**NASA DEVELOP National Program**

Mobile County Health Department

**Summer 2015**

**Short Title: COASTAL TEXAS WATER RESOURCES**

**Subtitle:** Utilizing NASA Earth Observations to Assess Estuary Health and Enhance Management of Water Resources in Coastal Texas through Land Cover and Precipitation Mapping

**VPS Title:** Rooting Out the Problem: Mesquite Trees’ Effect on Estuary Health

**Project Team & Partners**

**Project Team:**

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**Partner Organizations**

National Park Service, End-user, POC: Joe Meiman

**Project Details**

**Applied Sciences National Applications Addressed:**

Water Resources

**Study Area:** Texas (TX): Kleberg and Kenedy Counties

**Study Period:** 2000 - 2015

**Earth Observations & Parameters**

Landsat 7, ETM+ - Land cover

Landsat 8, TIRS & OLI - Thermal bands, land cover

GRACE, ACC/SCA/KBR - Equivalent water thickness, groundwater

TRMM, Precipitation Radar - Rainfall accumulation

Terra, ASTER - Thermal bands

**Ancillary Datasets Utilized**

* National Park Service - *In situ* and historic water temperature and salinity data
* Texas State Data Center - County Shapefiles of Kleberg and Kenedy counties
* Texas Natural Resources Information System - (Experimental Advanced Airborne Research Lidar) EAARL sensor Oct 2005 Bare Earth lidar & 2006/ 2008 DEMs

**Software Utilized**

ERDAS IMAGINE - land classification of Landsat imagery

ArcGIS - raster analysis of GRACE data, Landsat 7 ETM+ and Landsat 8 TIRS, map creation, TRMM precipitation analysis

dnnpy - scripts for converting Landsat imagery to TOA reflectance and surface temperature with Python

**Project Overview**

**80-100 Word Objectives Overview**

The project was conducted in conjunction with the National Park Service to address concerns regarding the salinity of the Laguna Madre in the Padre Island National Seashore. NASA Earth observation data were utilized to conduct precipitation analysis, in addition to creating a land use/land cover (LULC) map time series of vegetation in the study area, a groundwater map time series, and a thermal map of the Laguna Madre. These products were ultimately used to understand the suspected correlation between the increased salinity of the lagoon and the increase in the number of mesquite trees in the surrounding area.

**Abstract**

This project partnered with the National Park Service (NPS) in order to analyze the correlation between mesquite trees and the salinity of the Laguna Madre of Padre Island National Seashore. The lagoon is a hypersaline estuary. However, there is historical evidence that this was not always the case. It is hypothesized that the increase in the number of honey mesquite trees (*Prosopis grandulosa var. glandulosa)* in the area has contributed to the lagoon’s increased salinity by decreasing the groundwater inflow to the Laguna Madre. These mesquite trees have long taproots capable of extracting significant amount of groundwater. This project utilized Earth observation data in ERDAS IMAGINE and ArcGIS software to create map time series and analyze precipitation data. Landsat 7 and 8 data were used to create a land use/land cover (LULC) map in order to analyze the change in the number of mesquite trees over time. Thermal maps of the lagoon were generated using Landsat 8 and Terra data in order to understand changes in groundwater inflow to the lagoon. In addition, TRMM data were used in precipitation analysis and a time series map of groundwater was generated using data from GRACE. By investigating the correlation between the mesquite trees and the salinity of the Laguna Madre, the NPS can improve land management practices.

**Community Concerns**

* Increasing salinity of Laguna Madre of the Padre Island National Seashore, an already hypersaline estuary
* Proliferation of mesquite trees (native but harmful to the ecosystem) in the ecosystem
* Decrease of groundwater inflow to the estuary

**Current Management Practices & Policies**

As part of the Padre Island National Seashore, the Laguna Madre falls under federal land management. Currently, the water quality and nutrient levels of the Laguna Madre are monitored with *in situ* data collection in limited locations by the National Park Service. However, the relationship between mesquite trees, groundwater and the salinity of the lagoon is not systematically being studied. One challenge in conducting studies of the Laguna Madre is that much of the surrounding land is privately owned. There are policies on both the state and federal levels which protect the health of the Laguna Madre. The Texas General Land Office (TGLO) manages the Texas Coastal Management Program, which is federally approved, and allocates funds to a number of projects that address issues concerning coastal health (TGLO 2015). The lagoon also falls within national park boundaries and, therefore, is under the care of the National Park Service (NPS). Additionally on the federal level, the Office of Water (OW) under the Environmental Protection Agency (EPA) is responsible for ensuring water health nationwide with the help of entities at the regional, state and local level (EPA 2014). The National Estuary Program (NEP), which was established by the 1987 Clean Water Act (CWA), is also managed by the EPA. The NEP is charged with creating a Comprehensive Conservation and Management Plan (CCMP) designed to ensure water quality and overall estuary health (EPA 2014). Some other federal policies which address the estuary’s health include the Shore Protection Act (SPA) of 1988, the BEACH Act of 2000 and the Coastal Zone Management Act of 1972 (EPA 2014).

**Decision Support Tools & Benefits**

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| **End-Product** | **Earth Observations Used** | **Benefit & Impact** |
| Precipitation Analysis | TRMM Precipitation Radar | TRMM data will be used to identify how precipitation relates to the change in lagoon salinity, analyzing precipitation trends that may have affected groundwater levels. This will aid in assessing any potential correlation between mesquite trees and decreased groundwater. |
| Land Use/Land Cover Map Time Series | Landsat 7 ETM+,  Landsat 8 OLI | Landsat 7 and 8 data will be used to identify possible correlations between mesquite tree density, a decrease in groundwater flow, and an increase in salinity to aid in land management practices. |
| Groundwater Map Time Series | GRACE ACC/SCA/KBR | GRACE data will be used to identify if there have been changes in groundwater levels so these changes can be addressed through land management practices. |
| Thermal Maps of Lagoon | Terra ASTER,  Landsat 8 TIRS | Terra and Landsat 8 data will be used to identify changes in groundwater inflow to the lagoon and if these changes can be addressed through altered land management practices. |

**Project Imagery**

**[Insert image here]**

**Caption:** [Insert Caption Here. Max of 25 words.] Image Credit: [Insert project short title] Team.

**Image:** File Name (Please submit your image as a separate .jpeg as well as inserting it in this document)

**References:**

Environmental Protection Agency. 2014. “About the Office of Water.” http://www2.epa.gov/aboutepa/about-office-water. (June 15, 2015).

Environmental Protection Agency. 2014. “National Estuary Program (NEP) Overview.” http://water.epa.gov/type/oceb/nep/index.cfm#tabs-2. (June 15, 2015).

Texas General Land Office. 2015. “Coastal Management Program.” http://www.glo.texas.gov/what-we-do/caring-for-the-coast/grants-funding/cmp/. (June 15, 2015).