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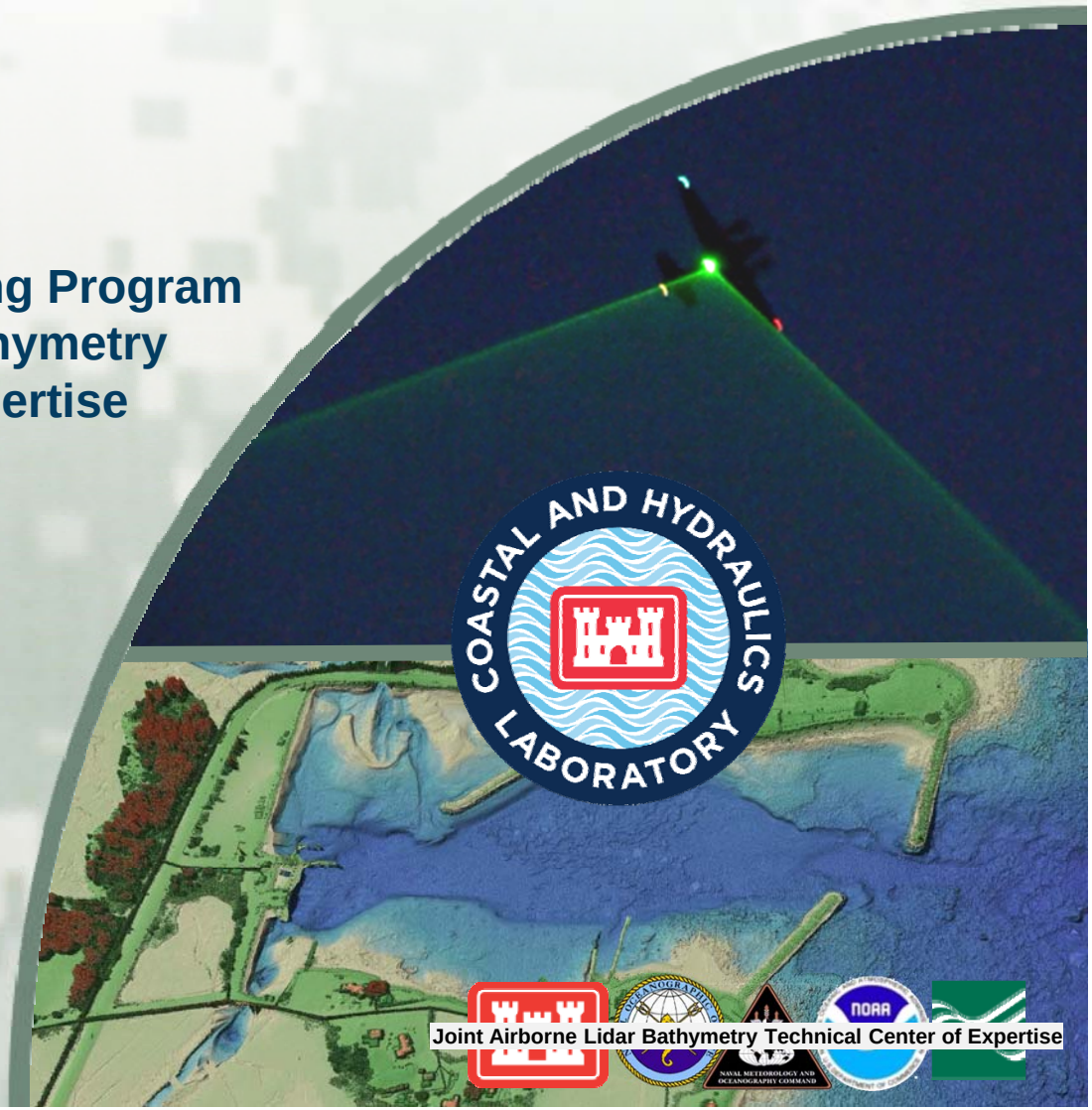
National Coastal Mapping Program Update and Tools

Jennifer M. Wozencraft
Research Physical Scientist
Manager, National Coastal Mapping Program
Director, Joint Airborne Lidar Bathymetry Technical Center of Expertise

Coastal and Hydraulics Laboratory
US Army Engineer R&D Center

17 May 2016
Regional Sediment Management IPR
Kitty Hawk, NC



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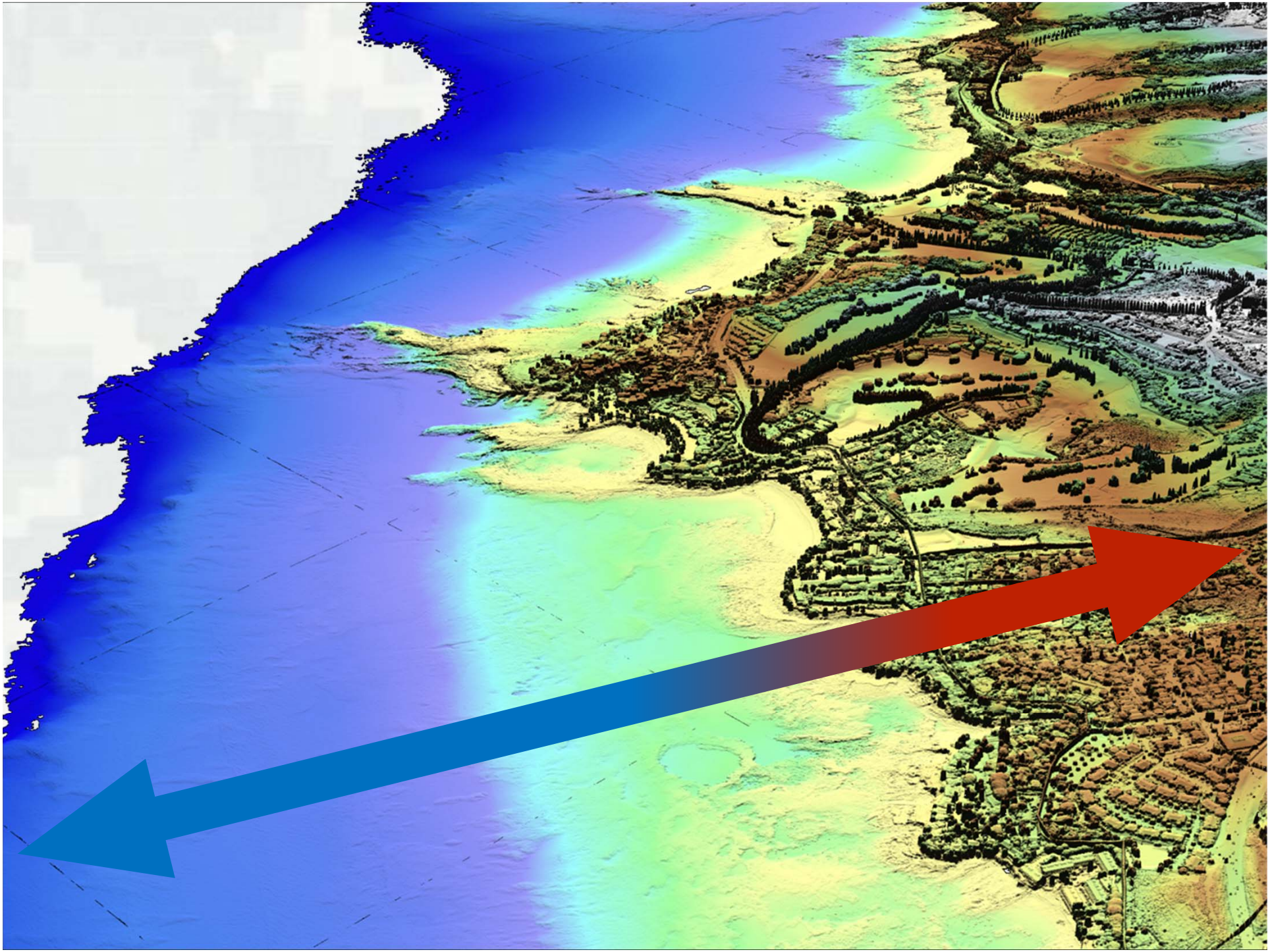
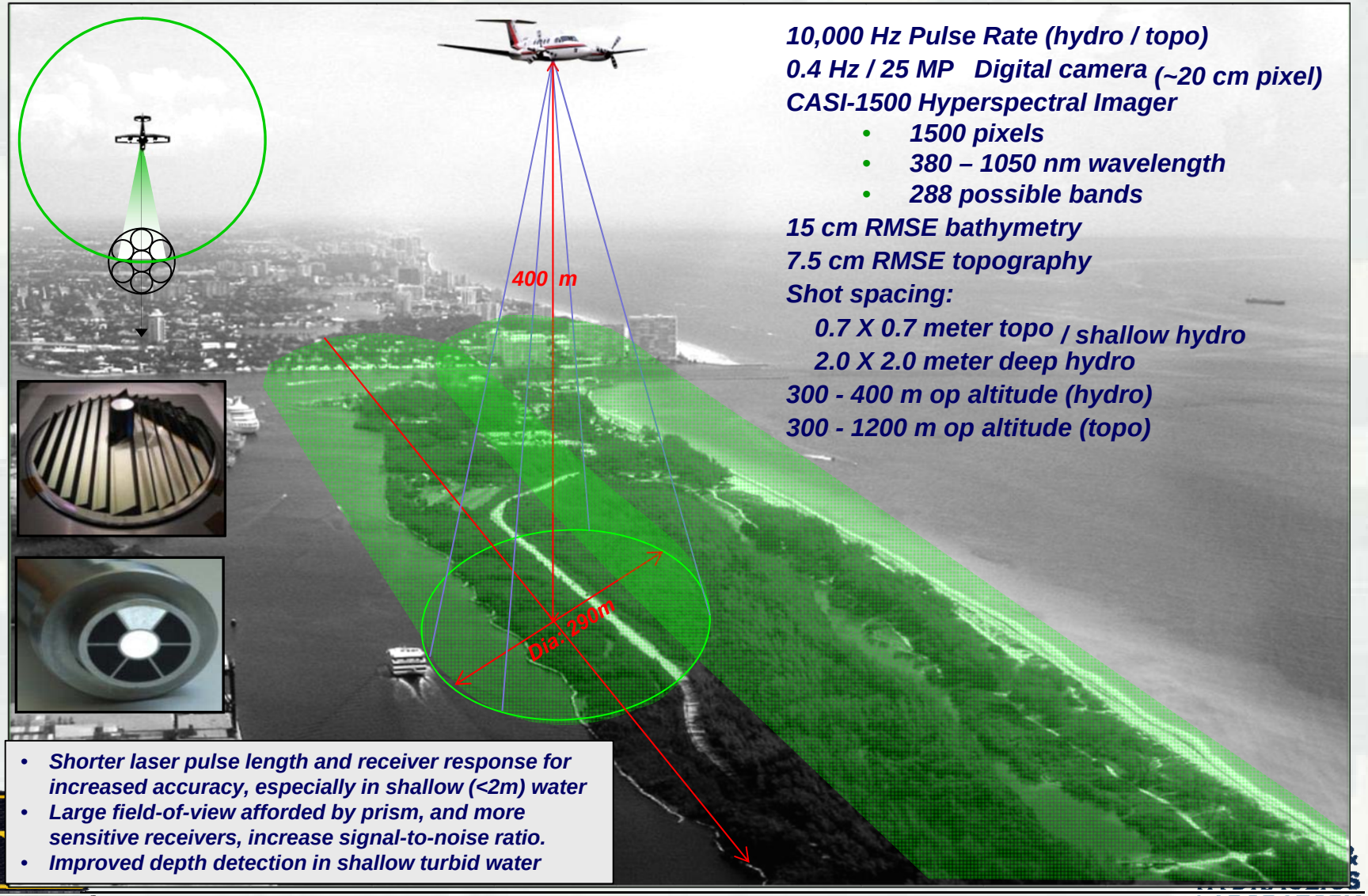


CZMIL Coastal Zone Mapping and Imaging Lidar



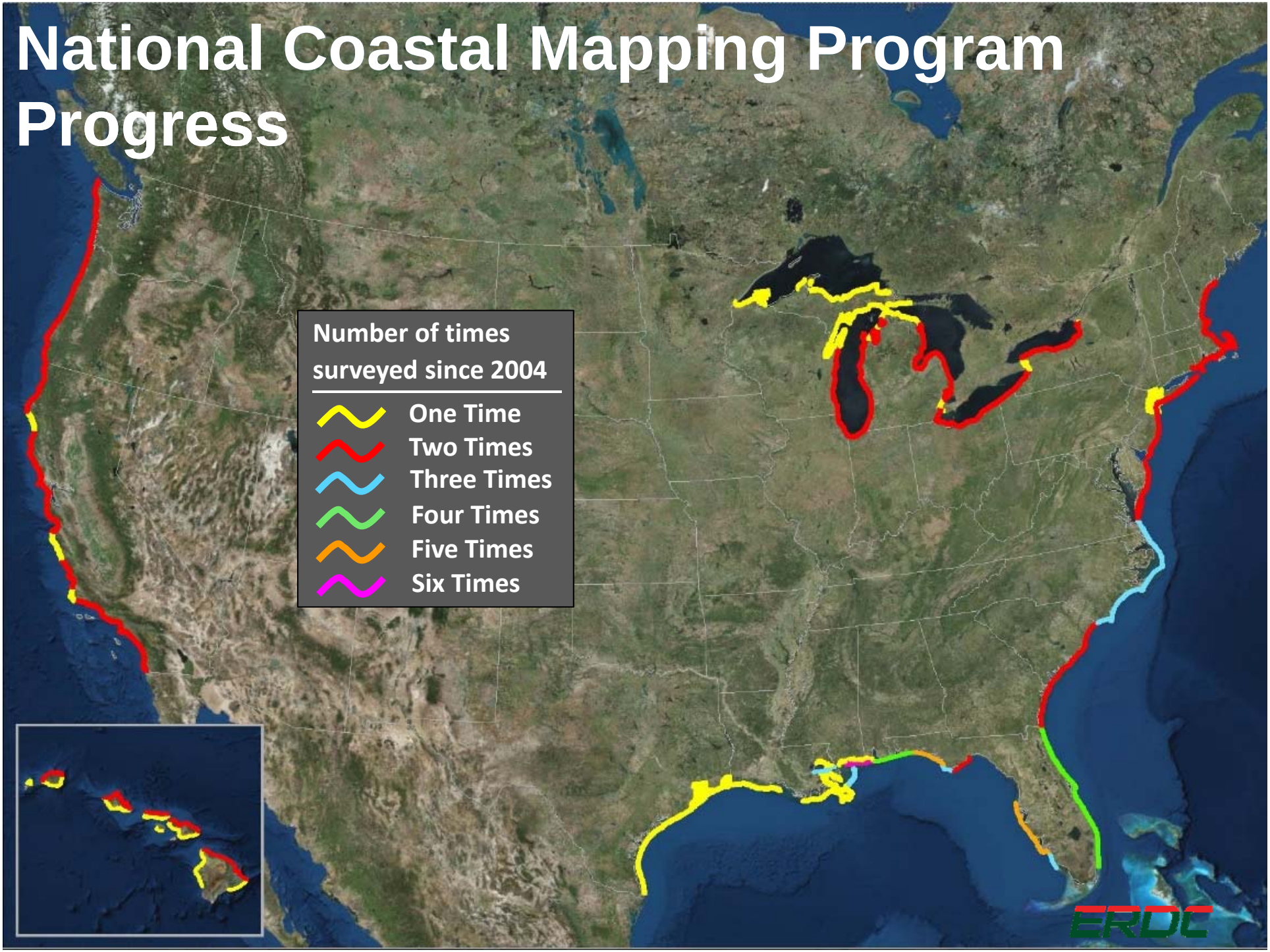
10,000 Hz Pulse Rate (hydro / topo)
0.4 Hz / 25 MP Digital camera (~20 cm pixel)
CASI-1500 Hyperspectral Imager
- *1500 pixels*
- *380 – 1050 nm wavelength*
- *288 possible bands*

15 cm RMSE bathymetry
7.5 cm RMSE topography
Shot spacing:
0.7 X 0.7 meter topo / shallow hydro
2.0 X 2.0 meter deep hydro
300 - 400 m op altitude (hydro)
300 - 1200 m op altitude (topo)

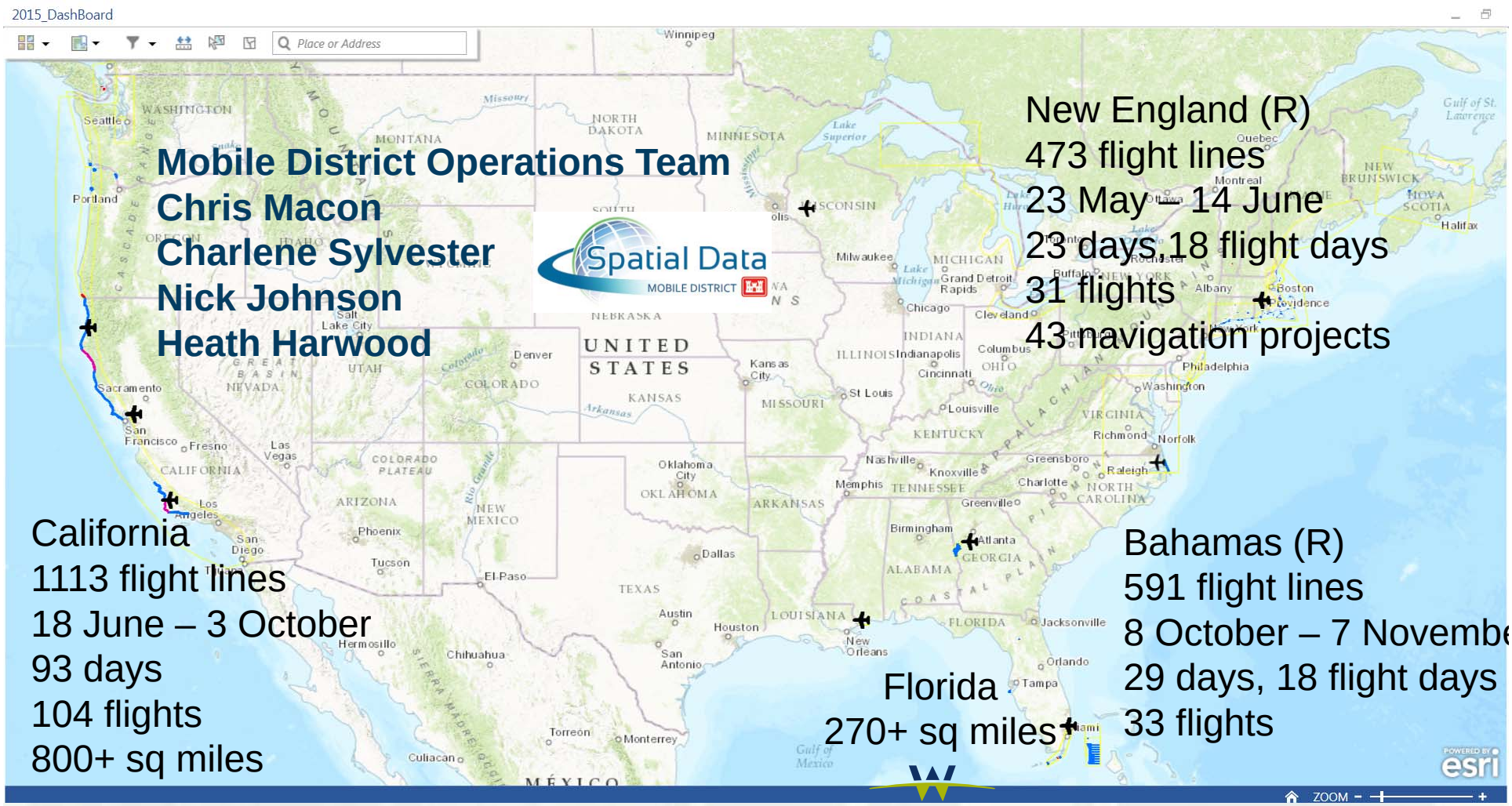
- *Shorter laser pulse length and receiver response for increased accuracy, especially in shallow (<2m) water*
- *Large field-of-view afforded by prism, and more sensitive receivers, increase signal-to-noise ratio.*
- *Improved depth detection in shallow turbid water*

Coastal Zone Mapping and Imaging Lidar

National Coastal Mapping Program Progress



2015 JALBTCX Survey Season



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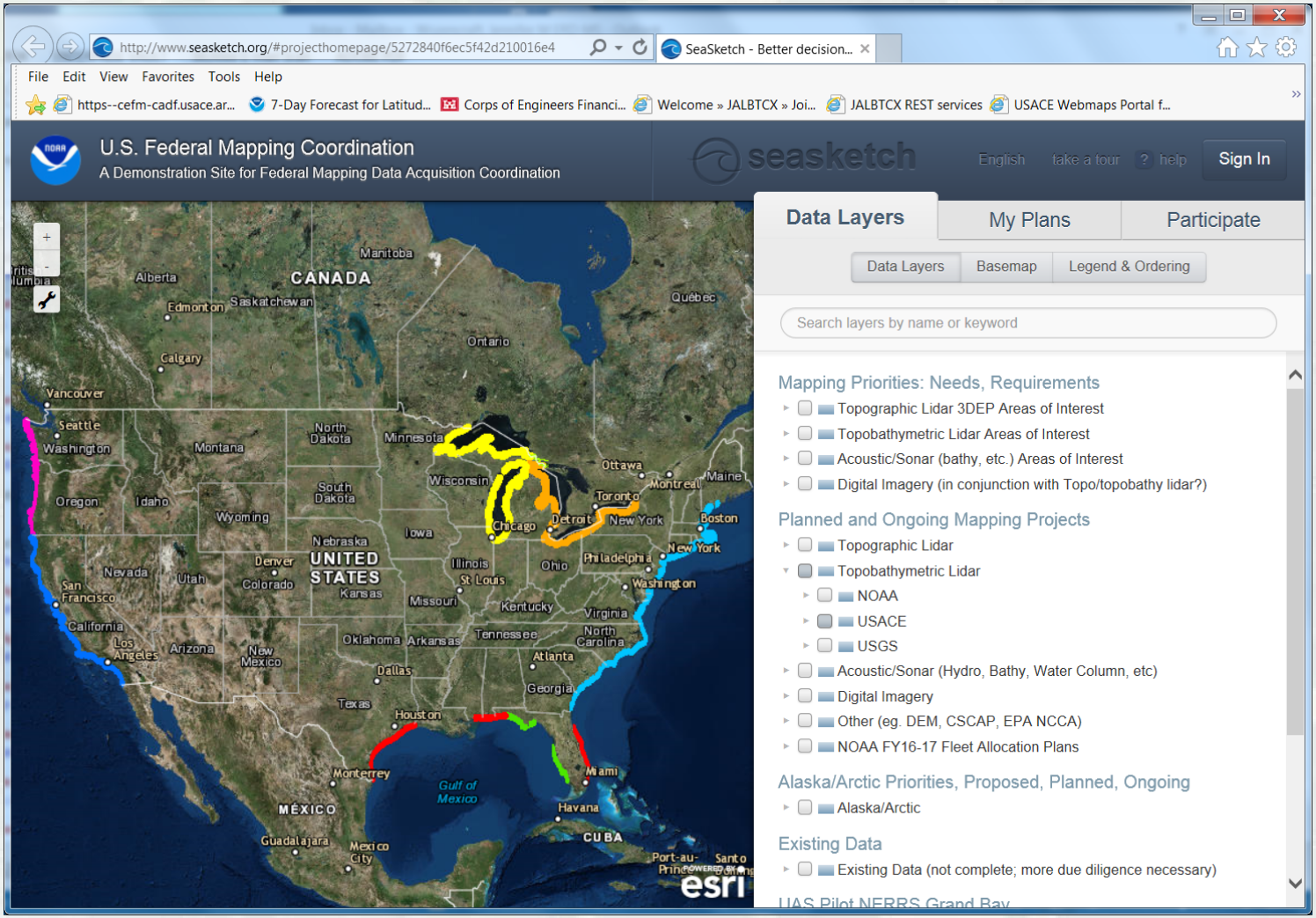
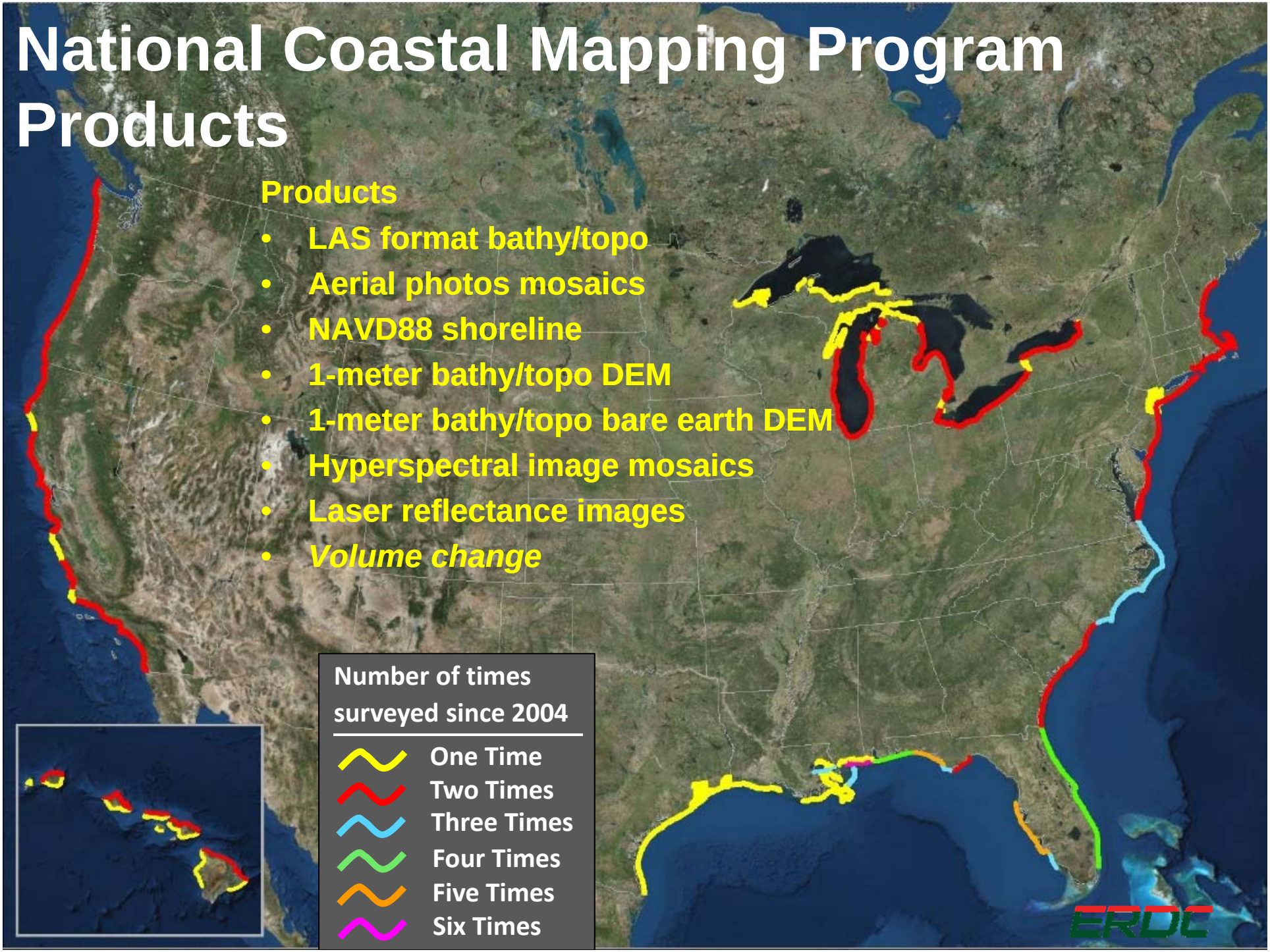
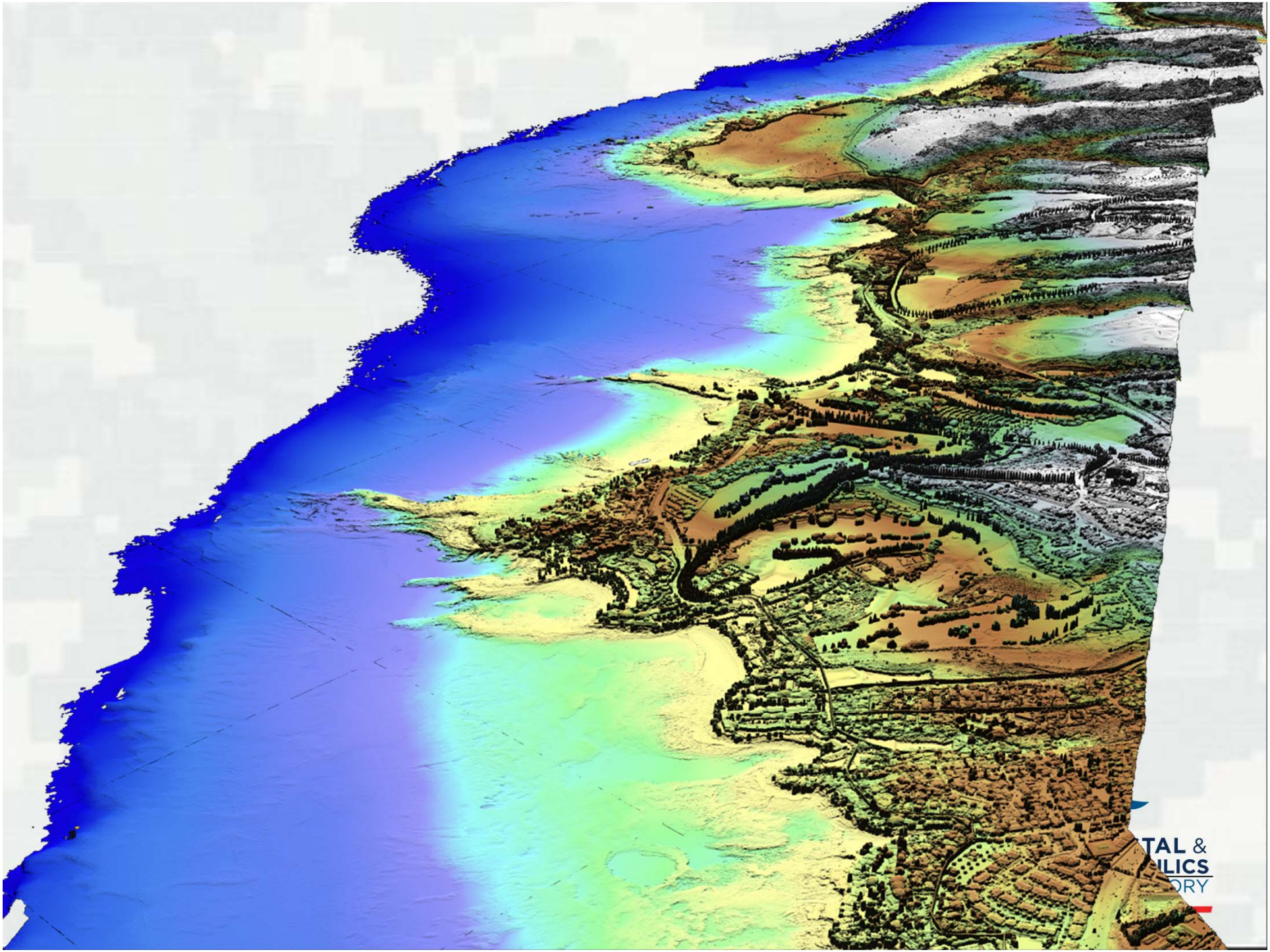
Future NCMP collections

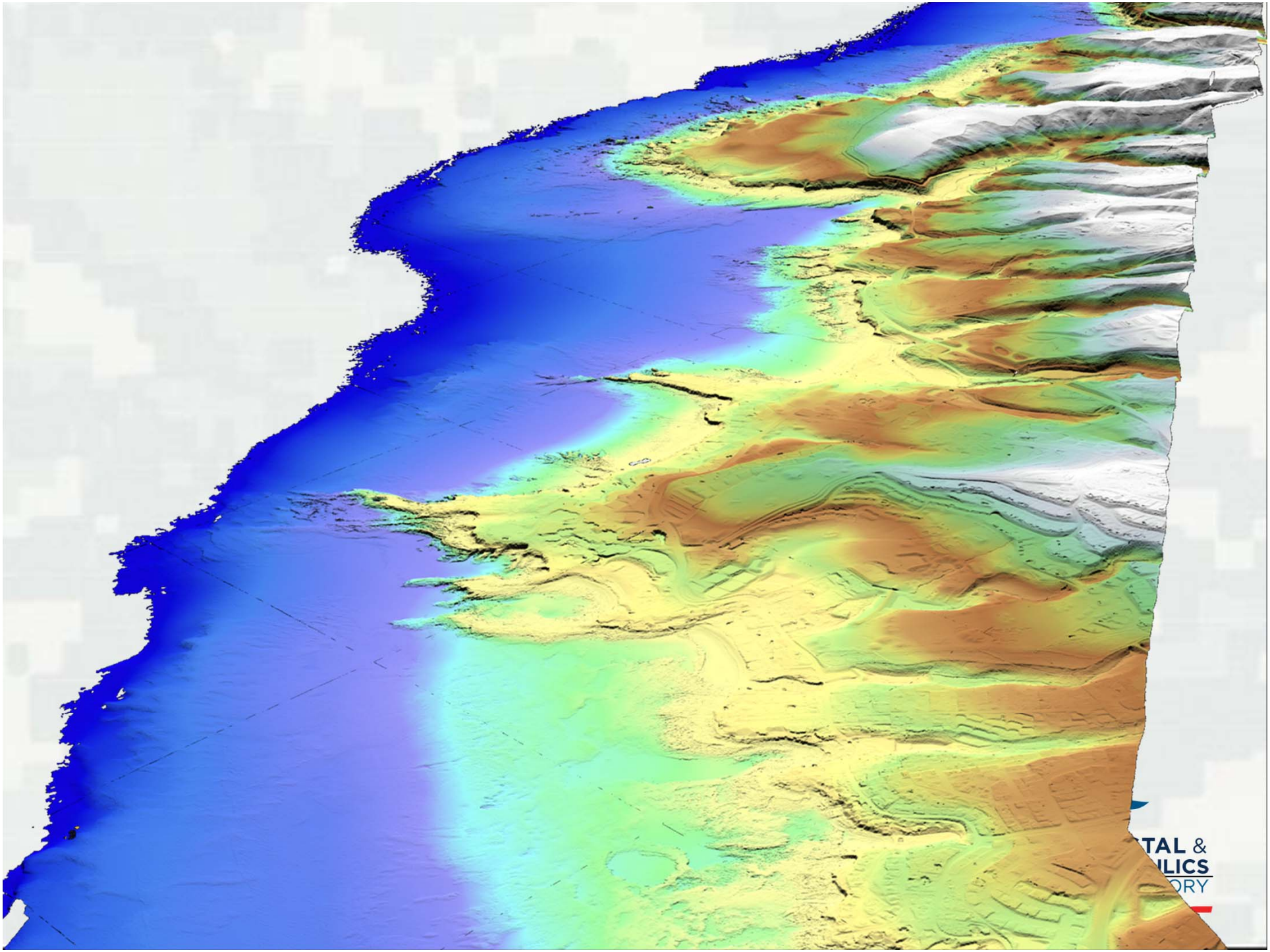


http://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4

National Coastal Mapping Program Products






TAL &
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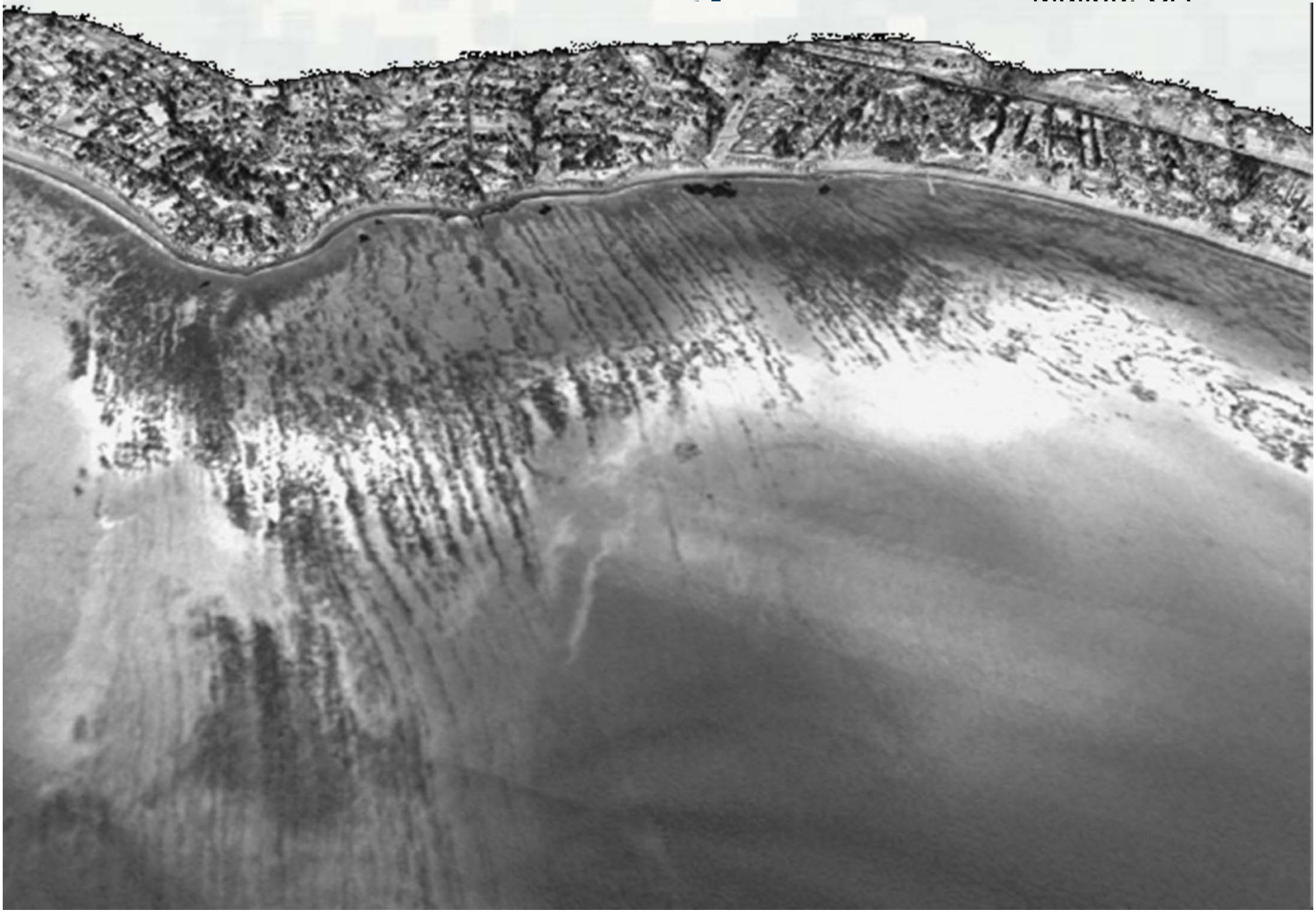
Laser reflectance image

NCMP 2009
Malibu, CA

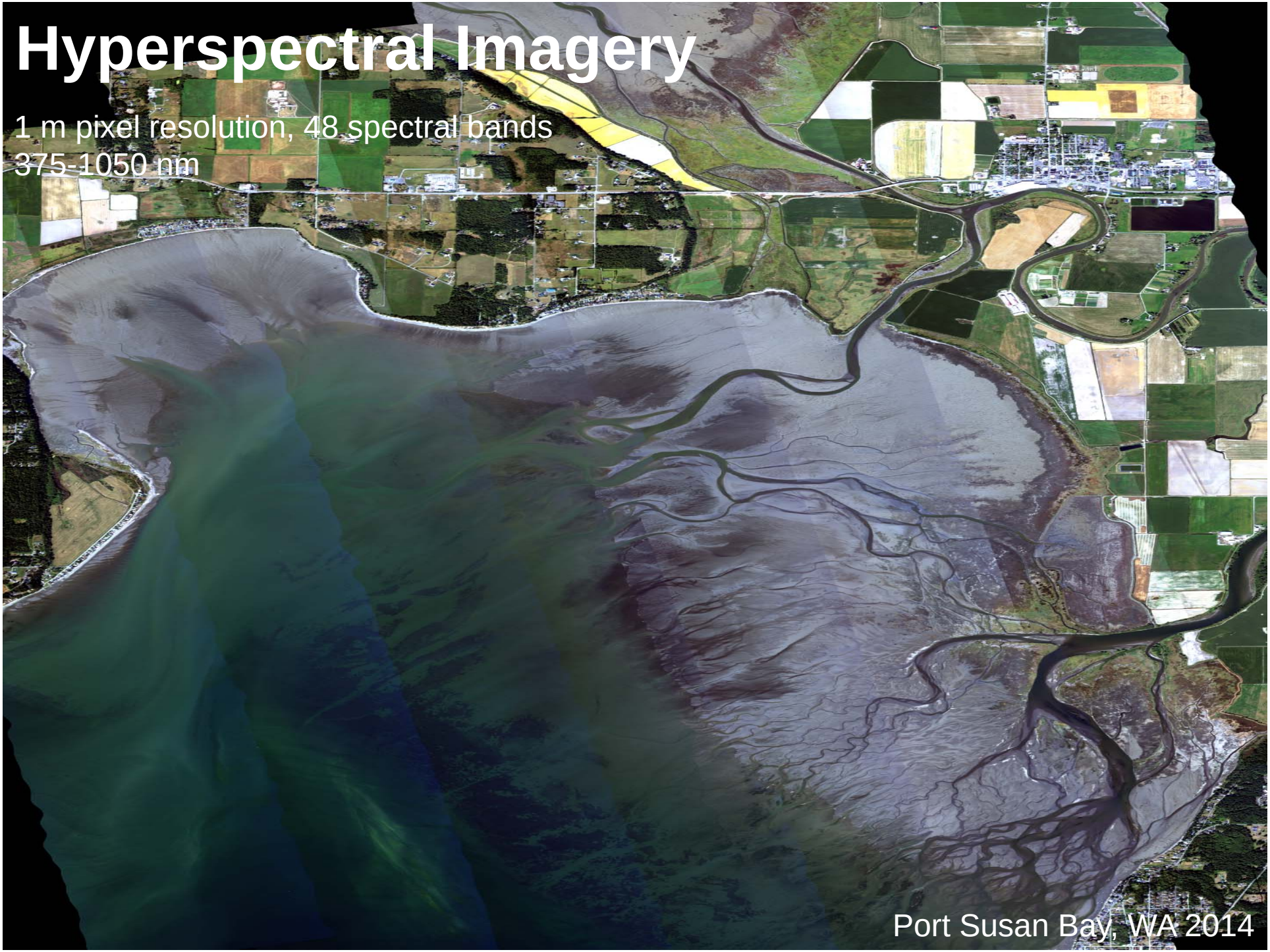


Aerial photography/lidar

Siuslaw River Entrance, OR 2014

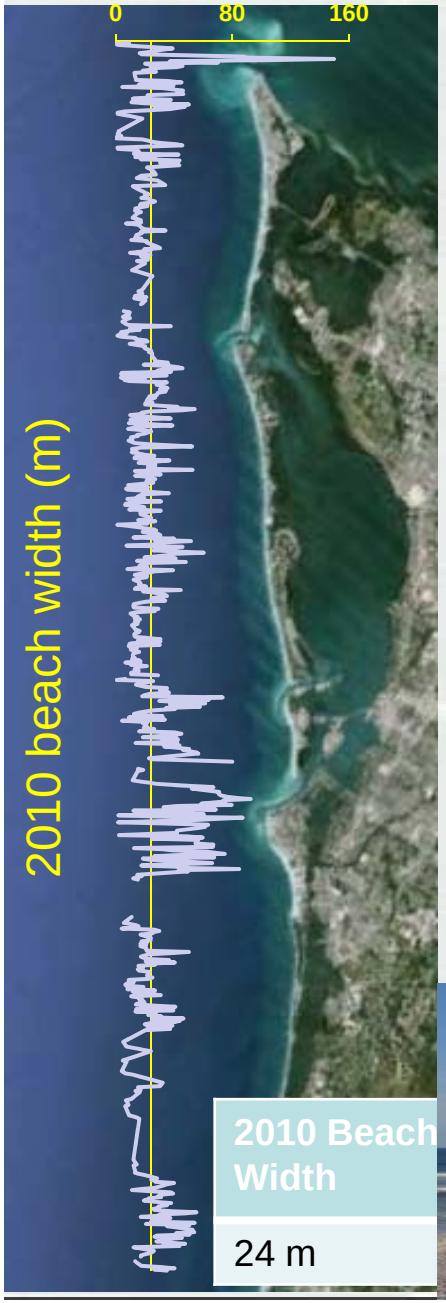
Hyperspectral Imagery

1 m pixel resolution, 48 spectral bands
375-1050 nm



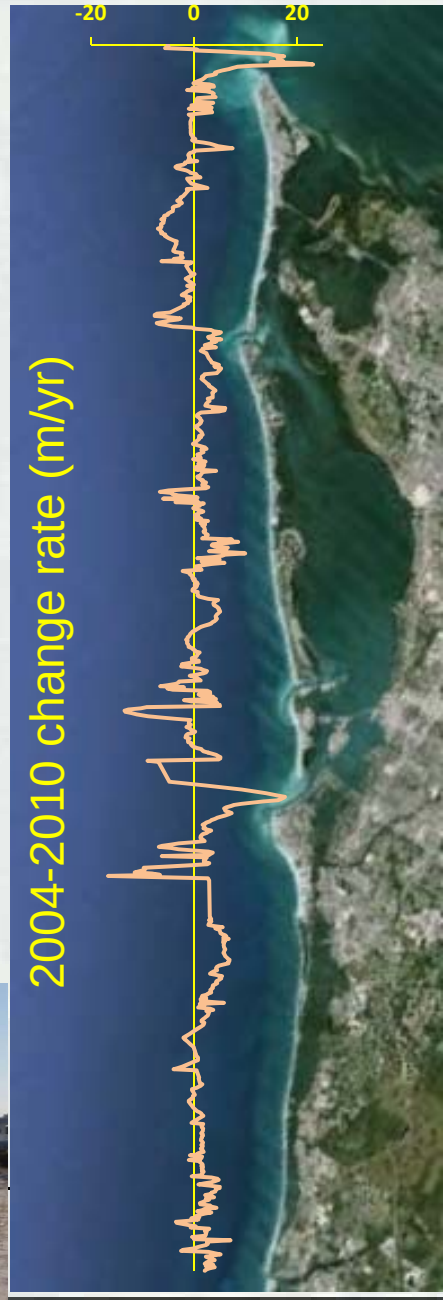
Port Susan Bay, WA 2014

Zero Contour

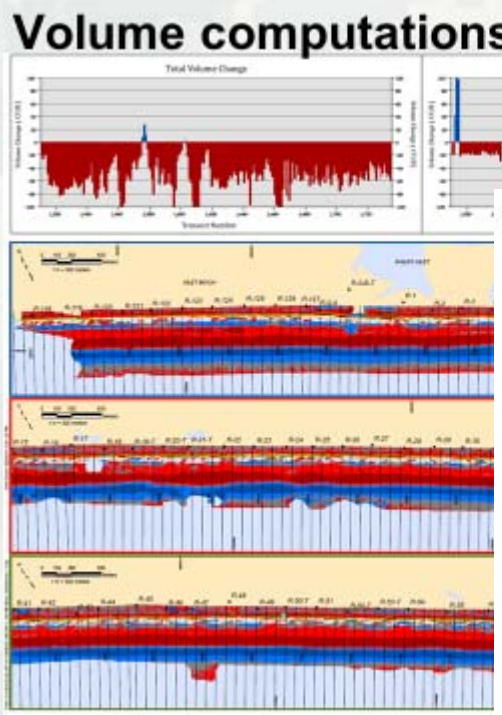


- Beach width provides buffer before the dune as well as recreational benefits
  - Defined as the distance between the zero contour and the dune toe
  - Active portion of the beach
- Contour change rate
  - Used to determine hot spots of erosion and cumulative change can identify extent of inlet influence

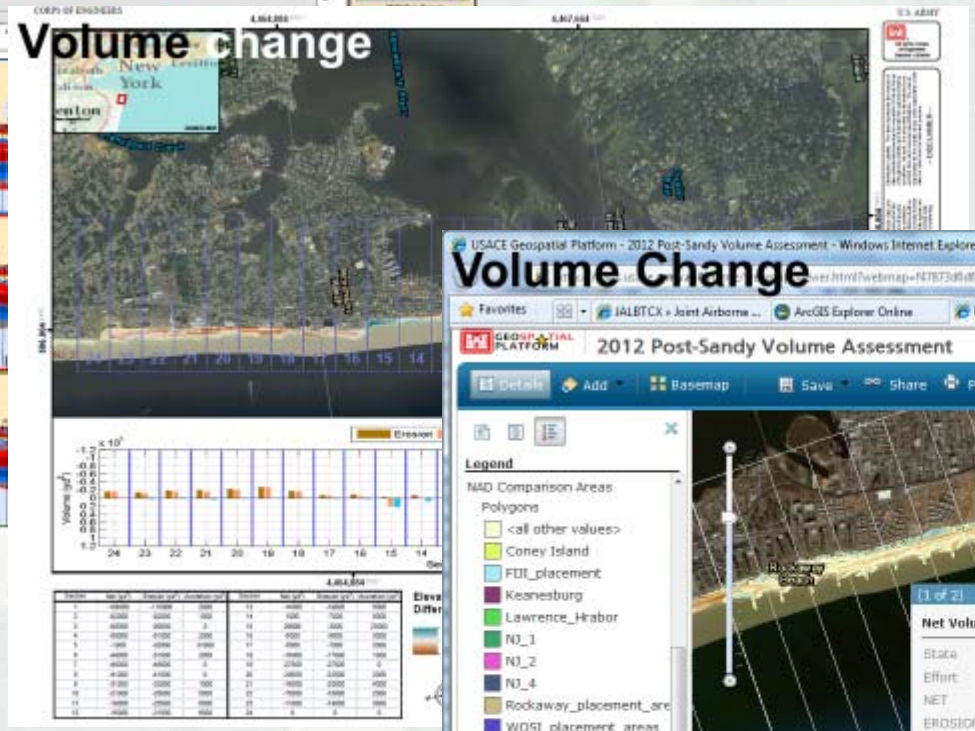
1) What shoreline is most meaningful to you?



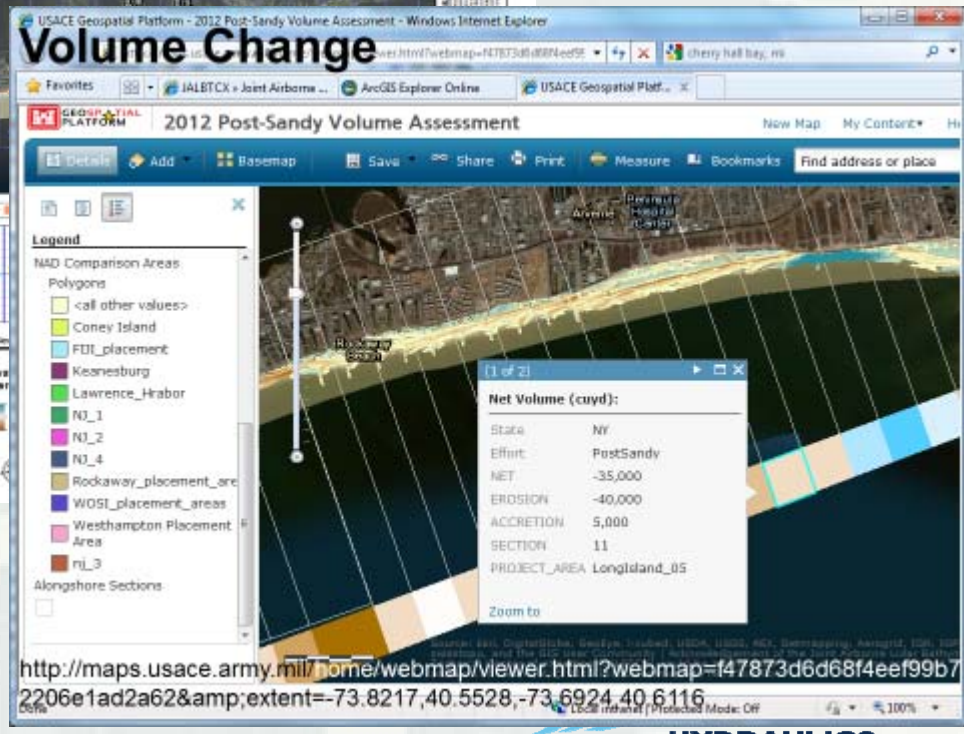
Volumes



2012 pilot project



2012 emergency operations



2013 web services

Volumes

Table 6. Condensed Results by State

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NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
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VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
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SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
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Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

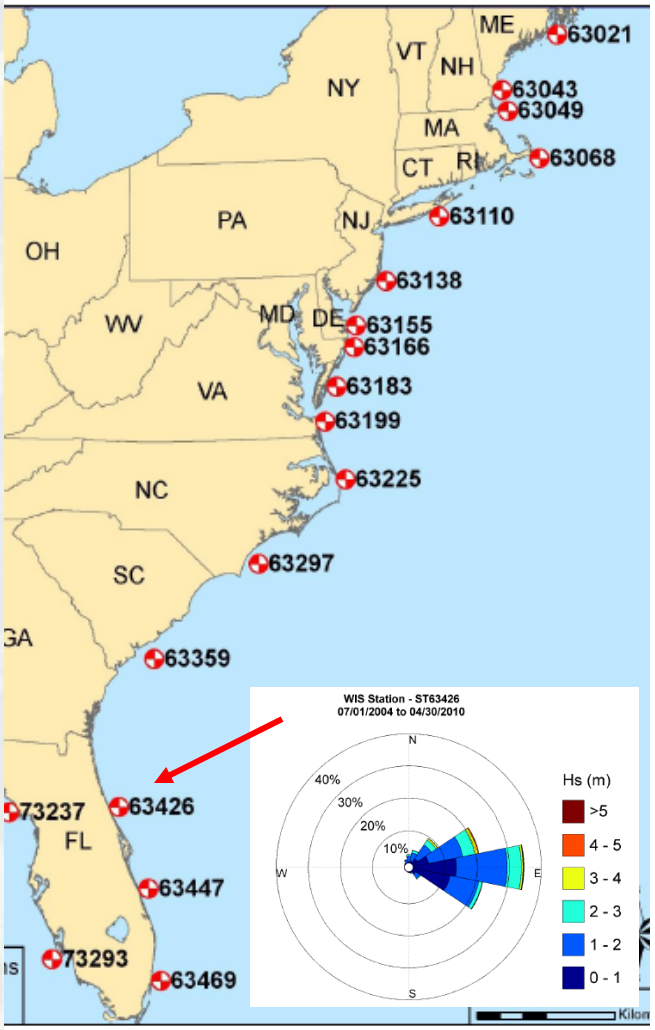

Figure 5. Locations of selected WIS stations.

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Volumes

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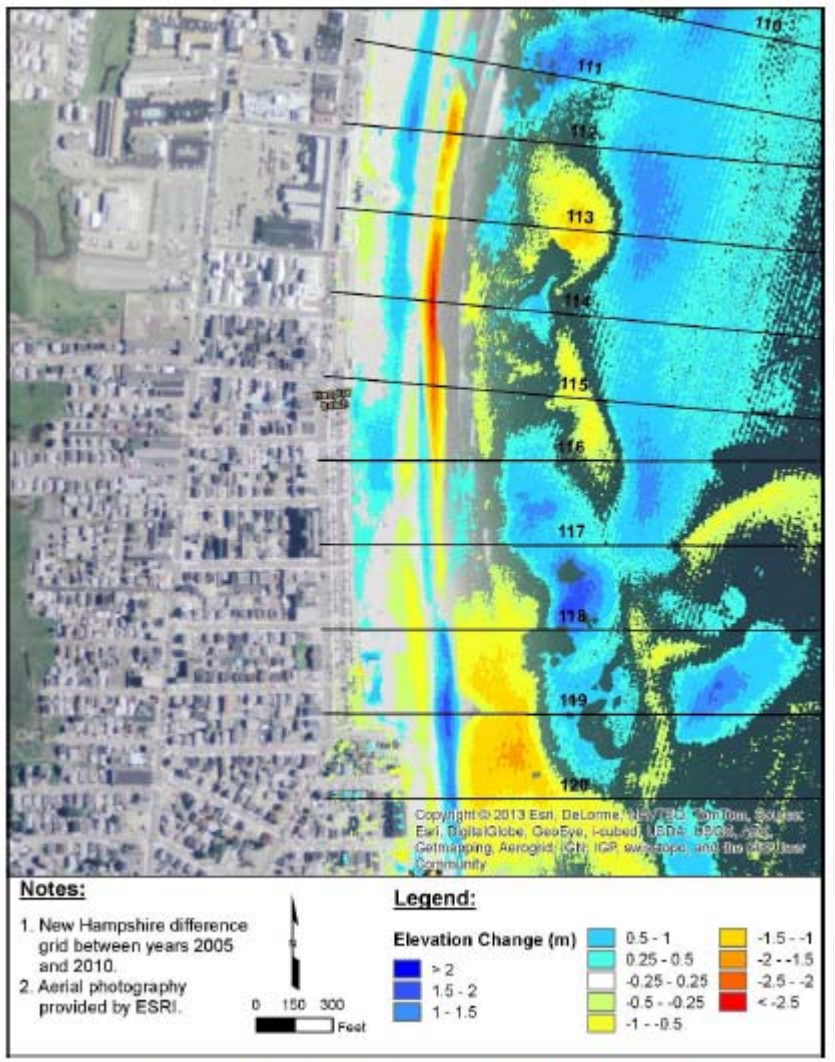

Figure 8. Elevation change near Hampton Beach, NH.

Volumes

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NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
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FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

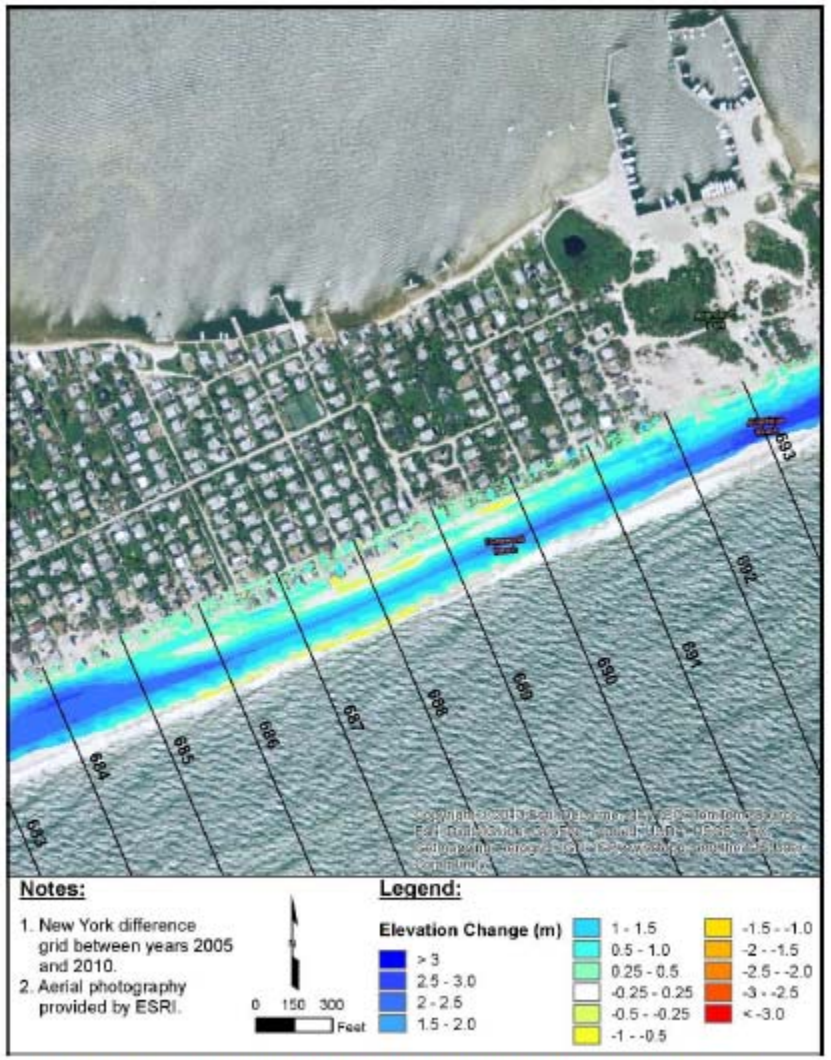

Figure 10. Elevation change near Dunewood, Fire Island, NY.

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Volumes

Table 6. Condensed Results by State

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Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

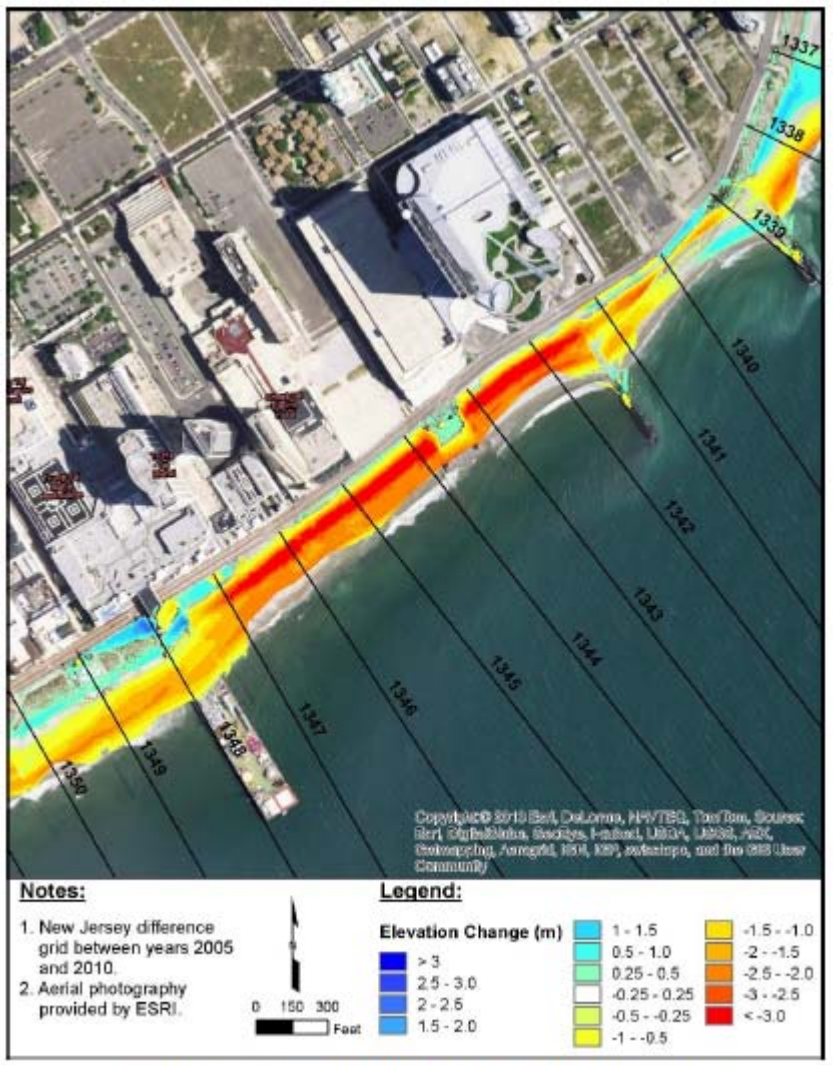

Figure 12. Elevation change near Atlantic City, NJ.

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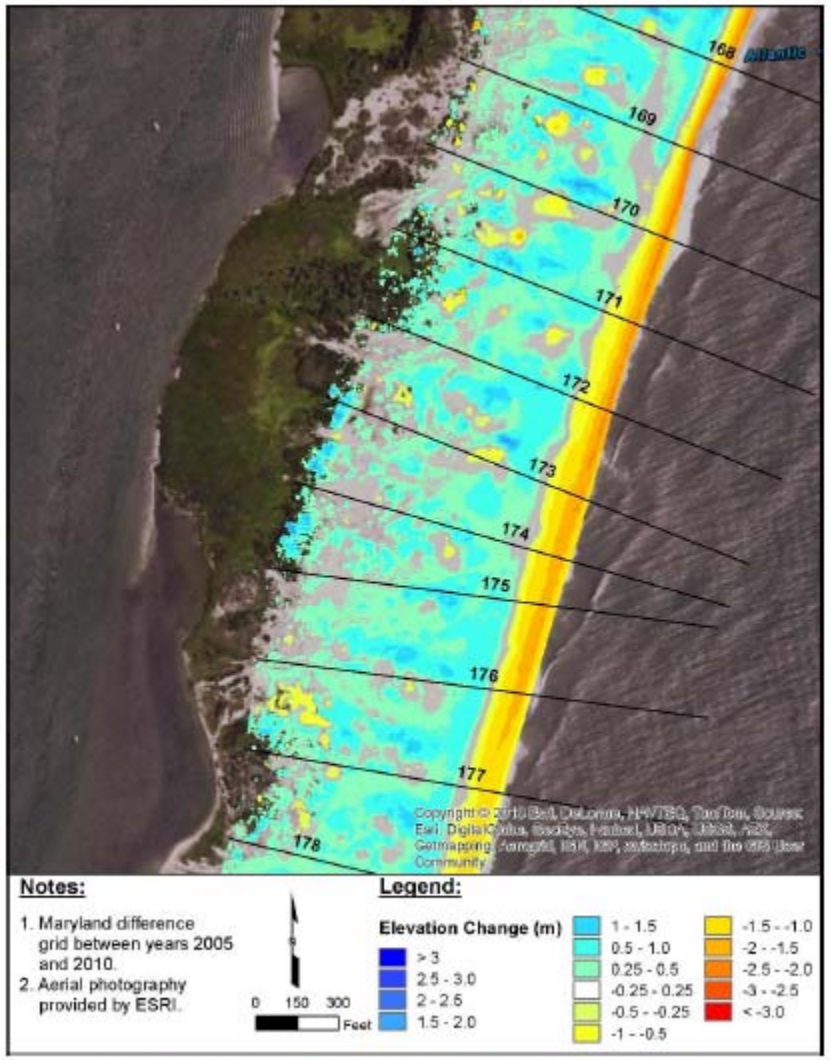

Figure 13. Elevation change on Assateague Island, MD.

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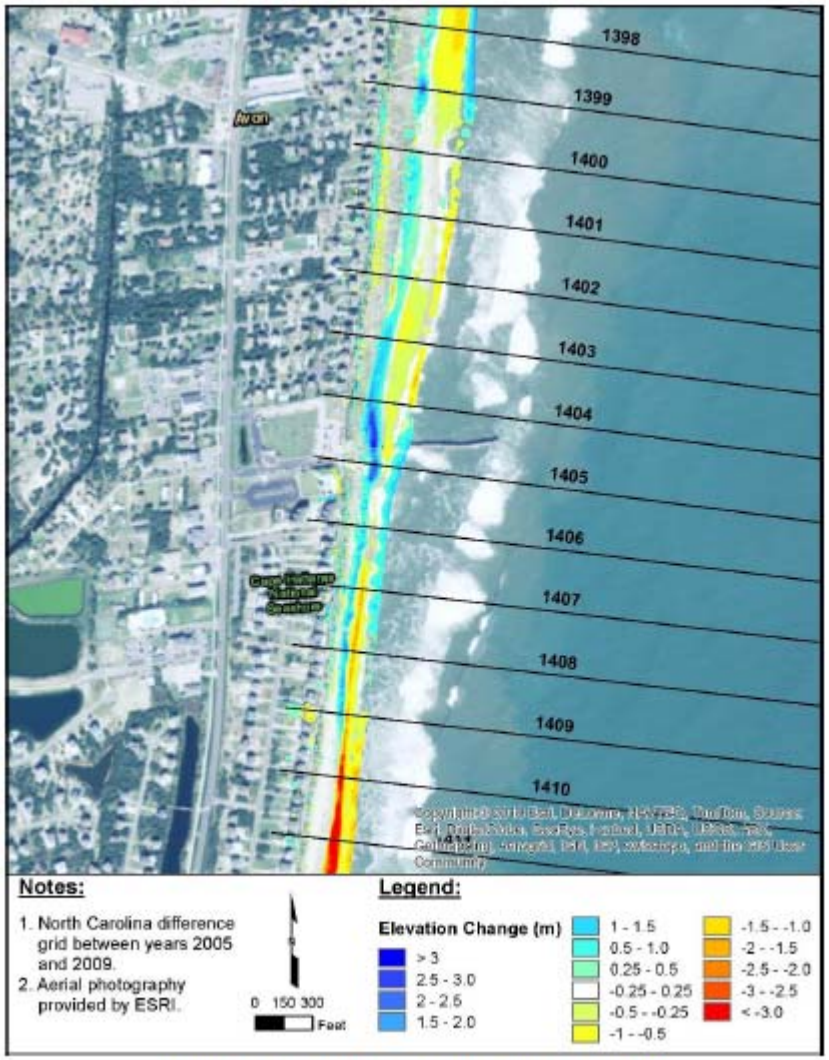

Figure 15. Elevation change near Avon, NC.

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ME	10/19/2005	6/19/2010	62	633	(0.4)	13.5	0.7	0.6
NH	11/01/2005	6/20/2010	15	152	(1.0)	2.6	(0.5)	(0.5)
MA	11/11/2005	5/26/2010	381	3,834	(2.8)	(2.8)	(0.9)	(0.8)
NY	10/26/2005	8/13/2010	192	1,921	6.9	4.5	4.1	4.2
NJ	9/2/2005	8/28/2010	203	2,034	0.6	2.1	2.2	2.2
DE	9/3/2005	9/11/2010	44	440	5.1	3.9	4.1	4.2
MD	9/3/2005	8/2/2010	50	505	(4.3)	2.8	2.7	2.7
VA	9/8/2005	7/28/2010	183	1,835	7.2	3.1	3.4	2.9
NC_2009	9/28/2005	8/16/2009	272	2,725	3.9	0.6	(1.3)	0.2
NC_2010	9/28/2005	5/4/2010	236	2,369	0.2	2.7	2.5	2.5
SC	1/13/2006	5/4/2010	277	2,778	2.1	2.3	1.3	0.9
GA	1/13/2006	5/4/2010	145	1,452	(0.2)	4.2	3.0	2.8
FL-E	7/1/2004	5/4/2010	587	5,875	(2.7)	6.2	1.0	0.8
FL-W	6/1/2004	6/20/2010	298	2,998	7.7	19.3	2.3	2.4
FL-NW	6/1/2004	6/20/2010	346	3,461	(9.5)	4.6	(0.2)	(0.2)
Total/ Average			3,289	33,012	0.9	4.6	1.6	1.7

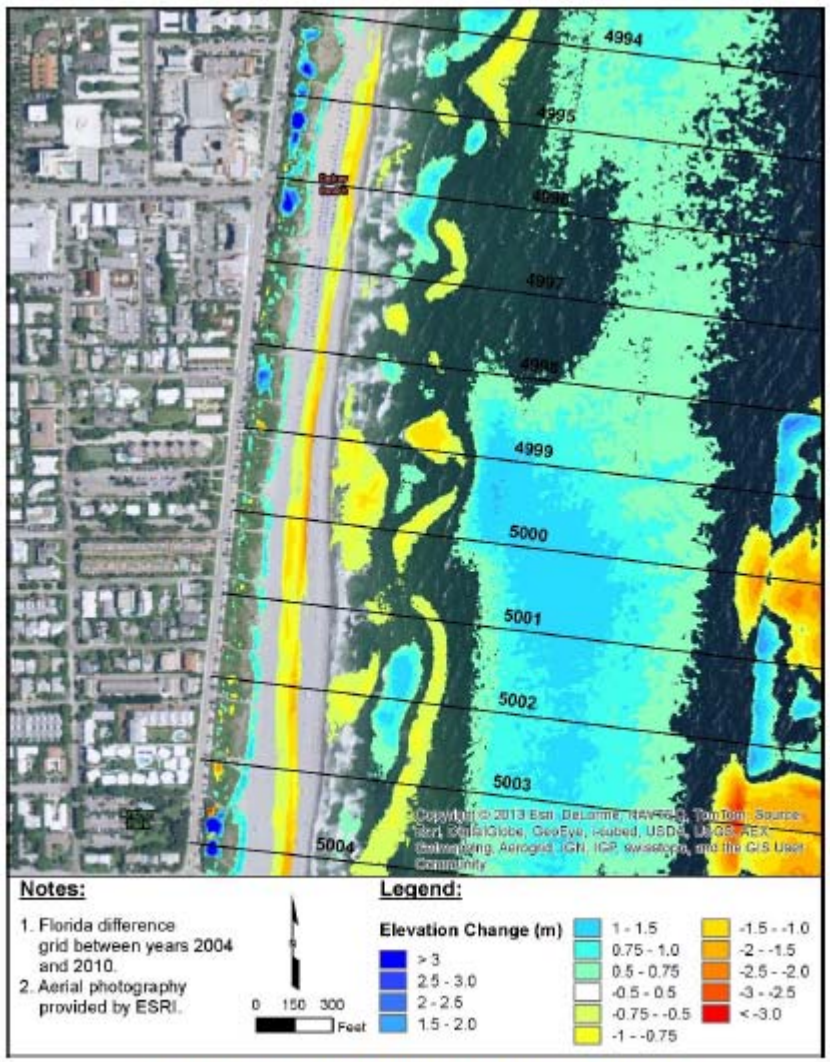

Figure 18. Elevation change at Delray Beach, FL.

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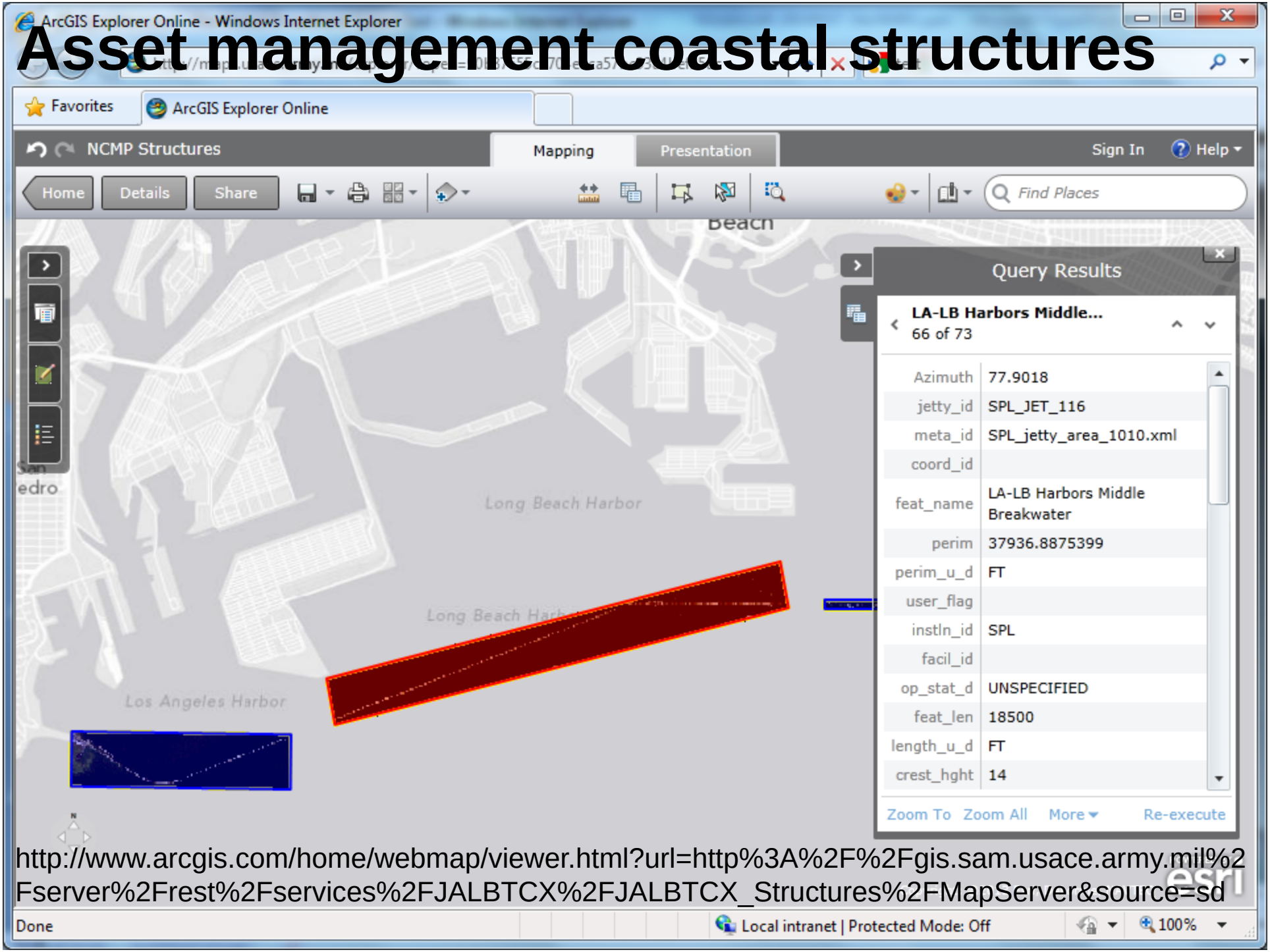
1) Does selection of MHW for volumes matter?

Asset management coastal structures



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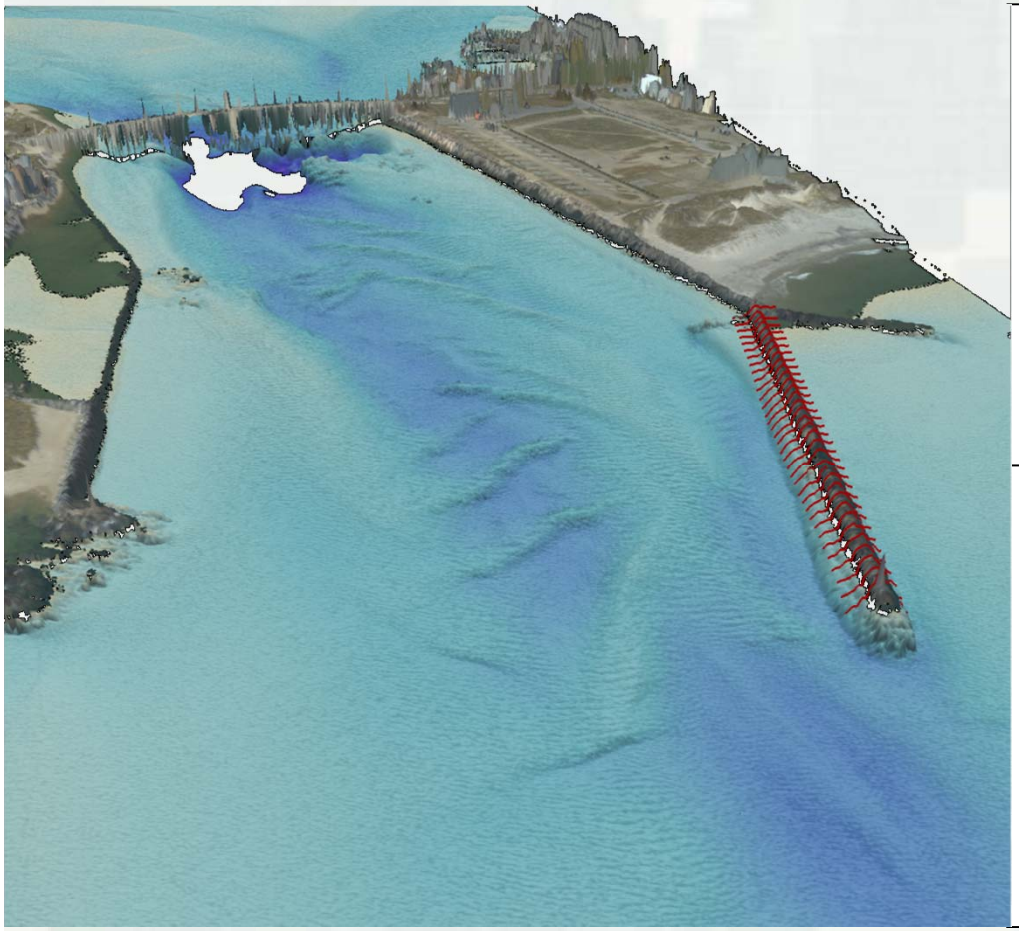
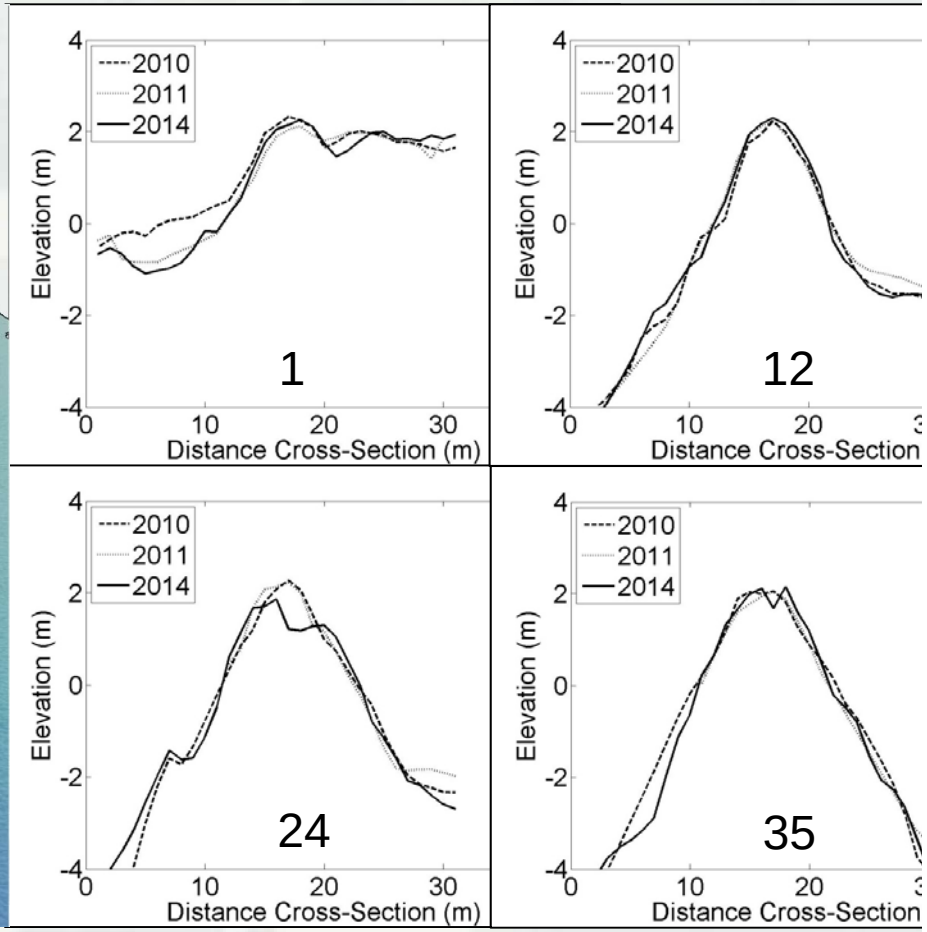
Asset management coastal structures



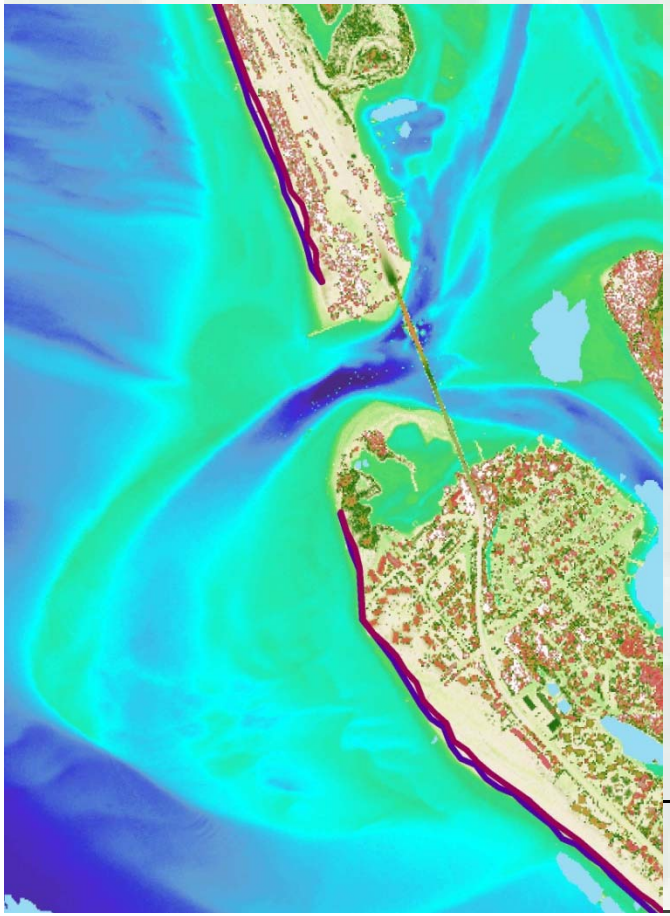


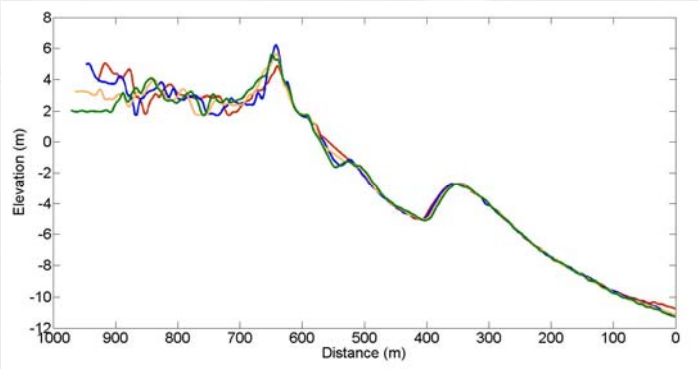
Hampton Harbor, NH, 2014

1) What are the meaningful structure parameters? Ex. Side slopes, rock size

Dunes

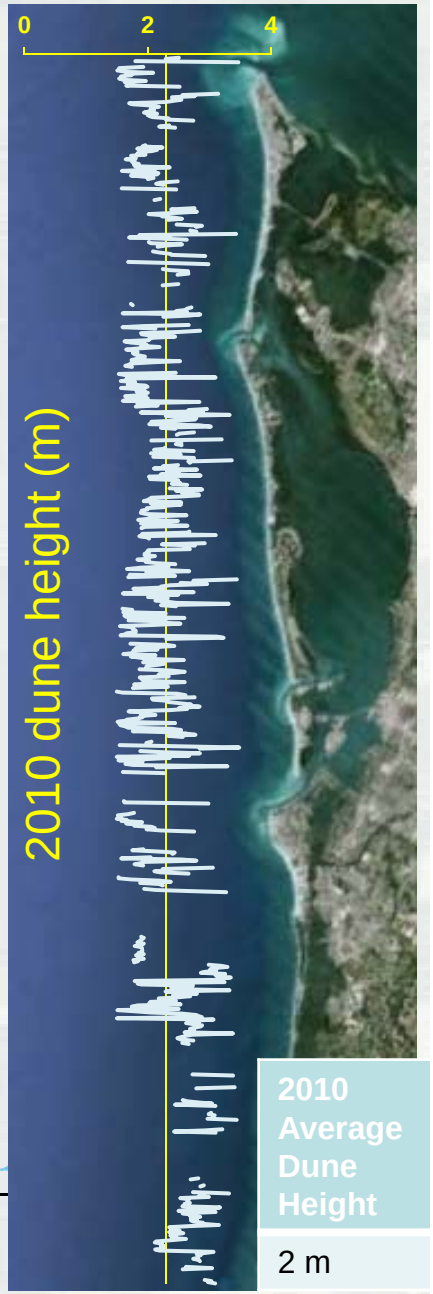
- Provide natural buffer from waves/runup to upland areas
- Volume of sediment available for beach recovery
- Included as part of beach nourishment projects





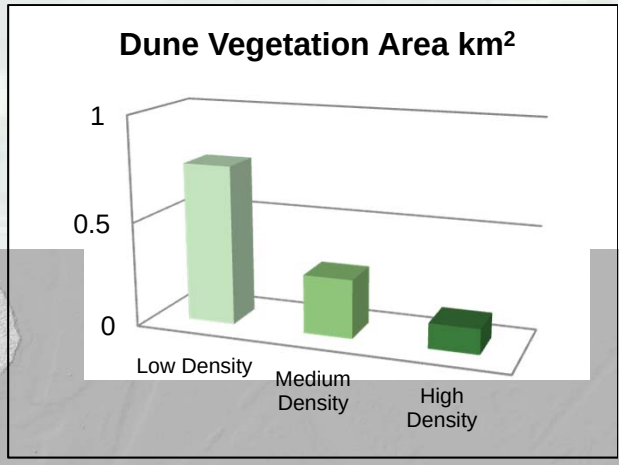
- Dune height – crest of the first dune
- Dune toe – slope change in dune

1) Dune footprints, or areal extent.
2) Dune volume and change.
3) Elevation/slope/curvature distributions within dune footprints



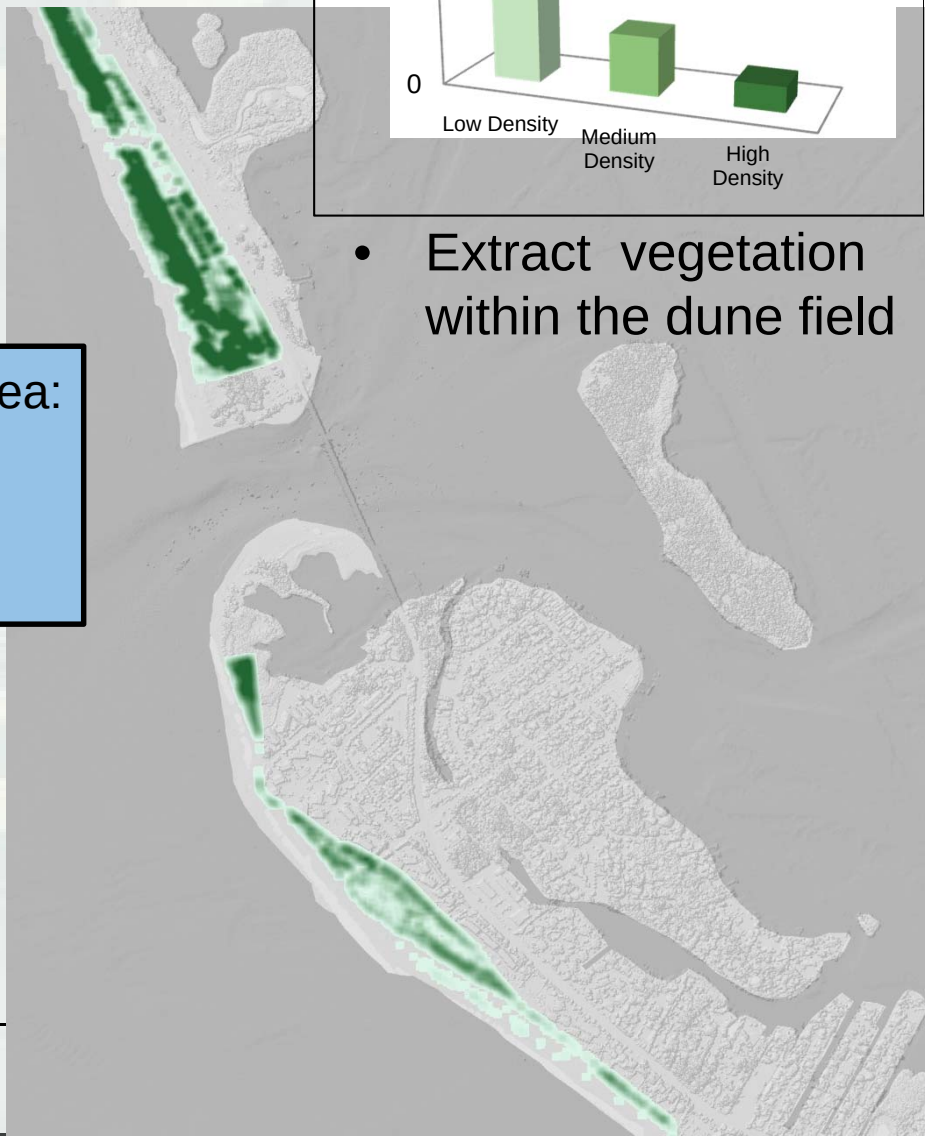
Dune Vegetation Density

- Helps stabilize dunes and reduces erosion by trapping sand
- Provide habitat for critical species, including TE species

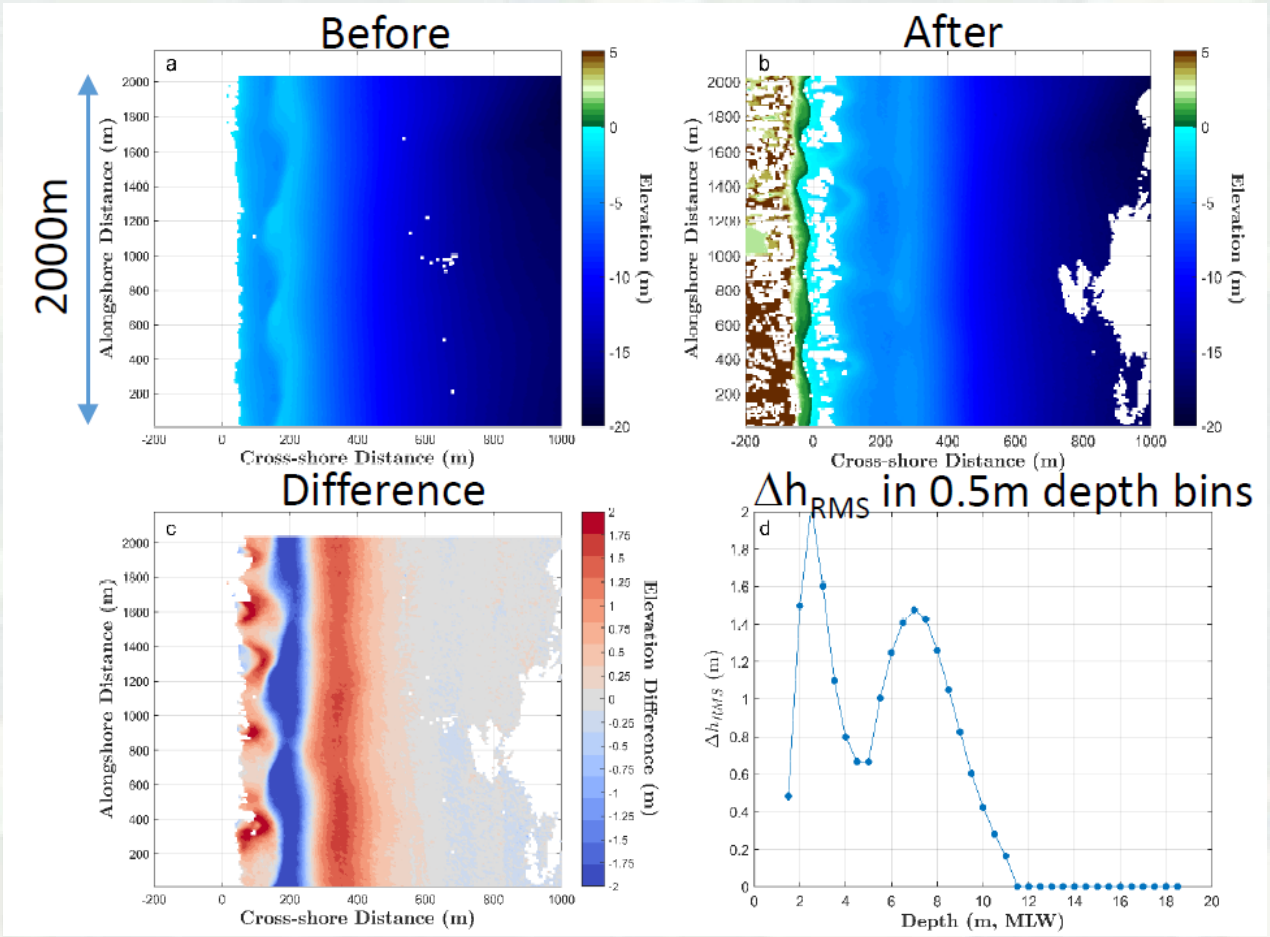


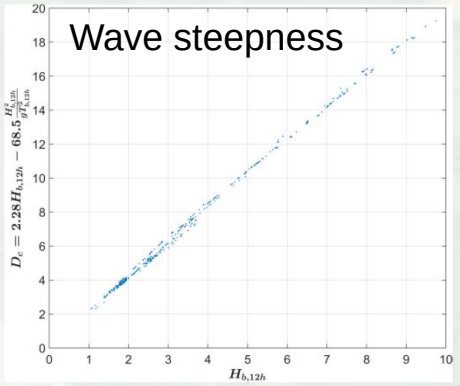
- Extract vegetation within the dune field

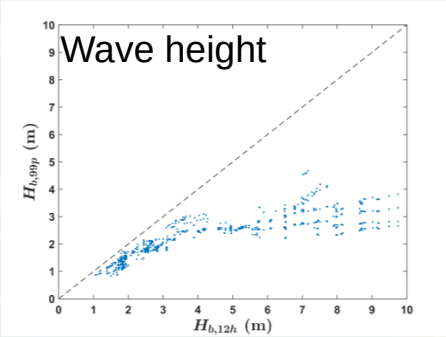
Dune Vegetation Density Area:
Low: *0.75km²*
Medium: *0.28km²*
High: *0.12km²*

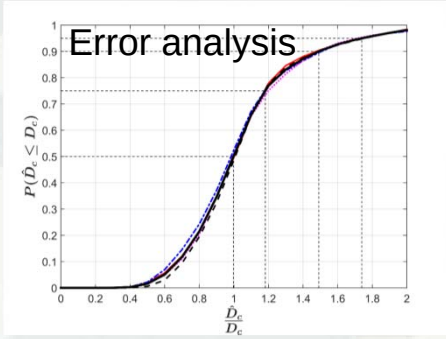


Depth of closure









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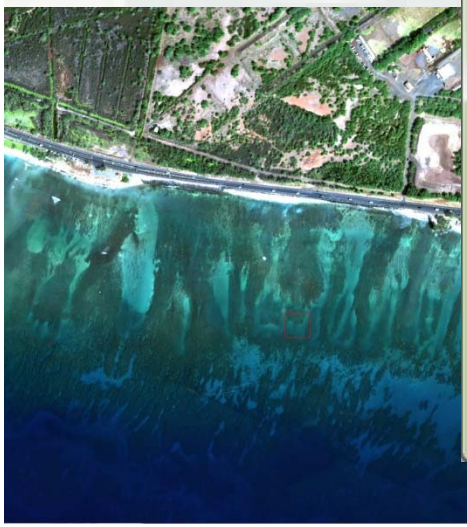
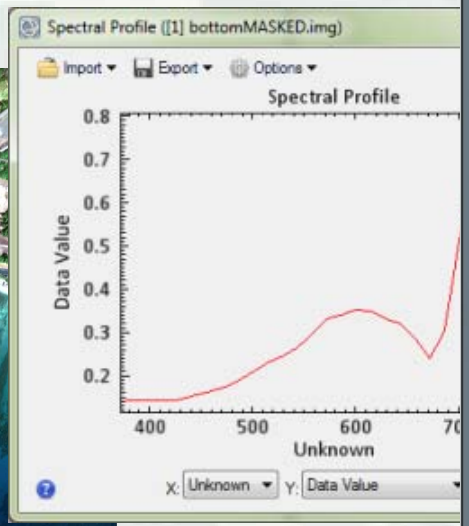
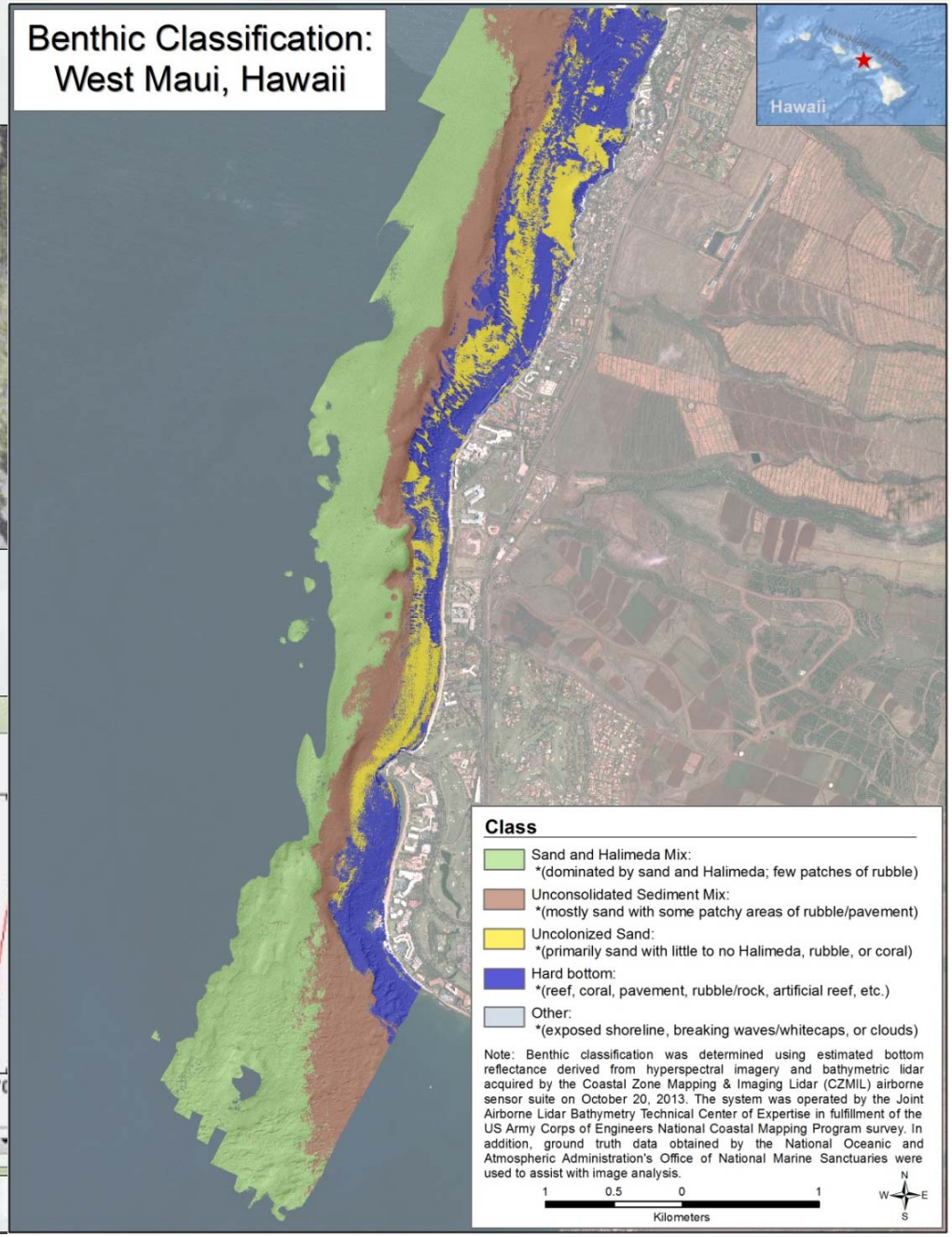
Benthic Habitat Mapping – West Maui, HI

- Estimate bottom reflectance from hyperspectral imagery and depth
- Apply NOAA's ground truth data to create regions of interest in a supervised classification approach to identify major bottom types



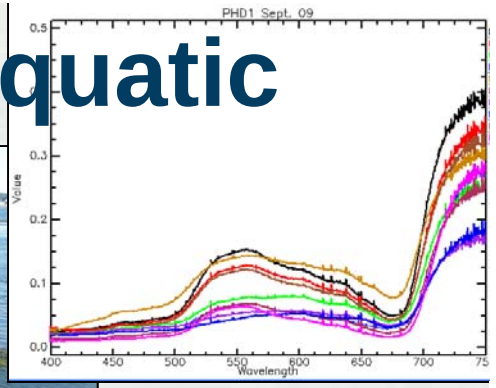




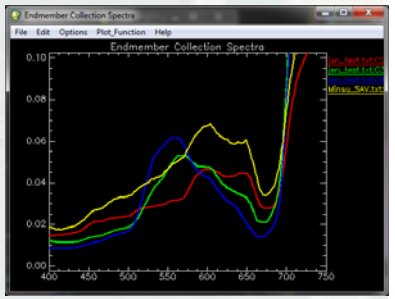
Discrimination of submerged aquatic vegetation species

Background: Dredging impacts to SAV vary by species; CWA lists SAV as a Special Aquatic Site
Mapping species is important for:

- Planning dredging operations
- Mitigating ecological damage
- Monitoring SAV



Submersed Eelgrass spectra, Plymouth Harbor, MA



Water leaving reflectance

Water column attenuation

CDOM absorption

Chl concentration

Active seafloor reflectance

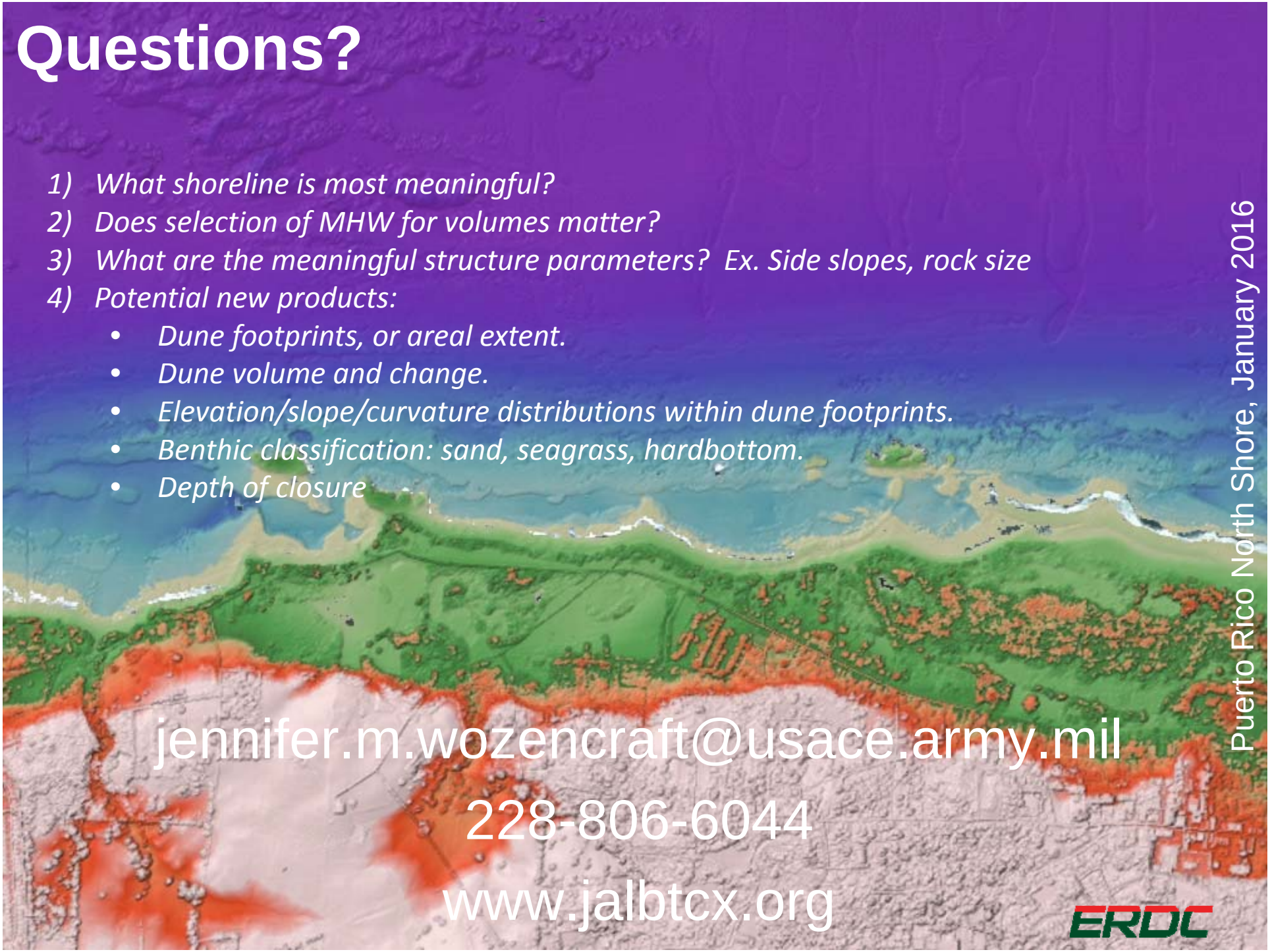
Spectral seafloor reflectance

Seagrass

ERDC

Questions?

1) *What shoreline is most meaningful?*
2) *Does selection of MHW for volumes matter?*
3) *What are the meaningful structure parameters? Ex. Side slopes, rock size*
4) *Potential new products:*
   - *Dune footprints, or areal extent.*
   - *Dune volume and change.*
   - *Elevation/slope/curvature distributions within dune footprints.*
   - *Benthic classification: sand, seagrass, hardbottom.*
   - *Depth of closure*



jennifer.m.wozencraft@usace.army.mil
228-806-6044
www.jalbtcx.org

Puerto Rico North Shore, January 2016

ERDC