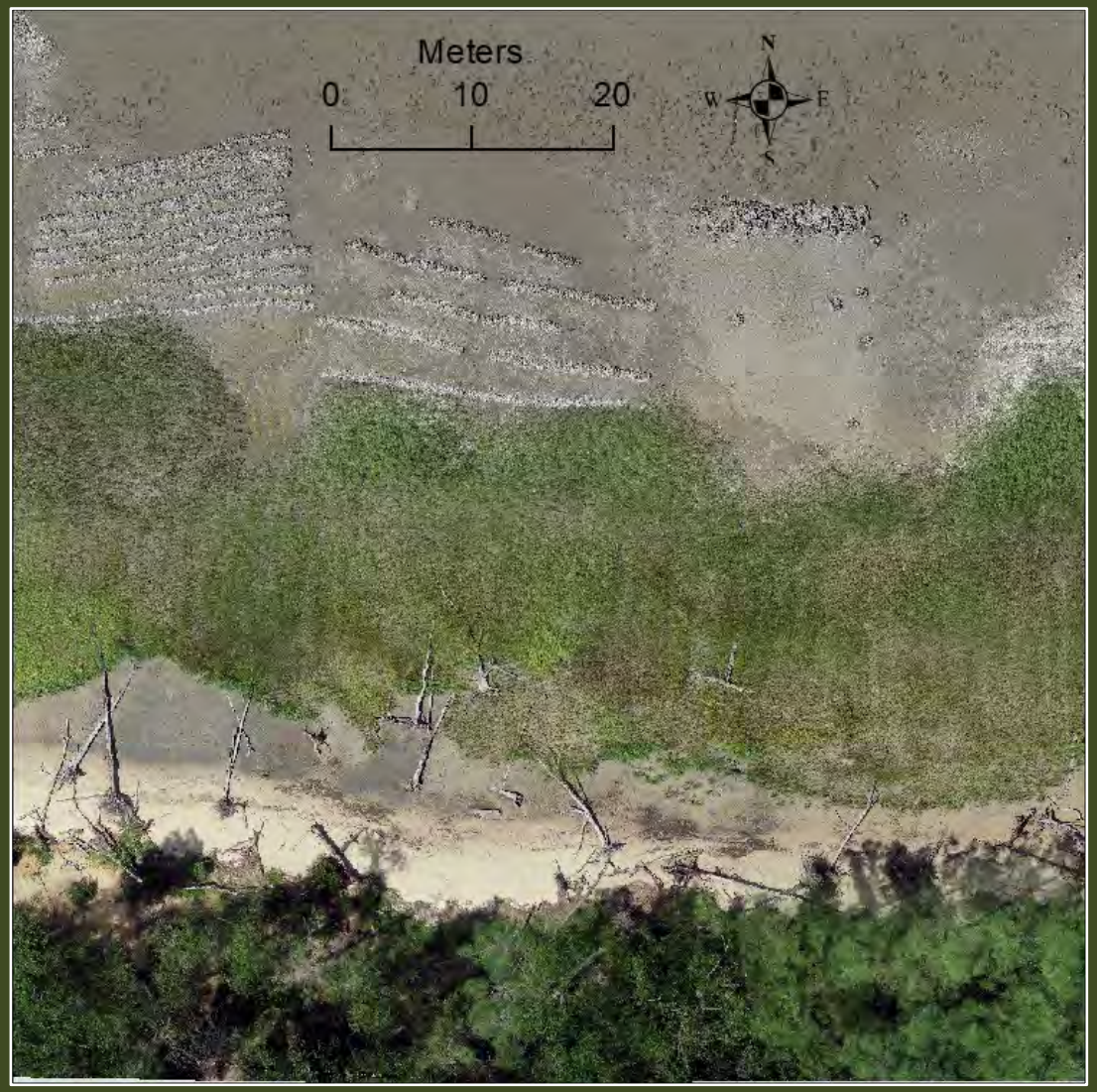
D H E C
PROMOTE PROTECT PROSPER
Ocean and Coastal Resource Management

NOAA

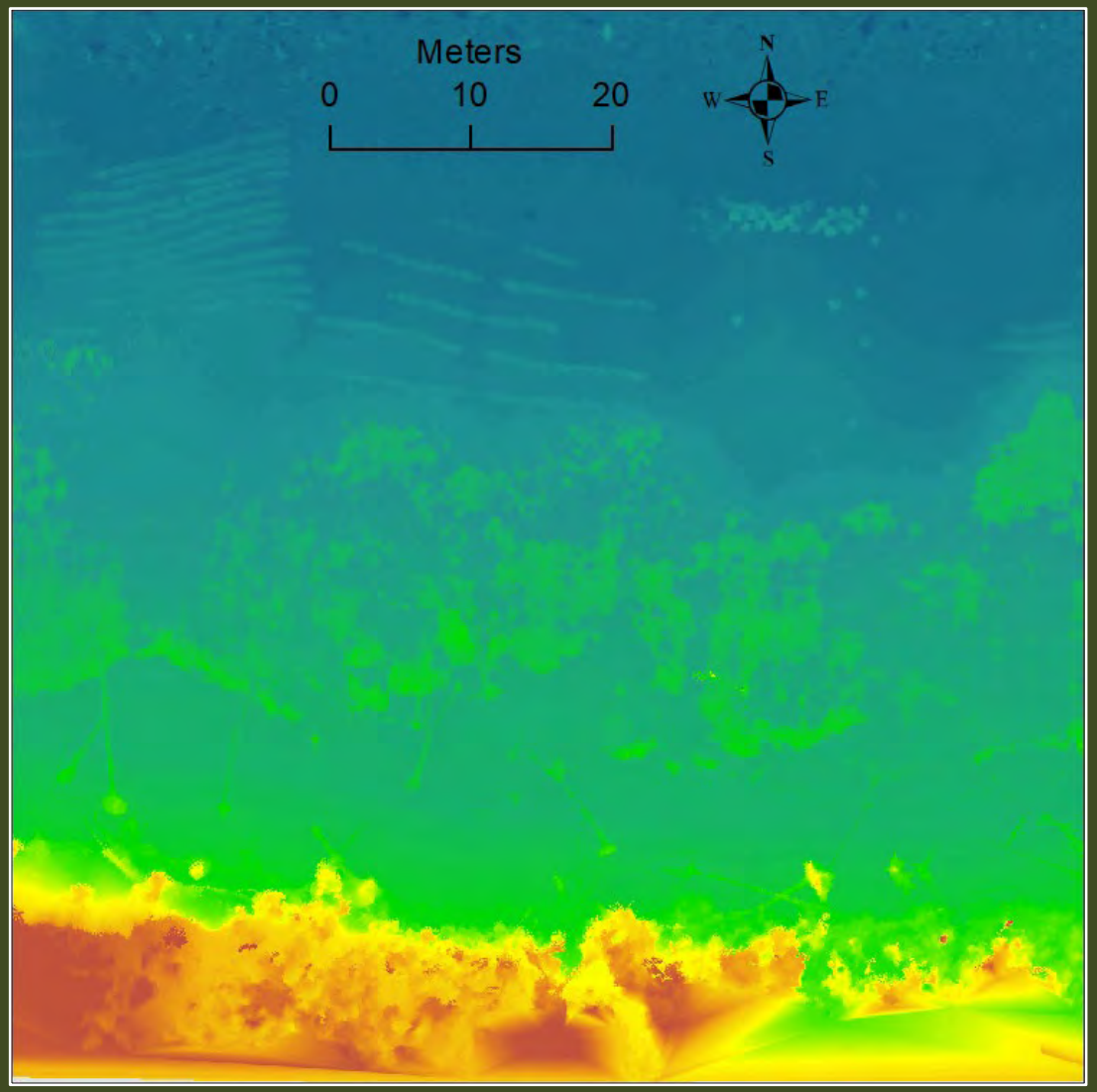
Why drones?

- Affordable and available
- Customizable
- Low elevation/relief
- Unpopulated

Orthomosaic imagery



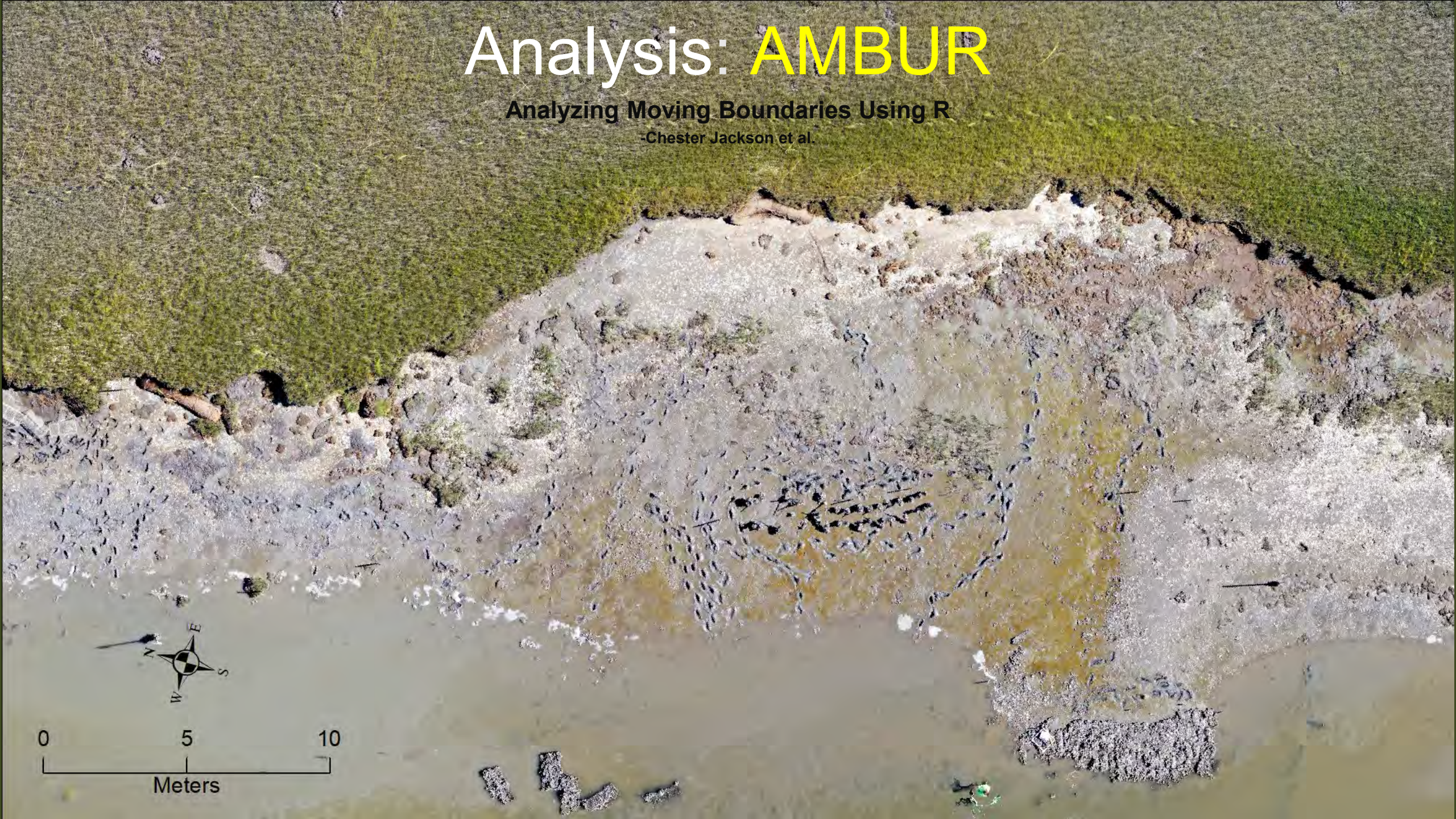
Digital surface model (DSM)
Surface feature elevation



Analysis: AMBUR

Analyzing Moving Boundaries Using R

-Chester Jackson et al.



Analysis: AMBUR

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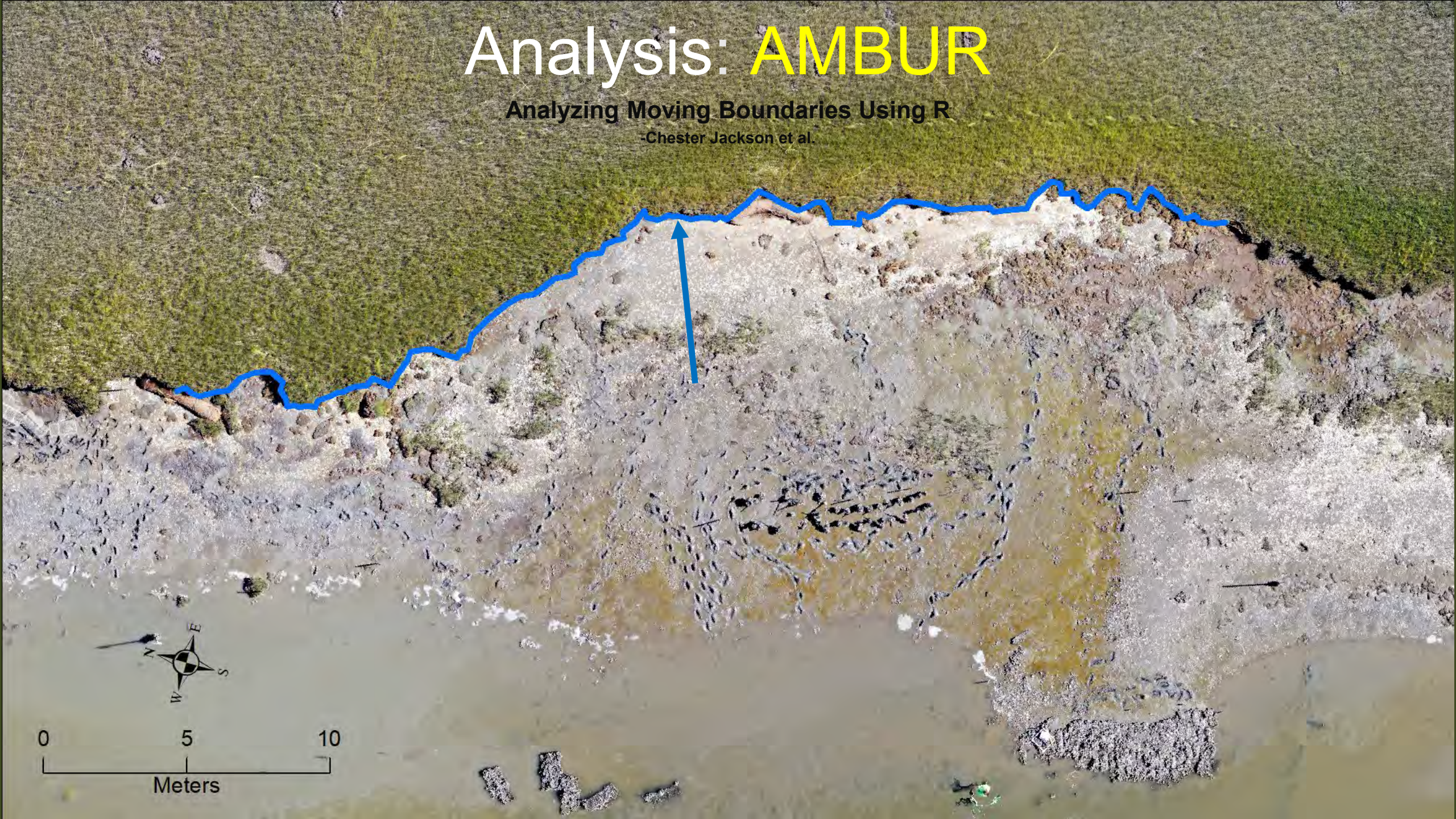
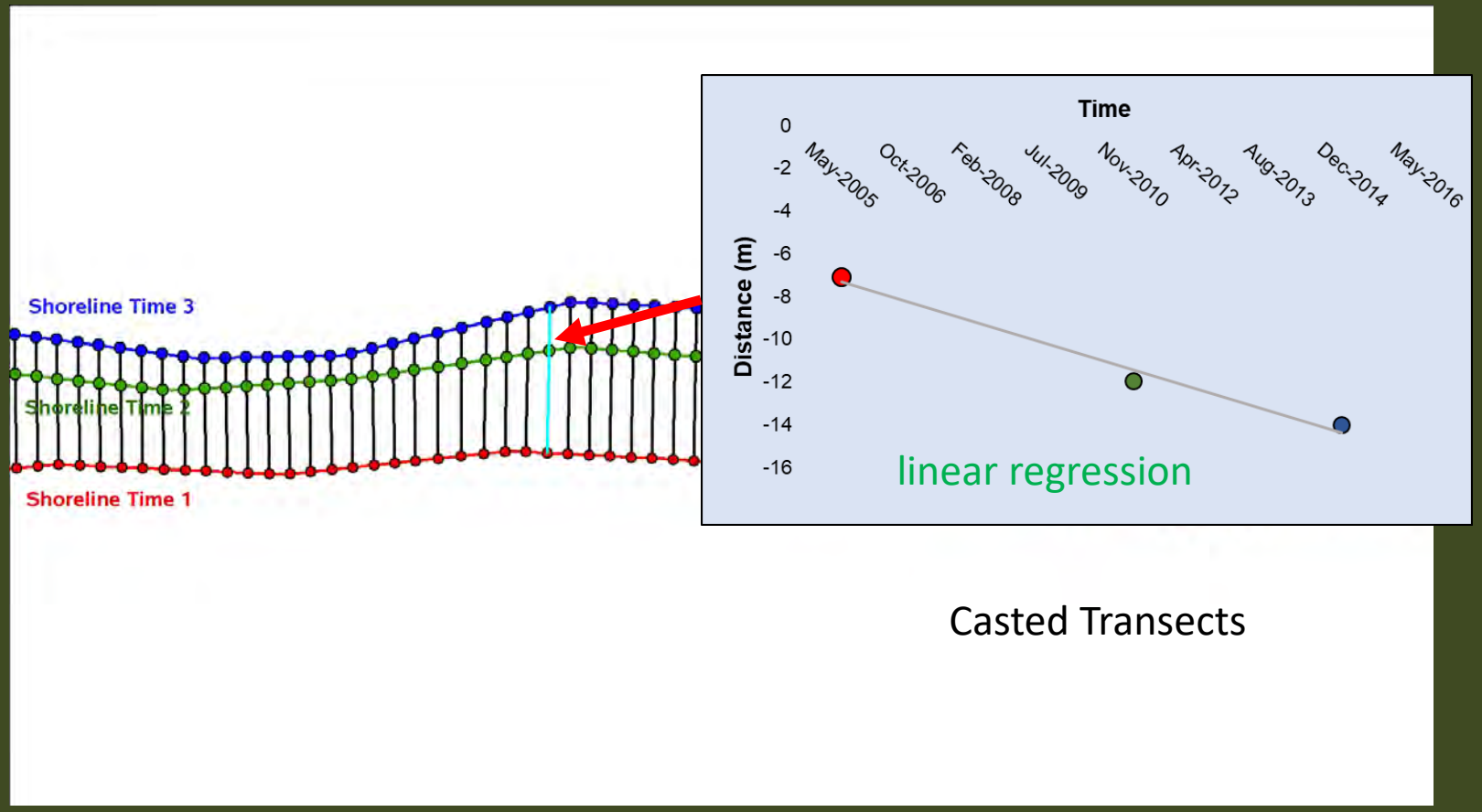


Analysis: AMBUR-

Analyzing Moving Boundaries Using R

-Chester Jackson et al.



Casted Transects

EPR: Endpoint Rate

-2 time points

WLR: Weighted Linear Regression Rate

-Slope = Rate

-Weighted by uncertainty

Error

root mean square error (rms)

RTK

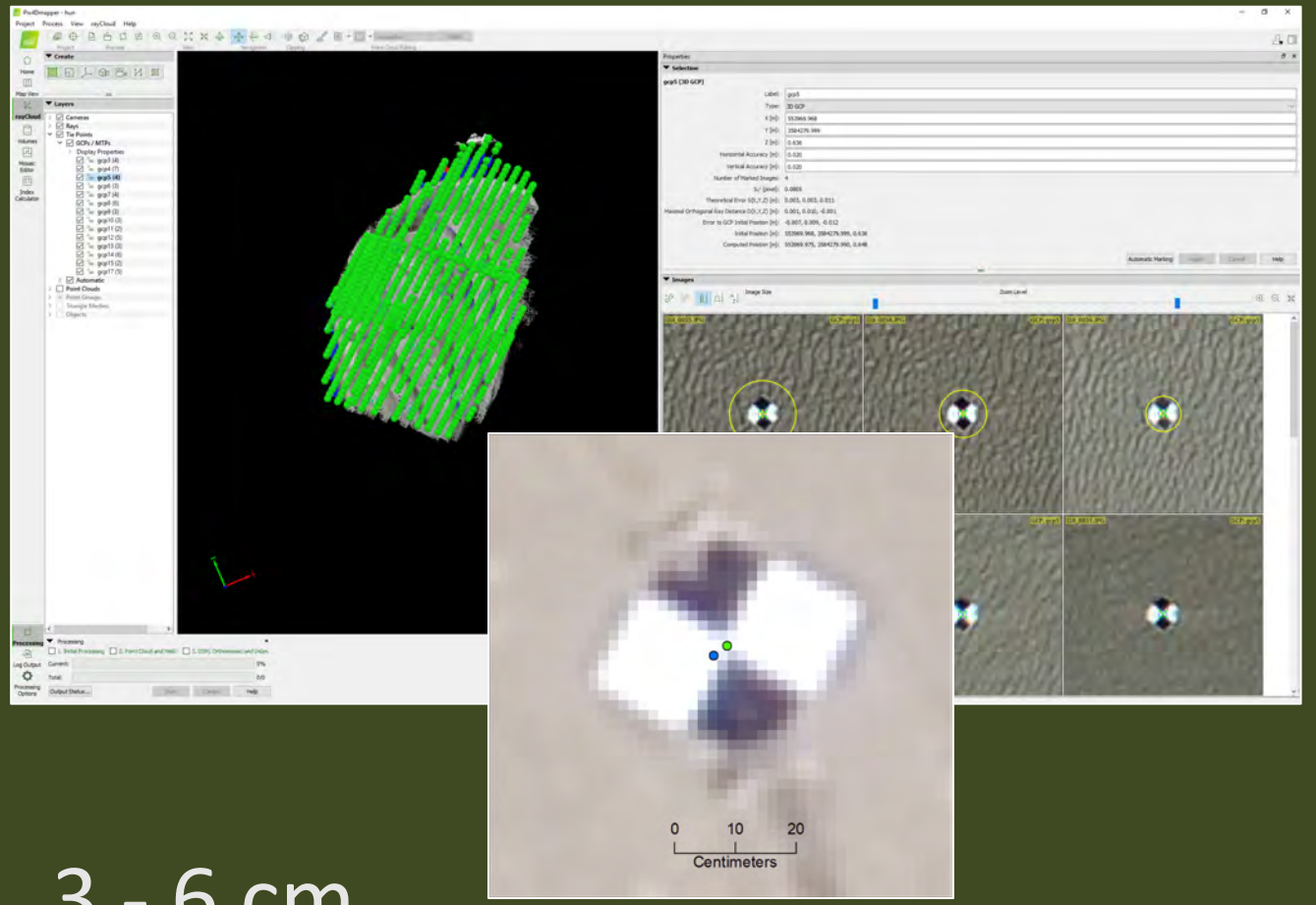
RTK vs. NGS Benchmarks (“the truth”)

1 – 4 cm

Error

Georectification

orthomosaic vs. RTK



3 - 6 cm

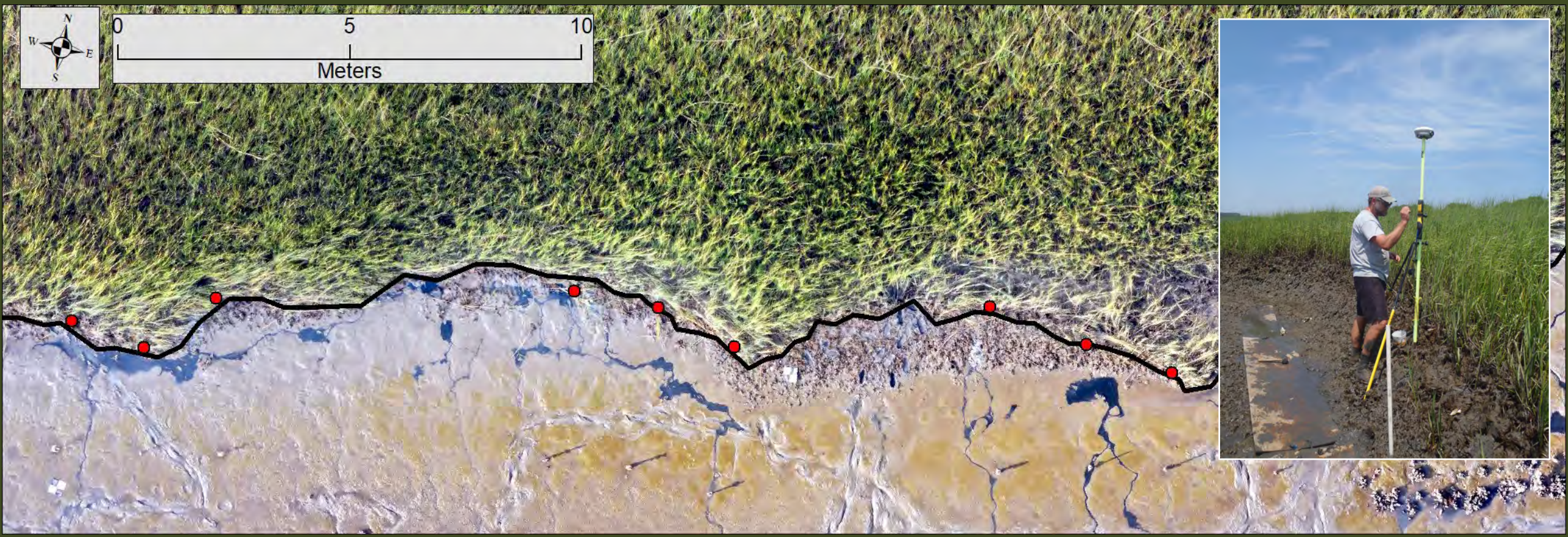
Error

Digitization

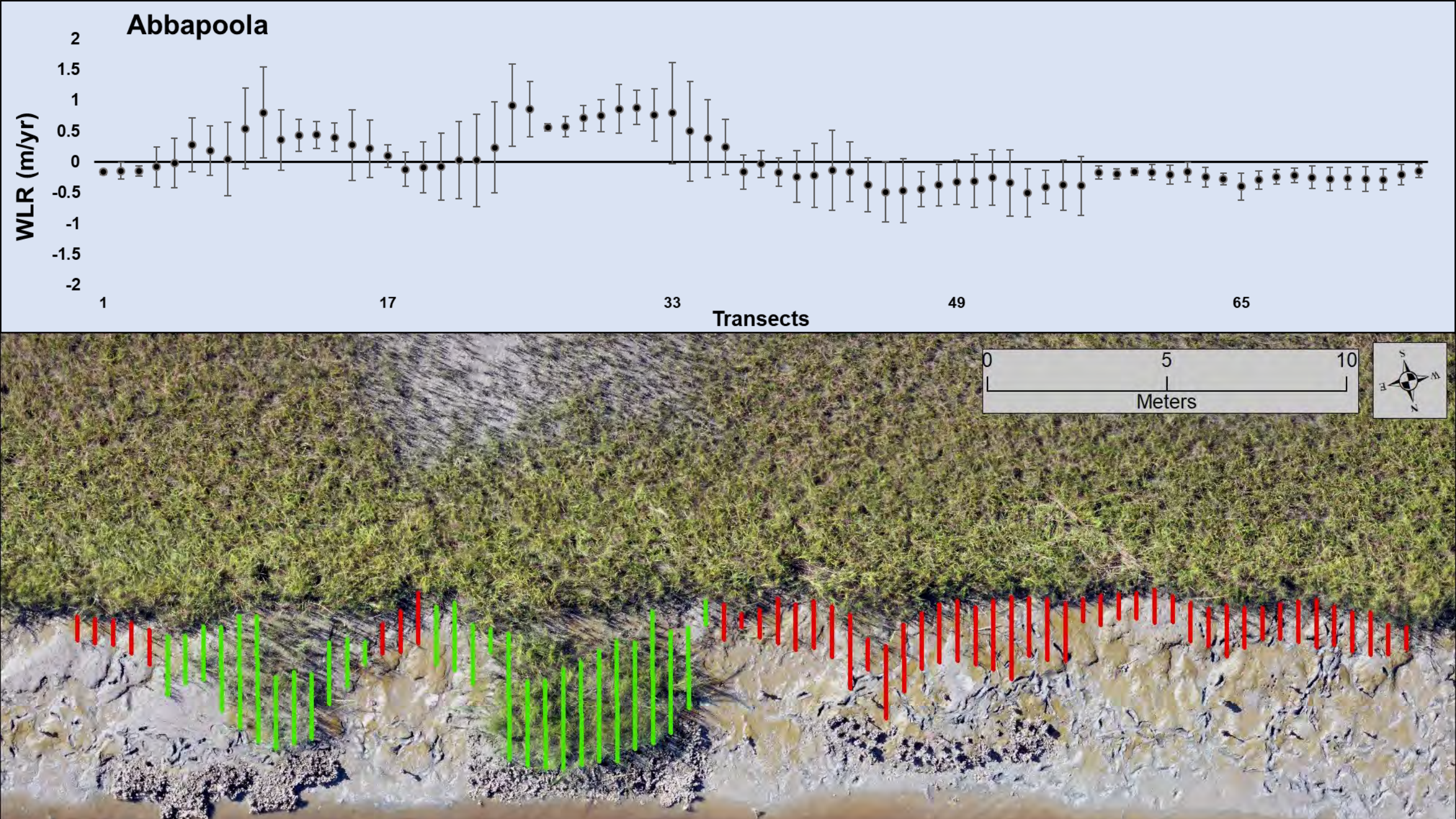
digitized feature vs. RTK

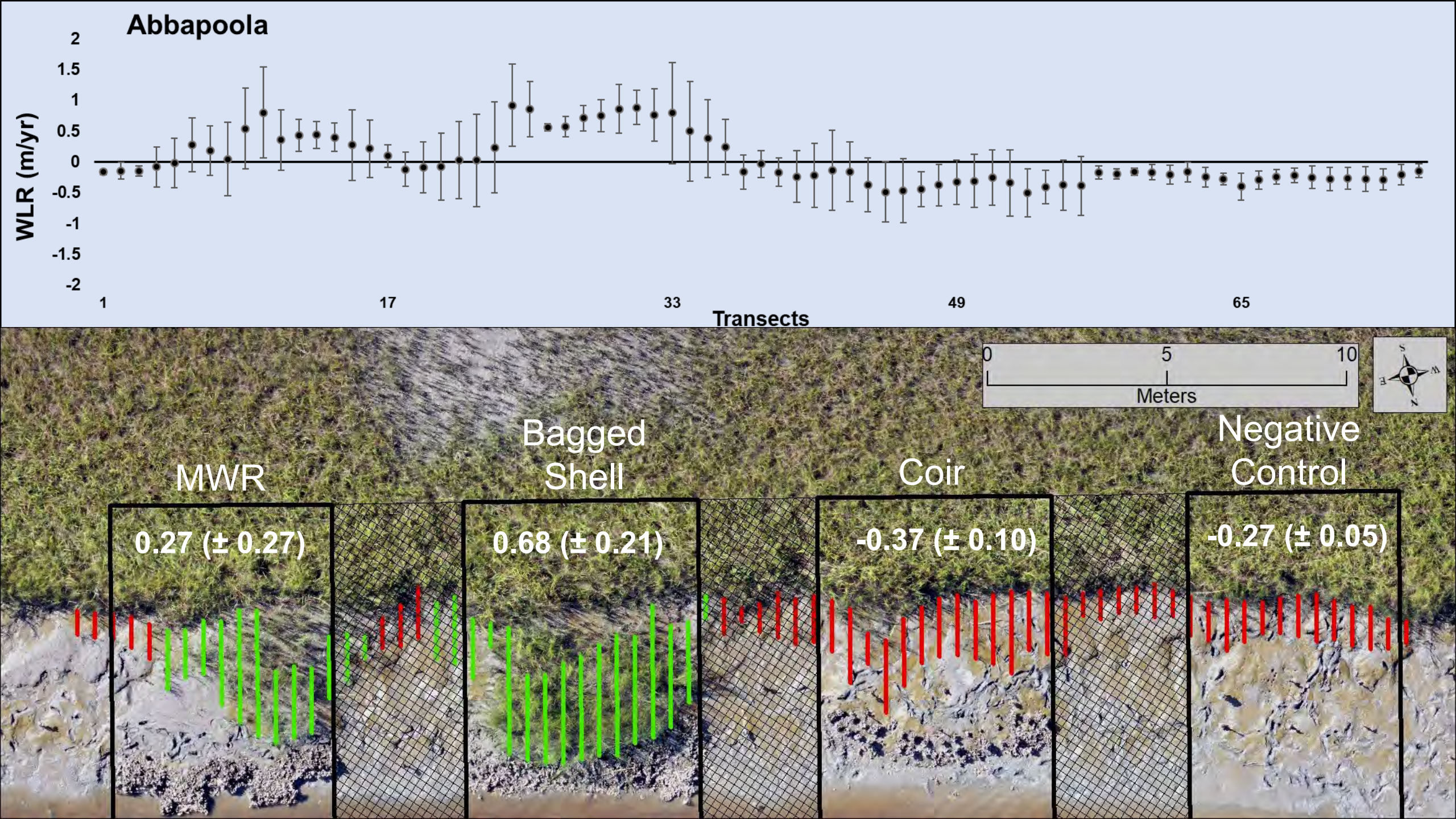
20 – 60 cm

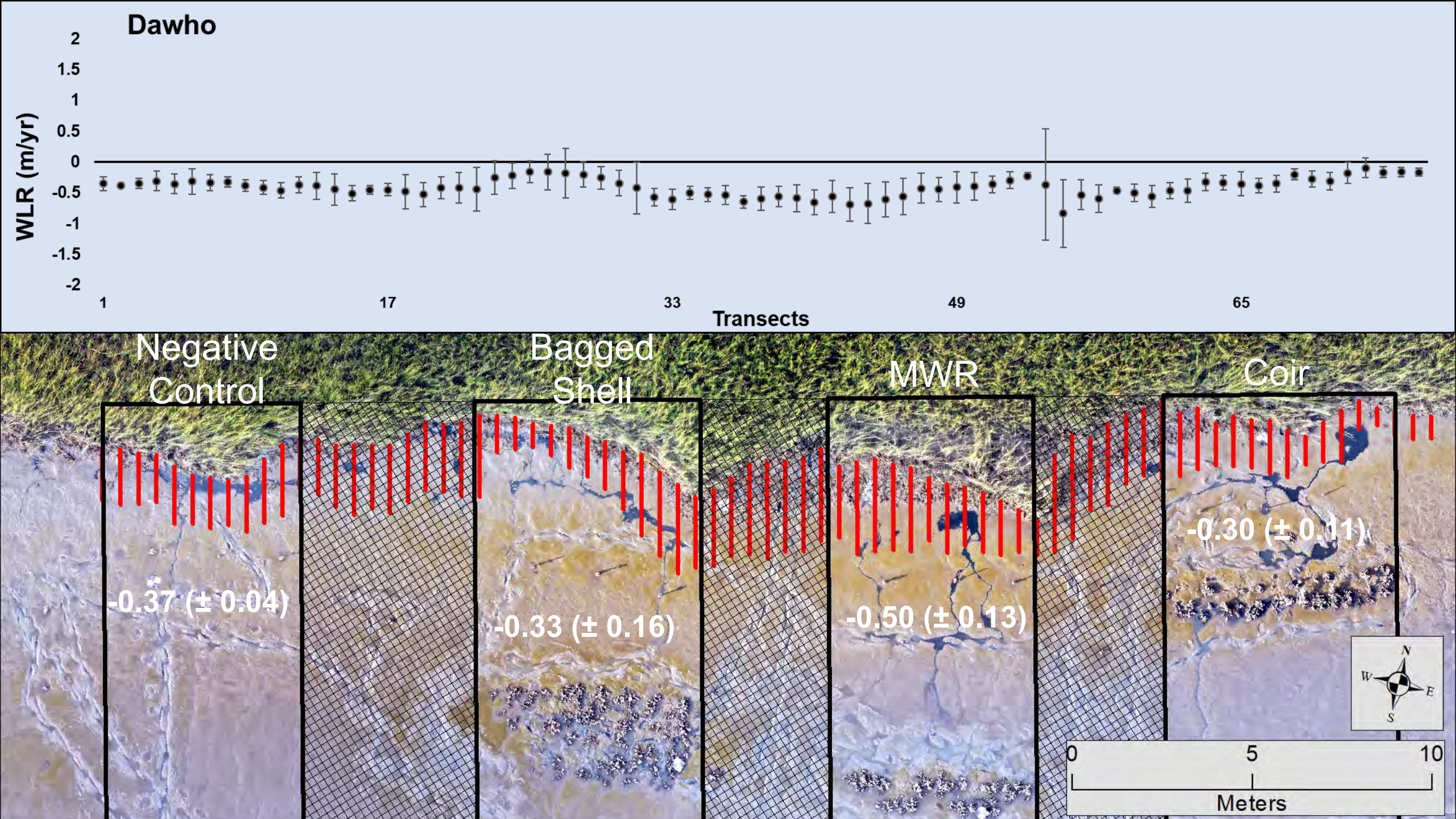
Uncertainty = (RTK rms) + (Georectification rms) + (digitization rms)



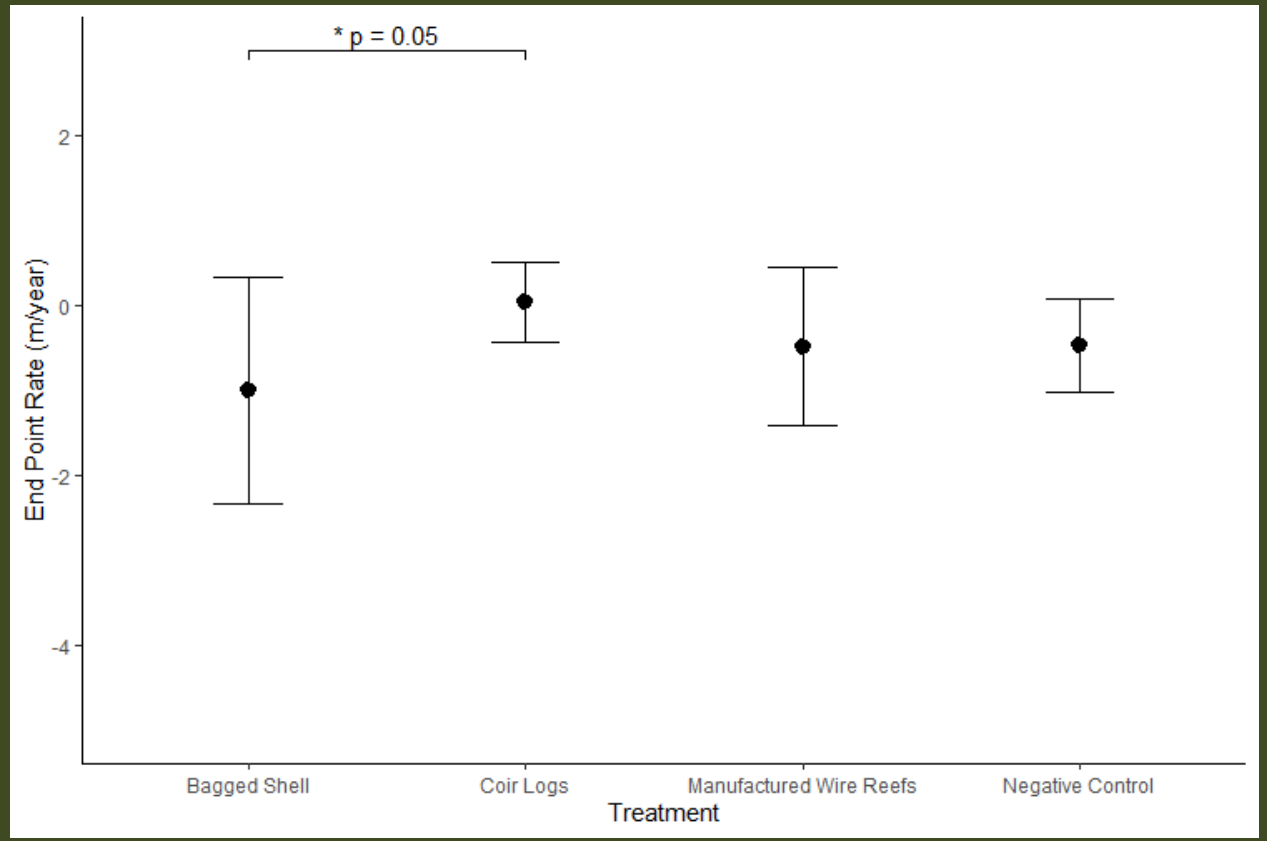

0
5
10
Meters
S
W
E
N
2018 Shoreline
2022 Shoreline


Abbapoola
WLR (m/yr)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1
17
33
49
65
Transects
0
5
10
Meters
S
W
E
N

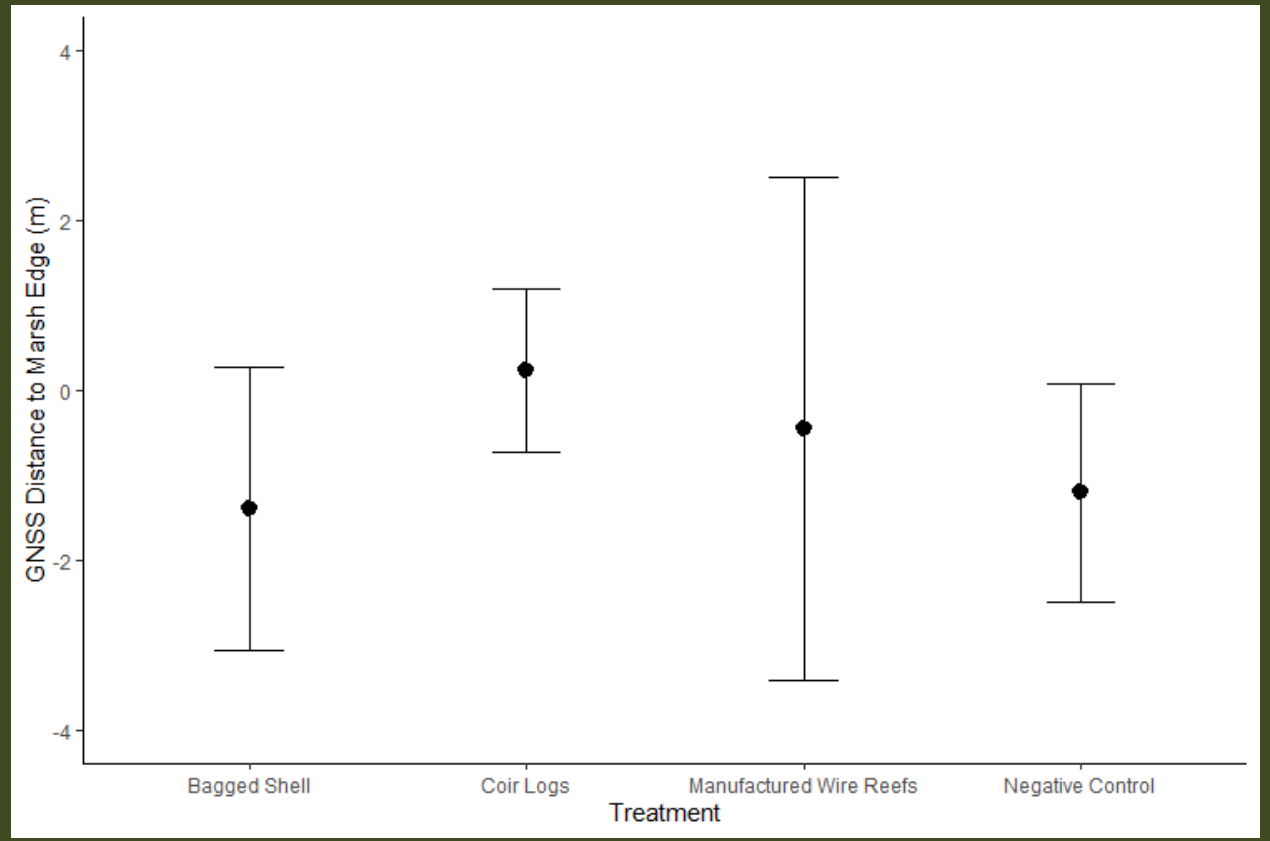

Abbapoola
WLR (m/yr)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1
17
33
49
65
Transects
0
5
10
Meters
MWR
0.27 (± 0.27)
Bagged Shell
0.68 (± 0.21)
Coir
-0.37 (± 0.10)
Negative Control
-0.27 (± 0.05)


Dawho
WLR (m/yr)
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
1
17
33
49
65
Transects
Negative Control
-0.37 (± 0.04)
Bagged Shell
-0.33 (± 0.16)
MWR
-0.50 (± 0.13)
Coir
-0.30 (± 0.11)
N
W
E
S
0
5
10
Meters

Results of AMBUR using EPR over 1-year period

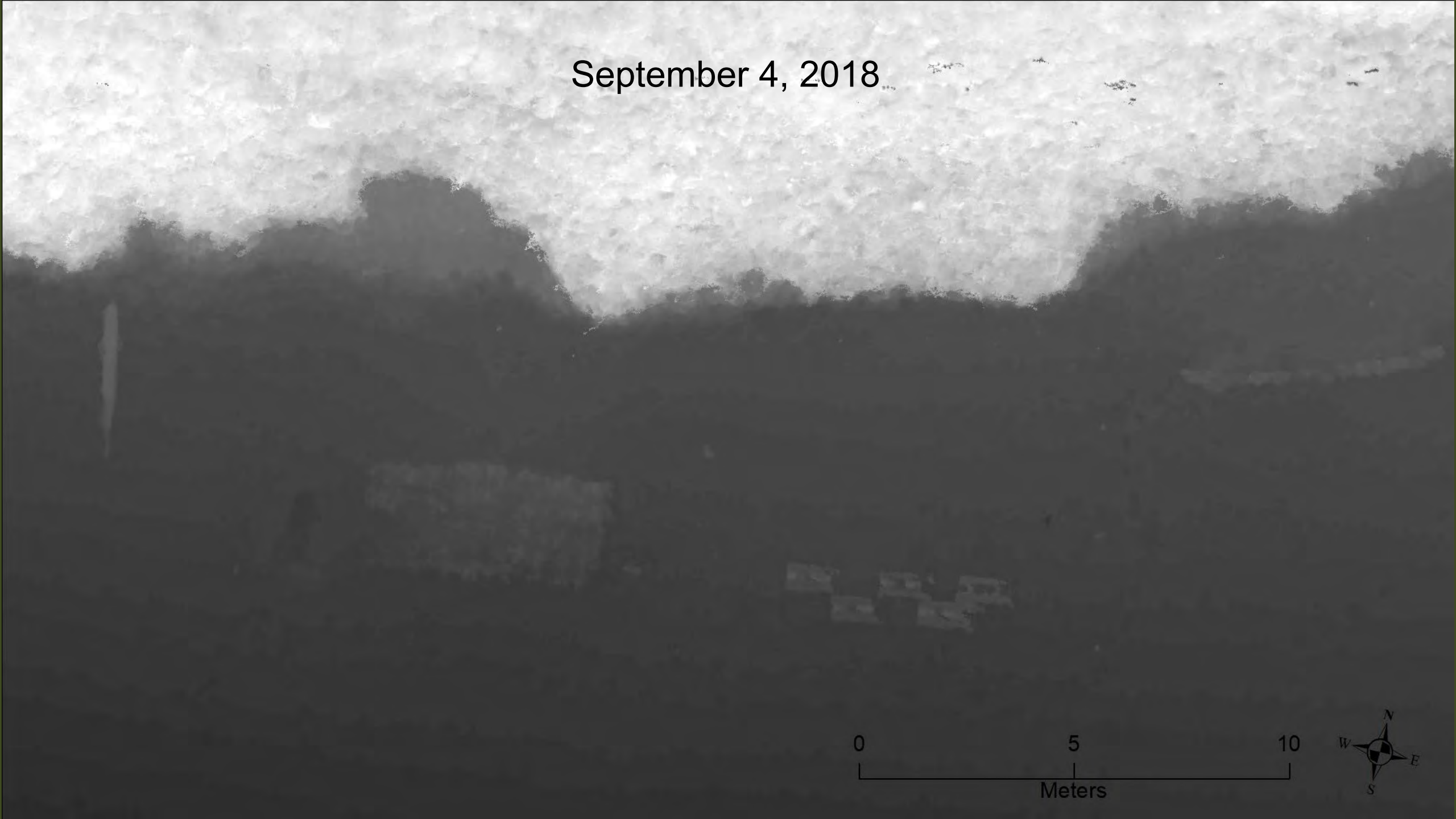


Results using RTK data over 3-year period




September 4, 2018
0
5
10
Meters
N
W
E
S


September 26, 2022
0
5
10
Meters
N
W
E
S


September 4, 2018
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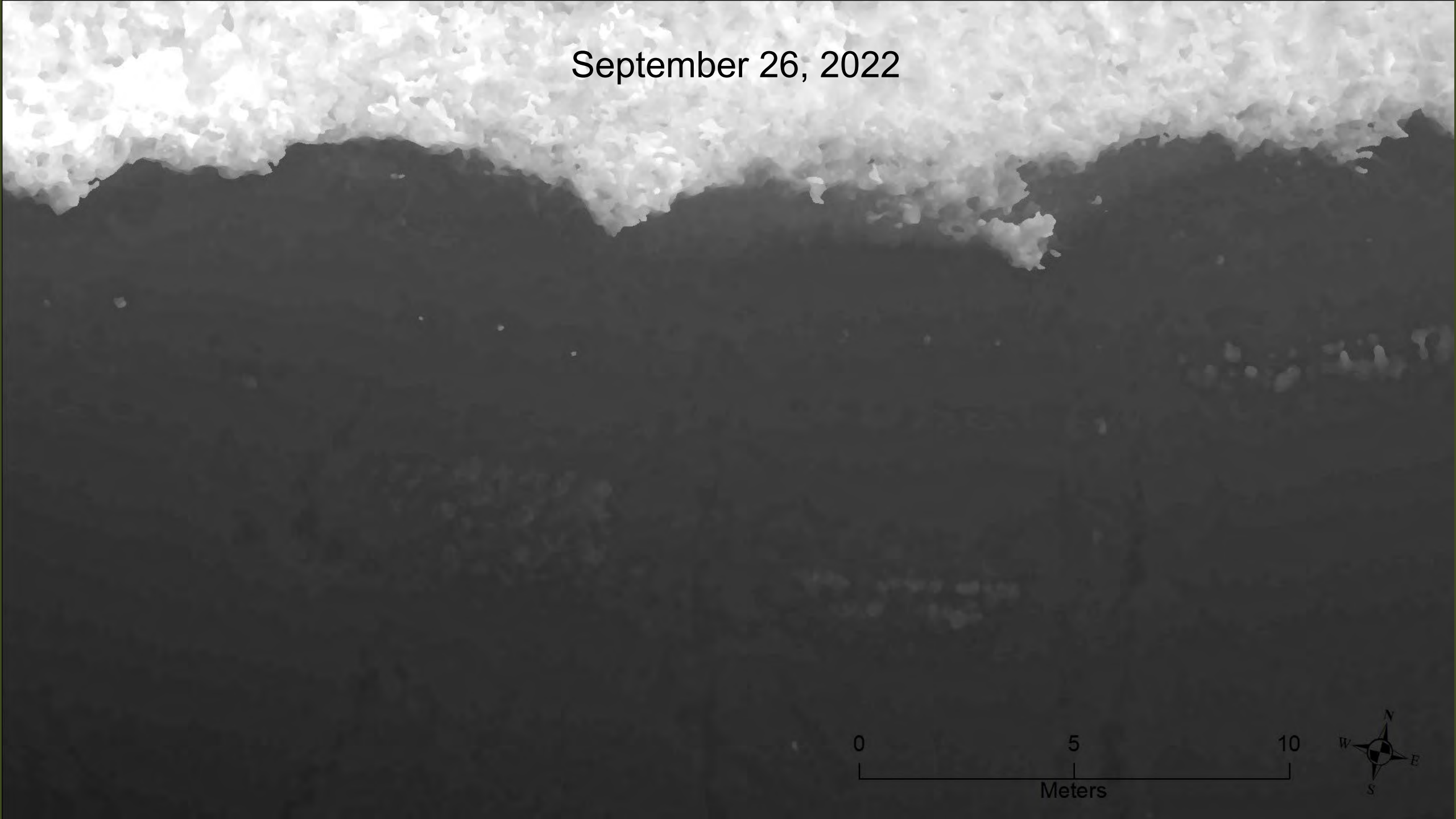
September 26, 2022
0
5
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Meters
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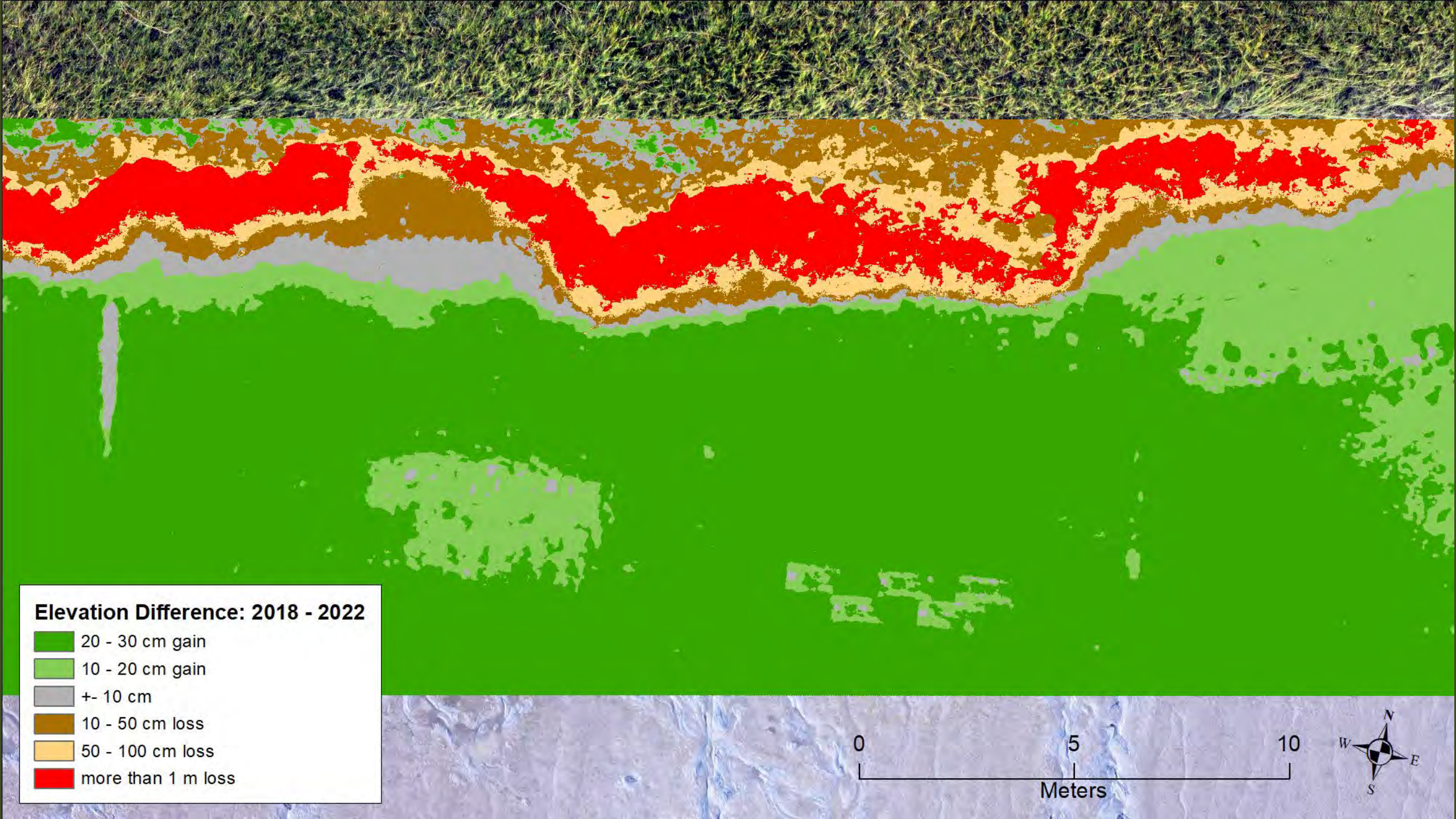
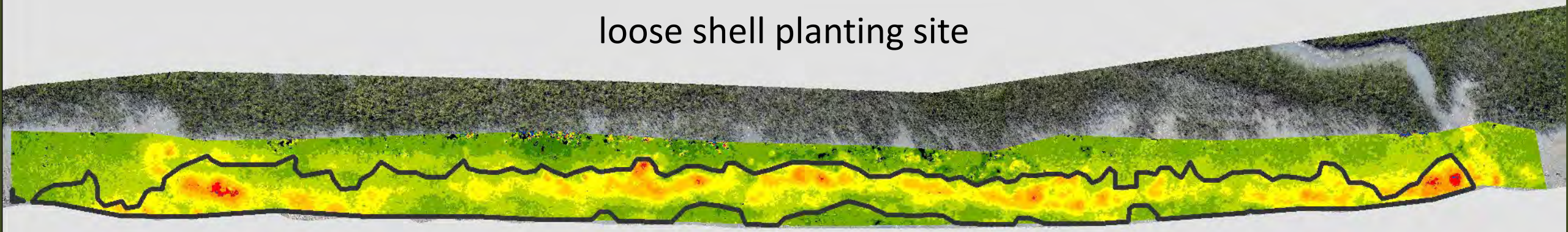
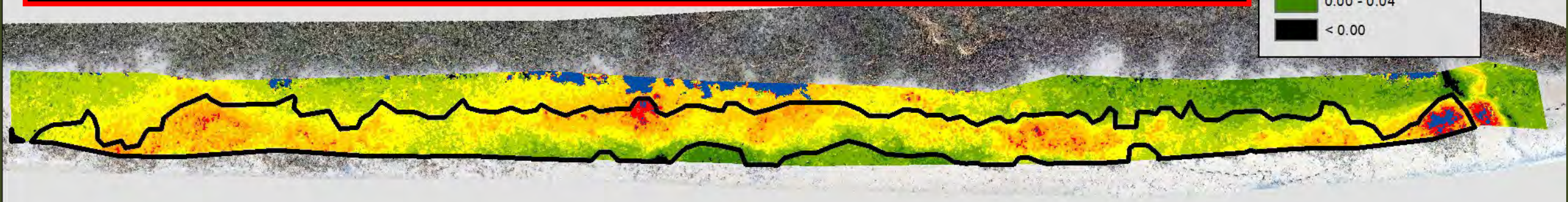

Elevation Difference: 2018 - 2022
20 - 30 cm gain
10 - 20 cm gain
+- 10 cm
10 - 50 cm loss
50 - 100 cm loss
more than 1 m loss
0
5
10
Meters
N
W
E
S

Murrells Inlet
loose shell planting site



Surface	Volume (m^3)	Change (m^3)	Cumulative Change (m^3)
Pre-planting (Jul. 2018)	194.8	na	na
Post-planting (Aug. 2018)	243.5	48.7	48.7
2.5 Years post-planting (Jan. 2021)	250.5	7	55.7
3.5 Years post-planting (Mar. 2022)	272.9	22.4	78.1



January 11, 2021 – July 12, 2018 DSM

Meters
0 10 20

S
E W
N