Assessing Estuarine Ecosystems for Improved Wetland Monitoring and Management

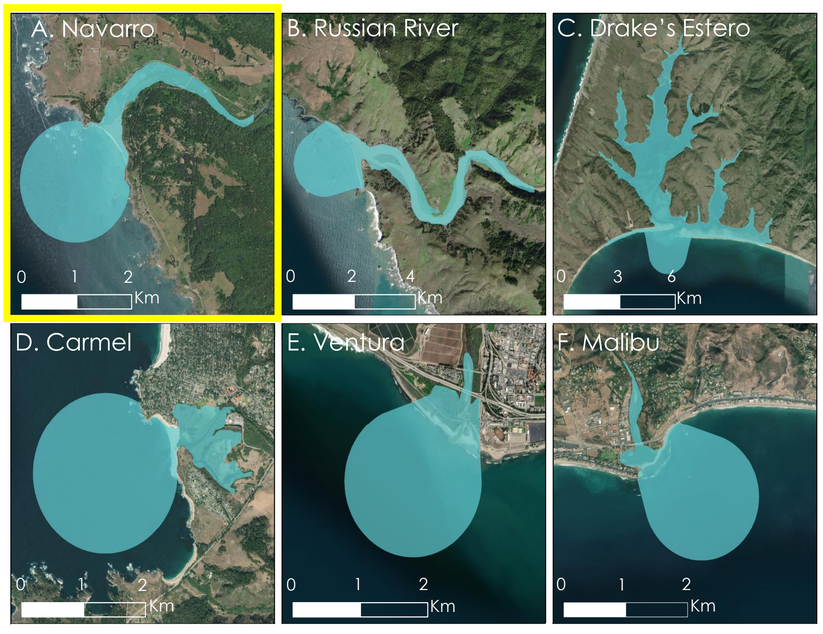
Abstract

Estuaries are vital ecosystems that serve important ecological functions. The Marine Life Protection Act aims to protect these ecosystems by establishing a network of marine protected areas (MPAs), in part by requiring regulatory agencies to monitor estuary extent and health. However, California has 23 estuarine MPAs (EMPAs) and approximately 440,000 total acres of estuarine habitat, making ground-based data collection time and resource intensive. This project used remotely sensed data to examine the health of California EMPAs in an effort to supplement ground-based field measurements. Using Landsat 8 Operational Land Imager (OLI), Sentinel-2 MultiSpectral Instrument (MSI), and Sentinel-1 C-band Synthetic Aperture Radar (C-SAR), this project assessed mouth state, inundation extent, turbidity, Chlorophyll-a, and colored dissolved organic matter (CDOM) for estuaries observable with these sensors. Determining the Normalized Water Difference Index (NDWI) from Sentinel-2 MSI data captured estuary mouth state and inundation extent. Meanwhile, Landsat 8 OLI and Sentinel-2 MSI indicated a capacity to capture differences in water quality metrics coinciding with changes to estuary mouth state using algorithms applied in Google Earth Engine (GEE). The GEE California Estuary Assessment tools will allow project partners to better monitor and understand estuarine dynamics and health.

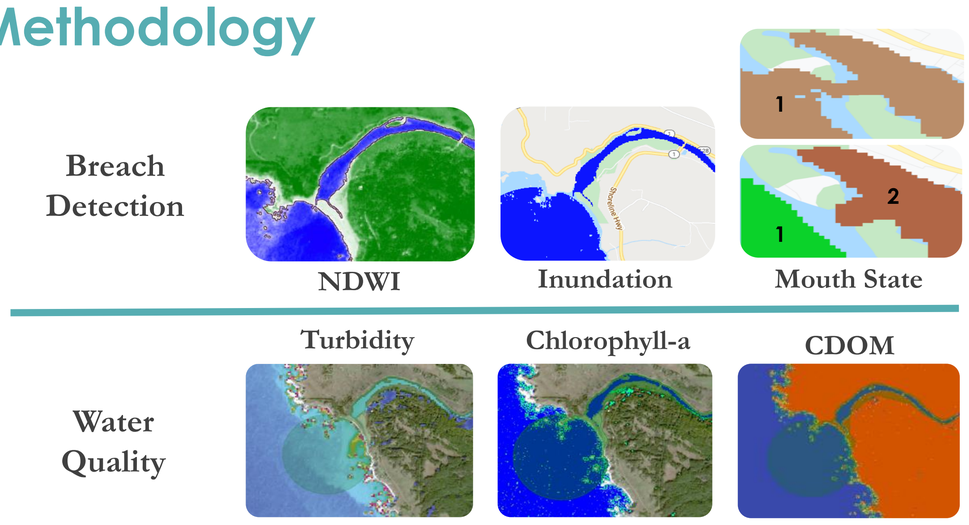
Objectives

- **Improve** data collection of EMPAs throughout California by incorporating remote sensing
- **Create** an estuary assessment tool in GEE for California (California Estuary Assessment CEA tools)
- **Identify** mouth state and inundation extent of estuaries
- **Assess** water quality metrics including turbidity, Chlorophyll-a, and colored dissolved organic matter (CDOM)

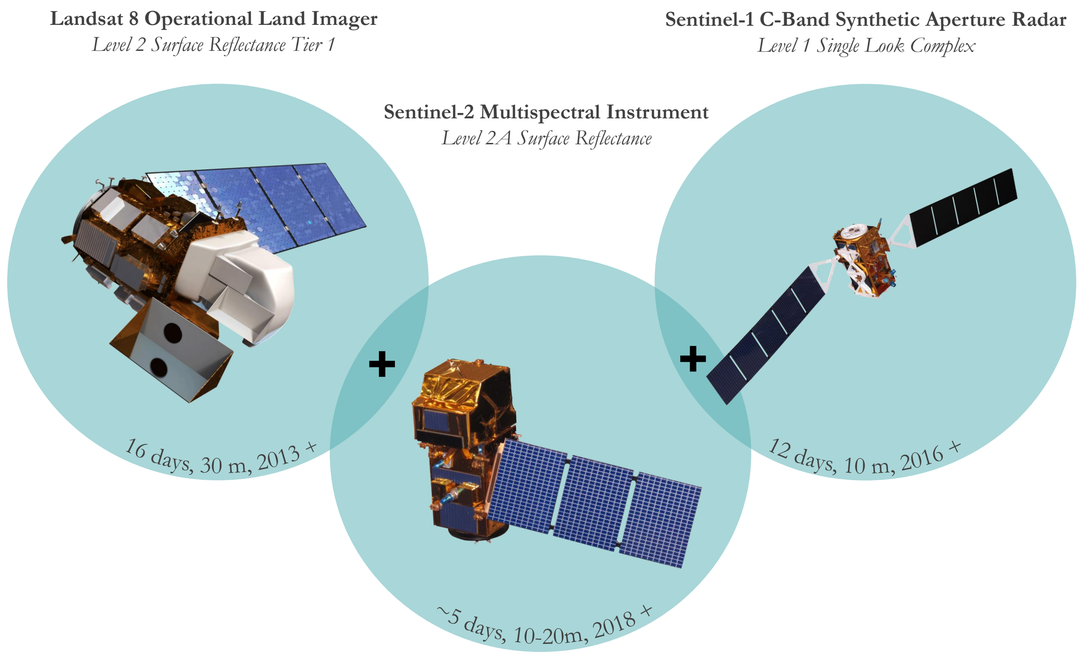
Study Area



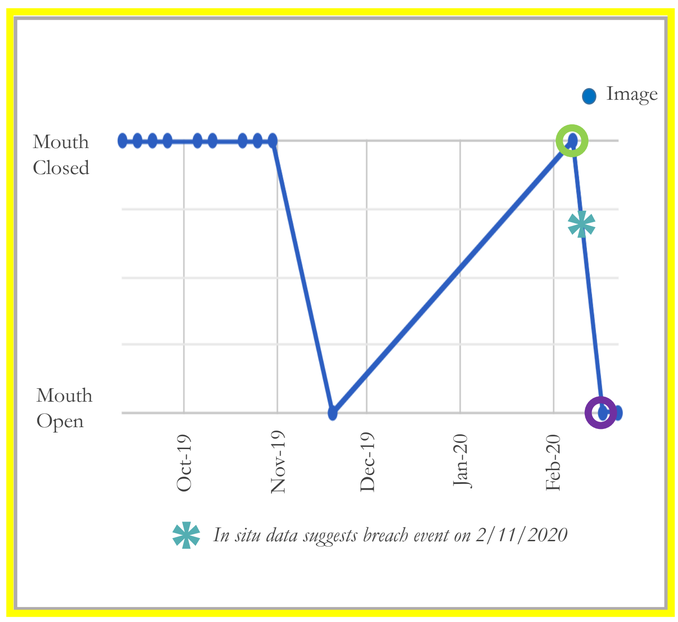
Methodology

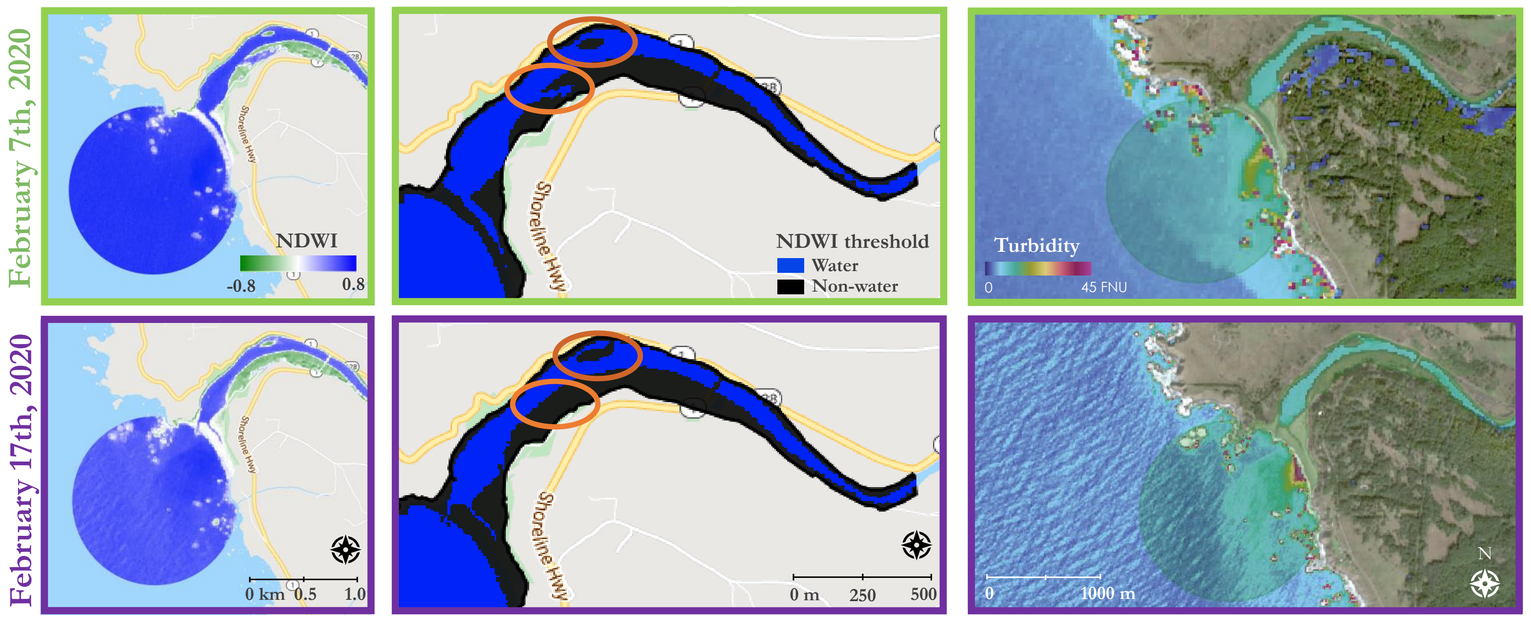


Earth Observations



Results





Project Partners

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- Ross Clark (Moss Landing Laboratories, Central Coast Wetlands Group)
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- Dr. Kyle Cavanaugh (University of California, Los Angeles)

Conclusions

- Sentinel-2 derived NDWI can be used to adequately determine estuary mouth state as open or closed
- Sentinel-1 C-SAR shows potential to supplement data gaps in Landsat 8 and Sentinel-2 imagery particularly regarding inundation extent
- Satellite imagery captures health metrics influenced by estuary mouth state: inundation extent and turbidity
- CEA Tool will allow partners to monitor and better understand estuarine dynamics and health

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