**NASA DEVELOP National Program**

**2018 Spring Project Proposal**

**Georgia – Athens**

**Miami Beach Urban Development II**

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

**Project Overview**

***Project Synopsis*:** This project aims to provide the Miami Beach Public Works Department with a better understanding of how green infrastructure can improve coastal resiliency and assist improving local ecosystems. This DEVELOP project will examine historic and current sea-level conditions in addition to mangrove habitat suitability in Biscayne Bay and adjacent cities. The team will work to create a vegetation time series, along with a suitability analysis and sea level rise scenarios, to enhance habitat restoration efforts. These end-products will assist management in evaluating the changing conditions across the Biscayne Bay area and provide decision makers with additional information to assess restoration plans.

***Community Concern:*** Due to projections of sea level rise, the cities surrounding Biscayne Bay have increased their storm water drainage capacity and pump stations as the primary adaptive strategy to mitigate effects associated with changing sea level conditions. These predicted changes in shoreline could significantly impact the economies (primarily the tourist industry) of The City of Miami Beach and others in Biscayne Bay. Additionally, declining water quality and hurricanes pose major threats to coastal communities surrounding Biscayne Bay.

***Source of Project Idea:*** Francisco D’Elia, a GIS Analyst from the Miami Beach Public Works Department met UGA’s Lead Science Advisor, Dr. Marguerite Madden, and National Science Advisor, Dr. Kenton Ross, at the annual American Society for Photogrammetry and Remote Sensing (ASPRS) conference in Baltimore, MD in 2017. After sharing more information about the DEVELOP National Program and discussing the needs of the Miami Beach Public Works Department, the University of Georgia Center Lead, began working on a proposal along with Mr. D’Elia.

***National Application Area Addressed:*** Urban Development

***Study Location:*** Miami Beach and surrounding Biscayne Bay, FL

***Study Period:*** January 1995 – December 2016

***Advisors:*** Dr. Marguerite Madden (University of Georgia, Department of Geography), Dr. Rosanna Rivero (University of Georgia, College of Environment and Design)

**Partner Overview**

***Partner Organization:***

|  |  |  |  |
| --- | --- | --- | --- |
| **Organization** | **POC (Name, Position/Title)** | **Partner Type** | **Boundary Org?** |
| **City of Miami Beach, Public Works Department** | Francisco D’Elia, GIS Analyst | End User | Yes |

***End-User Overview***

***End User’s Current Decision-Making Process:***The Miami Beach government monitors and assesses water quality in the areas surrounding Miami Beach to monitor runoff and stormwater discharge from the canals and pumping stations in the region. As pumping requirements increase with expected sea level rise and subsidence, in addition to a growing population and urban development, there are concerns that water quality will no longer support aquatic biodiversity and ecosystems.

***End User’s Capacity to Use NASA Earth Observations:***

*City of Miami Beach, Public Works Department* – The end user is familiar with NASA Earth observations, and assesses remotely sensed data through partnerships with local universities and other agencies. However, they do not currently have a system in place to utilize remotely-sensed data to assess water quality historically, which will be provided by this project.

***Collaborator & Boundary Organization Overview***

***Dissemination by Boundary Organizations*:**

*City of Miami Beach, Public Works Department* – The Miami Beach GIS department intends to disseminate the methodology and results of this project with their partner organizations and support the implementation or use of remote sensing and NASA Earth observations into future work. This can be achieved by conducting a workshop once the NASA DEVELOP project is complete.

***Project Communication & Transition Overview***

***In-Term Communication Plan*:** Francisco D’Elia from The City of Miami Beach will be the main point of contact. Weekly communication will be done by email and conference calls with the DEVELOP team and additional collaborators will be invited to participate when necessary.

***Transition Plan*:** The team will conduct a virtual hand-off to share end products and results to the Miami Beach Public Works Department at the end of the term. Software release is not anticipated at this time.

**Earth Observations Overview**

***Earth Observations:***

|  |  |  |
| --- | --- | --- |
| **Platform & Sensor** | **Parameter(s)** | **Use** |
| **Landsat 5 TM** | Spectral vegetation indices | Landsat 5 data will be used in vegetation mapping and time series analysis. Images will be used to examine mangrove health and estimate past extent. Additionally, these data will be used to assess historic changes in shoreline conditions. |
| **Landsat 8 OLI** | Spectral vegetation indices | Historical and current imagery will be used in vegetation mapping and time series analysis. Landsat 8 images will be used to quantify mangrove health and estimate habitat extent. Additionally, these data will assist in identifying recent changes in shoreline conditions. |
| **Terra ASTER** | Elevation | ASTER will provide topographic information.  |

***Ancillary Datasets:***

City of Miami Beach, Public Works Department Bathymetry – provide underwater terrain and

 shoreline features

City of Miami Beach, Public Works Department LiDAR – provide high resolution terrain and vegetation

 structure data

USDA National Agriculture Imagery Program – high resolution aerial photography of urban areas in Miami- Dade County for validation of results

USGS Digital Orthophoto Quadrangles – historic aerial photography of urban areas in Miami-Dade County

USGS National Elevation Dataset – high resolution elevation data for Miami-Dade County for validation of results

Miami-Dade County GIS Open Data – study area boundary shapefile

***Software & Scripting:***

Esri ArcGIS 10.2 – raster analysis, image enhancement & map creation; DSAS tools for shoreline mapping

Google Earth Engine API – creation of time series animations; urban green space mapping

**Decision Support Tool & End Product Overview**

***End Products:***

|  |  |  |  |
| --- | --- | --- | --- |
| **End Products** | **Partner Use** | **Datasets & Analyses** | **Software Release Category** |
| **Shoreline Change Time Series & Analysis** | The time series will provide officials at the City of Miami Beach Public Works Department with information regarding changes in shoreline and sea level conditions in the Biscayne Bay area. | Landsat 5 TM and Landsat 8 OLI data will be used to map the current extent of the Biscayne Bay shoreline and identify locations where conditions or shoreline position have changed over time. | N/A |
| **Historic Vegetation Maps** | Vegetation maps will give officials at the City of Miami Beach Public Works Department with information about the historic range of vegetation and changes in extent in the Biscayne Bay area. | Landsat 5 TM and Landsat 8 OLI will be used to map the historic range of local vegetation of interest to the City of Miami Beach Public Works Department for their green infrastructure planning efforts.  | N/A |
| **Green Infrastructure Suitability Map** | The green infrastructure suitability map will identify suitable locations for additional green spaces with a focus on mangrove habitat and assist the City of Miami Beach Public Works Department with their green infrastructure planning.  | Landsat 5 TM and Landsat 8 OLI data will be used to identify ideal locations for green infrastructure development in the Biscayne Bay area. | N/A |

***End-User Benefit*:** These end products will contribute to resilience studies being conducted by officials at the Miami Beach Public Works Department. The outputs of this project will enhance ongoing storm surge modeling research for Miami Beach and other neighboring cities. Decisions about prioritizing certain areas of interest in relation to sea level rise and coastal resiliency will be enhanced by the methods and analysis conducted during this project.

**Project Timeline & Previous Related Work**

***Project Timeline:*** 2 Terms: 2017 Fall to 2018 Spring

***Multi-Term Objectives:***

* **Term 1:** 2017 Fall (GA) – Miami Beach Urban Development
	+ The first term team examined shoreline conditions, coastal damage, and assessed the extent and health of coastal wetlands before and after Hurricane Irma. The results were presented to end users at the City of Miami Beach Public Works Department for review. This will allow the project partner to provide feedback that can be incorporated in the next term of the project and update the end-products as necessary.
* **Term 2 (Proposed Term):** 2018 Spring (GA) – Miami Beach Urban Development II
	+ The team will first update and include any additional information to the previous term results based on feedback from project partners. In this term, they will work to create an initial green infrastructure suitability model using sea level rise projections for the years 2030, 2060, and 2100 from the Sea Level Rise Work Group of the Intergovernmental Panel on Climate Change. They will also examine the relationship between biomass and vegetation species with existing green infrastructure in Biscayne Bay. Partners will provide additional data and mentoring as the team creates model outputs that will be used to support ongoing coastal resilience and green infrastructure projects. Final results will be presented to partners at the City of Miami Beach Public Works Department at the end of the term.

***Previous Terms:***

2017 Fall (GA) – Miami Beach Urban Development: Utilizing NASA Earth Observations to Assess Sea Level Rise and Develop Optimal Green Infrastructure Plans to Restore Mangrove Habitat and Enhance Coastal Resiliency

***Related DEVELOP Work:***

2014 Summer (GA) – Miami-Dade Ecological Forecasting: Utilizing NASA Imagery and GIS Modelling for the Design and Implementation of the Miami-Dade Western Greenway

2016 Spring (GA) – Atlanta Water Resources: Identifying Key Urban Areas to Reduce Stormwater Runoff in Metropolitan Atlanta to Maximize Conservation Efforts (Term I)

2016 Summer (GA) – Atlanta Water Resources: Identifying Key Urban Areas to Reduce Stormwater Runoff in Metropolitan Atlanta to Maximize Conservation Efforts (Term II)

2016 Fall (GA) – Atlanta Water Resources: Identifying Key Urban Areas to Reduce Stormwater Runoff in Metropolitan Atlanta to Maximize Conservation Efforts (Term III)

2016 Fall (GA) – Eastern India Ecological Forecasting: A Multi-Sensor Approach to Enhance the Prediction of Mangrove Biophysical Characteristics in Chilika Lagoon and Bhitarkanika Wildlife Sanctuary, Odisha, India

2017 Spring (GA) – Eastern India Ecological Forecasting II: A Multi-Sensor Approach to Enhance the Prediction of Mangrove Biophysical Characteristics in Chilika Lagoon and Bhitarkanika Wildlife Sanctuary, Odisha, India