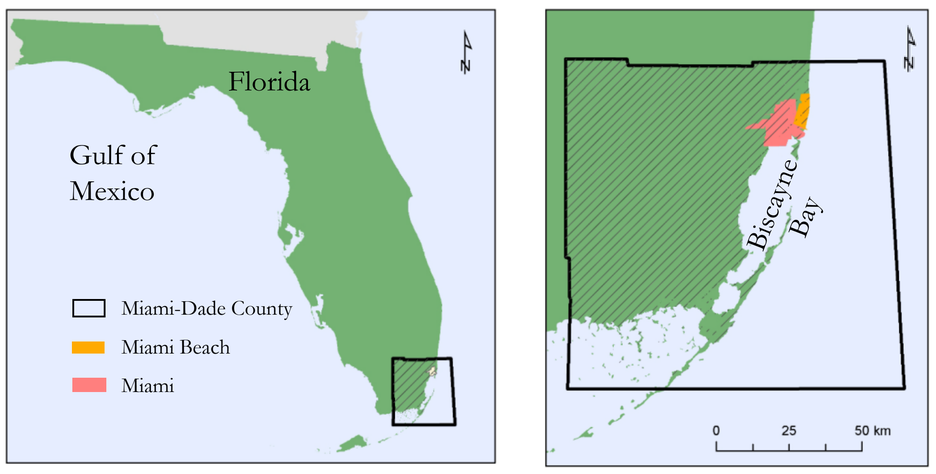
Utilizing NASA Earth Observations to Assess Sea Level Rise and Develop Optimal Green Infrastructure Plans to Restore Mangrove Habitat and Enhance Coastal Resiliency

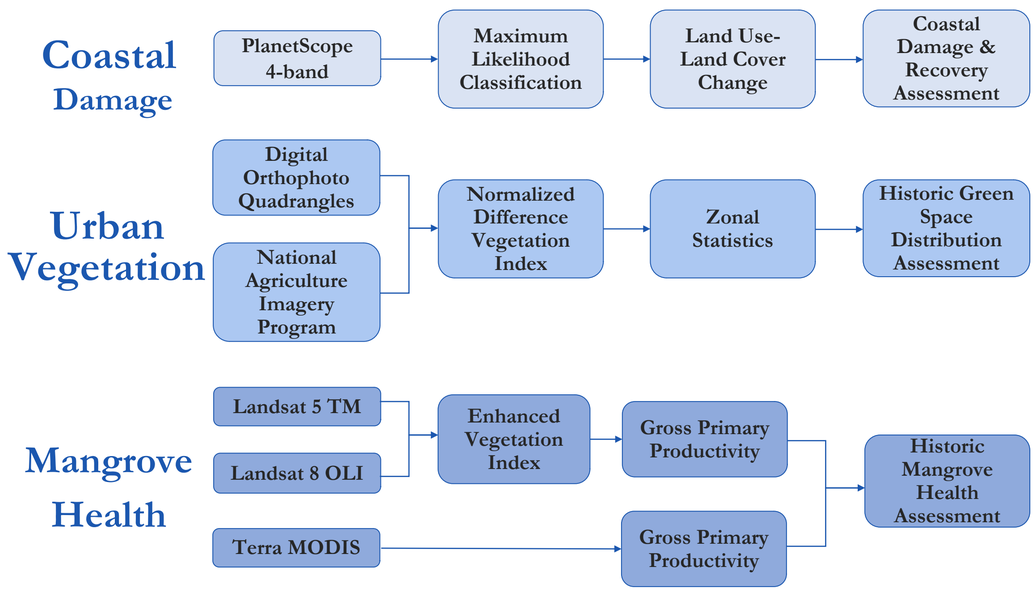
Abstract

In response to projected sea level rise and extreme weather events, Miami Beach and other urban areas surrounding Biscayne Bay are developing adaptive strategies to mitigate the effects of changing environmental conditions. Because the local economy, especially the tourism industry, is intricately tied to coastal resources, city officials are involved with on-going efforts to reduce storm damage and monitor shoreline conditions. Some important considerations for these adaptive strategies include water drainage capacity, green infrastructure, and maintenance of natural wetland ecosystems, particularly mangrove forests. This NASA DEVELOP project employed Earth observations to assess historical trends in urban vegetation density, post Hurricane Irma coastal damage, and the current extent and health of mangrove ecosystems in protected areas. The goal of this project was to enhance the wetland monitoring and shoreline management programs led by local organizations, such as the City of Miami Beach Public Works Department. The results of this project will be incorporated into a mangrove habitat suitability analysis that will aid the ecological management and land use planning efforts led by the City of Miami Beach Public Works Department to improve coastal resiliency.

Study Area



Methodology



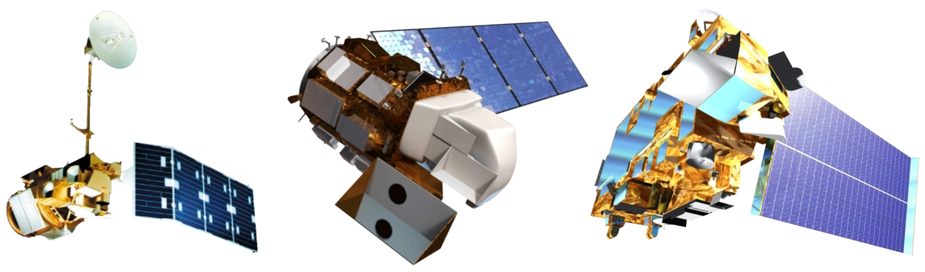
Project Partner

City of Miami Beach, Public Works Department

Objectives

- **Examine** coastal damage in Miami Beach following Hurricane Irma
- **Map** the distribution of historic urban vegetation in Miami Beach
- **Assess** the range and health of coastal wetlands in southeast Florida using Landsat 5 TM, Landsat 8 OLI, and Terra MODIS data products

Earth Observations



Landsat 5 TM | **Landsat 8** OLI | **Terra** MODIS

Team Members

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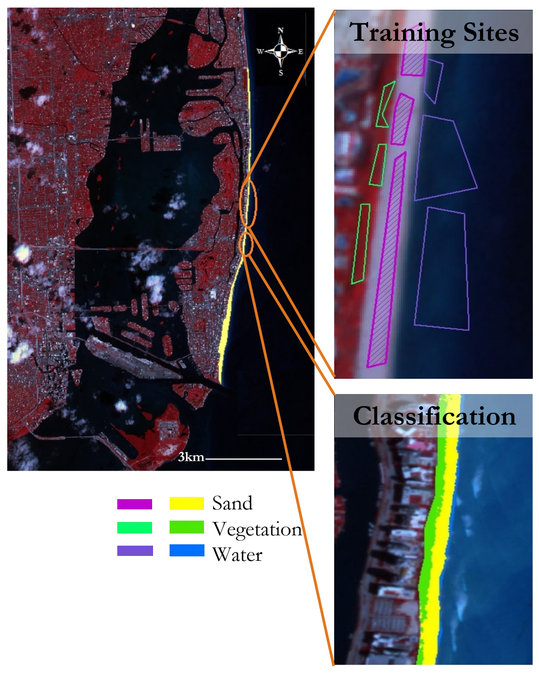
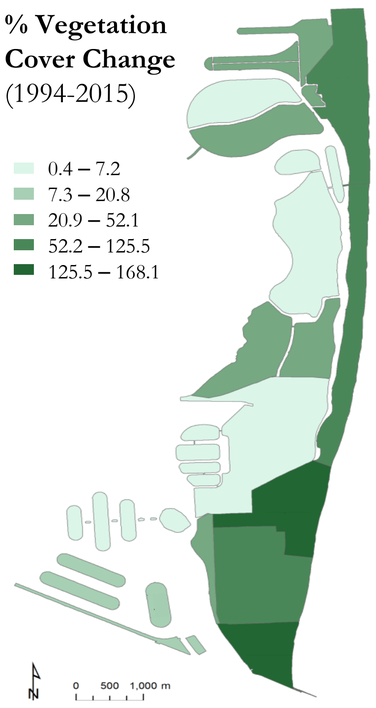
Results

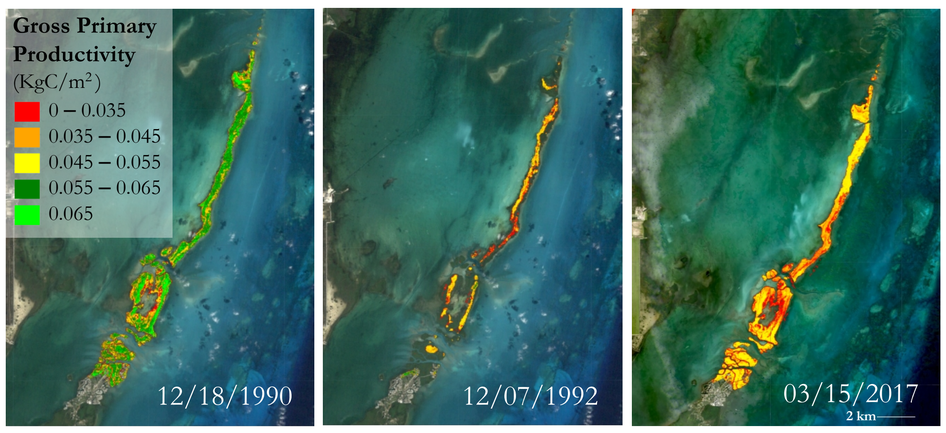
Coastal Damage



Urban Vegetation



Mangrove Health



Conclusions

- As a result of Hurricane Irma, approximately 45% of coastal vegetation along Miami Beach was lost or damaged. An estimated 26% of this vegetation recovered within 40 days of the storm's passing.
- The city of Miami Beach saw a 24% increase in vegetation cover between 1994 and 2015.
- Mangrove forests in Biscayne National Park represent effective, self-sustaining green infrastructure options because of their resiliency in both hurricane and non-hurricane years.
- These results demonstrate the importance of existing resiliency strategies in geographically vulnerable areas like Miami Beach.

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Miami Beach Urban Development