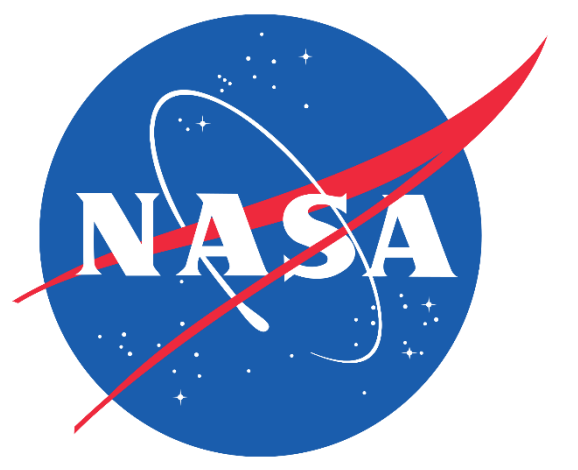




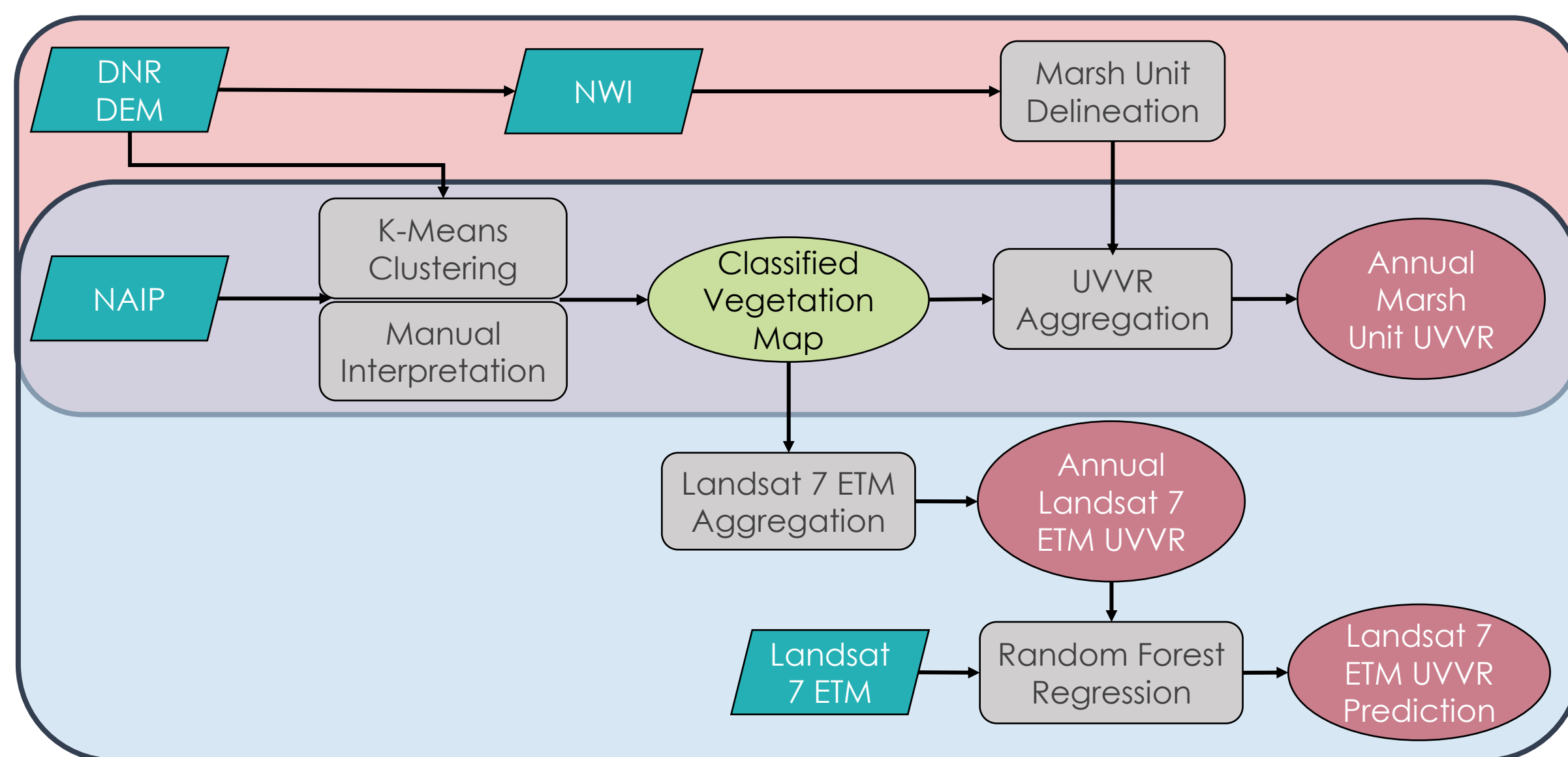
Implementing the Unvegetated-Vegetated Ratio to Assess Salt Marsh Vulnerability in South Carolina Using Airborne and Space-Based Remote Sensing Imagery



Abstract

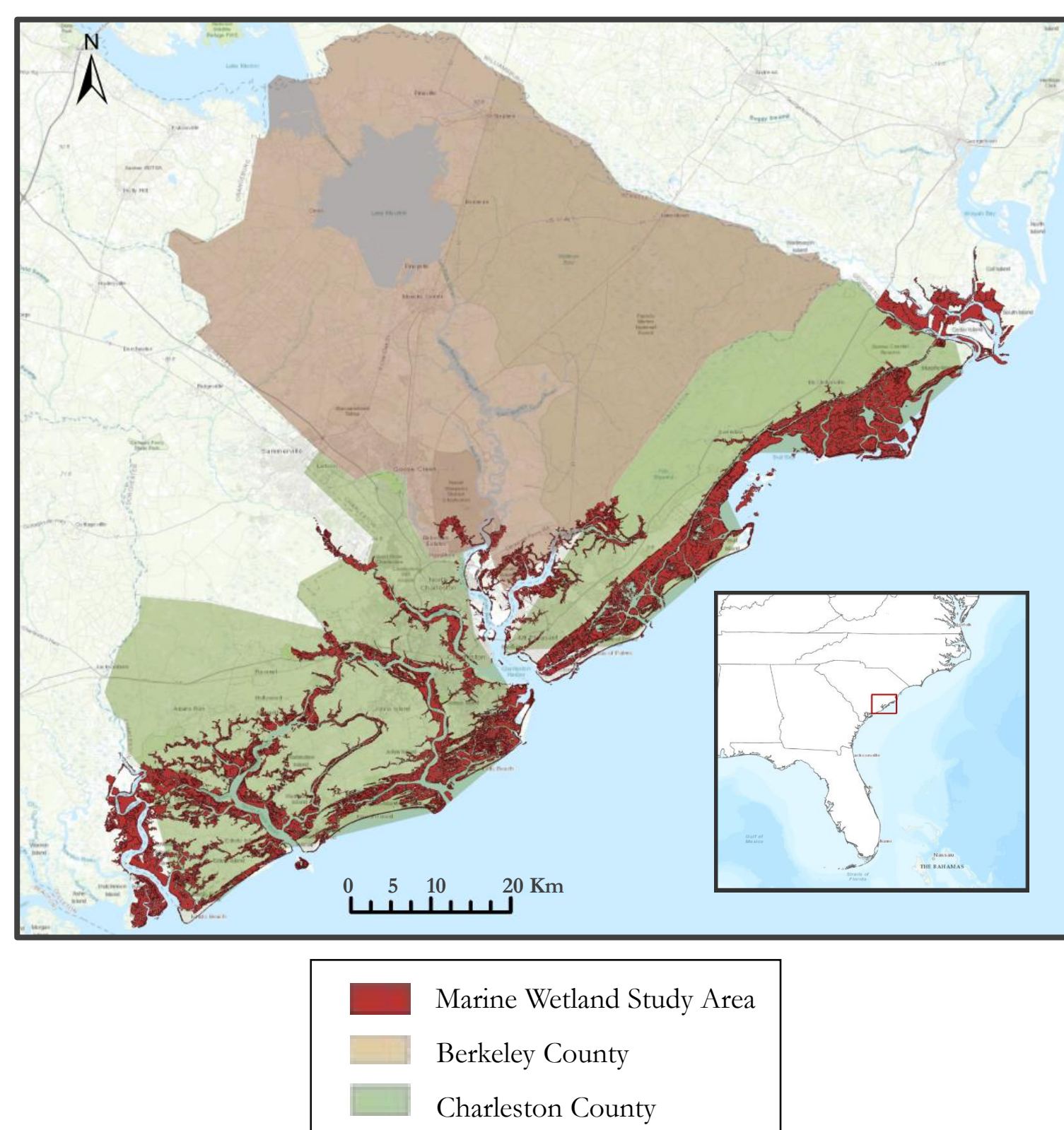
Among the most productive ecosystems on earth, salt marshes provide crucial ecosystem services including water filtration, shoreline protection, storm surge buffering, and flood mitigation. Marshes are largely dependent on their sediment budget which can significantly vary across a region. Upstream land use change near Charleston, South Carolina, along with rising sea levels, are expected to alter sediment budgets and threaten marsh stability and long-term health. The unvegetated-vegetated ratio (UVVR) is a scalable and efficient method to assess vulnerability. This NASA DEVELOP project collaborated with the South Carolina Department of Natural Resources, the South Carolina Department of Health and Environmental Control, and the United States Geological Survey Woods Hole Coastal and Marine Science Center. Marsh vulnerability was analyzed using UVVR derived from Landsat 8 Operational Land Imager (OLI), Landsat 7 Enhanced Thematic Mapper (ETM+), Landsat 5 Thematic Mapper (TM), and Sentinel-2 Multi-Spectral Imager (MSI) in conjunction with National Agriculture Imagery Program (NAIP) high-resolution aerial imagery. A Landsat random forest regression showed low correlation ($r^2 = 0.247$) between Landsat 7 ETM+ bands and NAIP aggregated UVVR suggesting the need for a more complex model and higher resolution sensors. Google Earth Engine scripting provided a novel approach to UVVR methodology that will allow decision makers to input new marsh areas and easily calculate UVVR without external data downloading.

Methodology



Study Area

- ▶ Charleston and Berkeley Counties, South Carolina
- ▶ Marine estuarine wetland habitat
- ▶ At risk from natural and anthropogenic changes such as:
 - ▶ Sea level rise
 - ▶ Major flooding events
 - ▶ Dredging
 - ▶ Land use changes



Team Members



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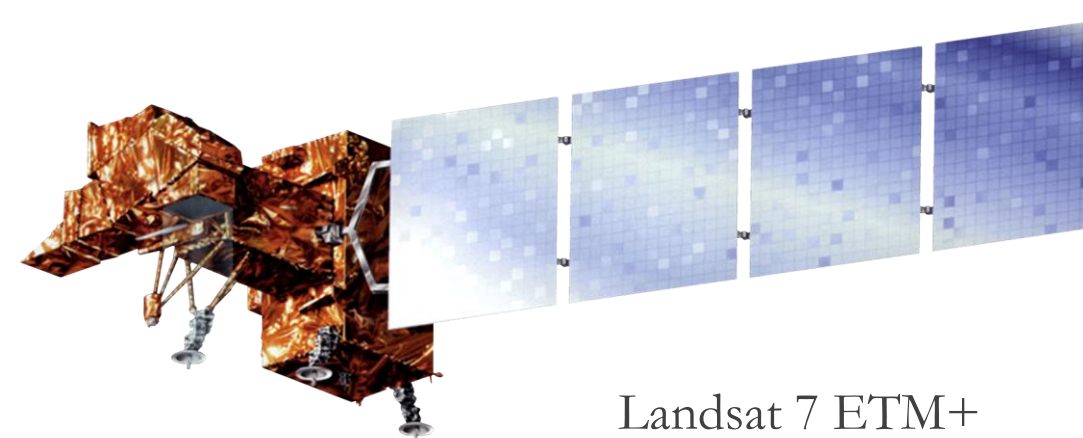


Adriana Le Compte

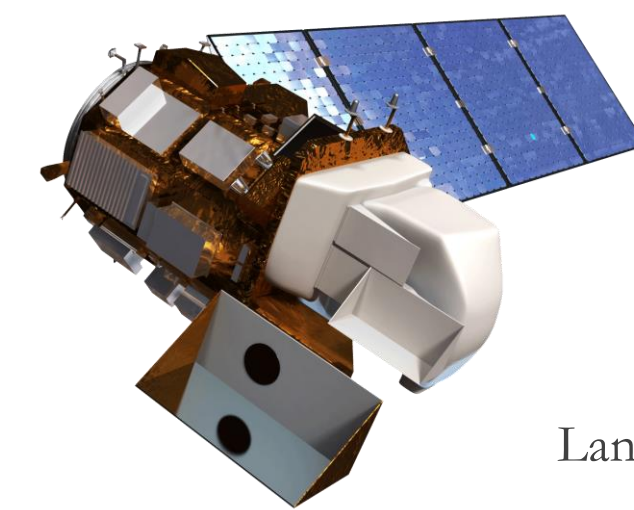
Objectives

- ▶ **Reproduce** USGS's UVVR methodology in Google Earth Engine to enhance project reproducibility, applicability to diverse study sites, and accessibility to partner organizations
- ▶ **Design** vulnerability maps for the South Carolina Department of Health and Environmental Control (DHEC) to enhance their decision making
- ▶ **Write** an accessible tutorial describing our methodology to enable users to apply it to other areas throughout the region and successfully achieve results

Earth Observations

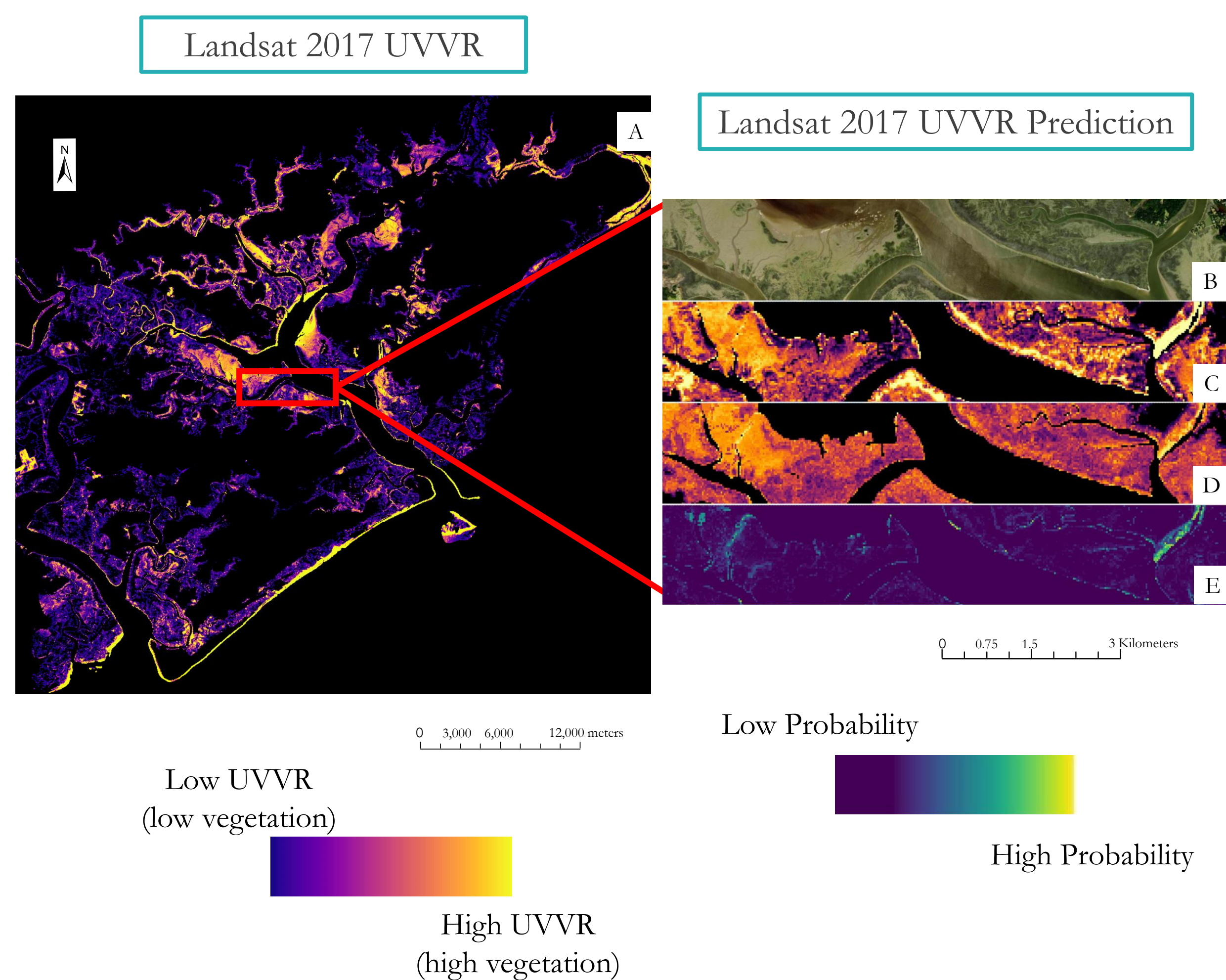


Landsat 7 ETM+



Landsat 8 OLI

Results



Conclusions

- ▶ Salt marshes along the coast of South Carolina are changing due to both natural and anthropogenic phenomena
- ▶ Satellite imagery can continue to be used to calculate marsh changes

Project Partners

- ▶ South Carolina Department of Natural Resources
- ▶ USGS Woods Hole Coastal and Marine Science Center
- ▶ South Carolina Department of Health and Environmental Control

Acknowledgements

- ▶ **USGS Woods Hole Coastal and Marine Science Center**
 - ▶ Dr. Zafer Defne, Dr. Neil Ganju
- ▶ **South Carolina Department of Natural Resources**
 - ▶ Tanner Arrington, Katie Luciano, Evan Cook
- ▶ **South Carolina Department of Health and Environmental Control**
 - ▶ Adam Bode, Jessica Boynton
- ▶ **NASA Langley Research Center**
 - ▶ Sydney Neugebauer, Dr. Kenton Ross