Using Landsat and Sentinel to Monitor and Predict Roseau Cane Die-offs Caused by The Invasive Roseau Cane Scale and Other Environmental Factors

Abstract
The Roseau cane mealy bug (Nipponacclerda biwakoeusia) is an invasive scale insect discovered in the United States during the 2016-2017 die-offs of Roseau cane (Phragmites australis) in the Mississippi River Delta. Plaquemines Parish, LA. Roseau cane stands stabilize sediment, protect against wave-action and storm surge, and provide critical habitat to wildlife. Roseau cane is the dominant vegetation type in the Mississippi River Delta and its loss will affect coastal marsh extent, shipping interests in the Mississippi River, and property owners along the lower Mississippi River Delta. The NASA DEVELOP Louisiana Ecological Forecasting team partnered with the National Wildlife Federation to use NASA Earth observations, including Landsat 5 Thematic Mapper (TM) and Landsat 8 Operational Land Imager (OLI), to monitor and assess the history of Roseau cane die-offs. These data, along with in-situ observations and European Space Agency Sentinel-2 Multispectral Instrument (MSI) imagery, were input into the Software for Assisted Habitat Modeling (SAHM) to forecast and predict the vegetative health of the marsh to 2030. Normalized Difference Vegetation Index (NDVI) maps assessed yearly changes and overall trends throughout the study period to identify areas of the marsh most impacted by major disturbance events (e.g., hurricanes, storm surges, oil spills, etc.) elucidating critical areas of interest for mitigation and restoration planning. Modeling with SAHM indicated a continued threat to Roseau cane stands through 2030 as overall marsh health continues to decline and relative sea-level rise coupled with subsidence continues to raise water levels and increase saline conditions for marsh plants.

Methodology

- **Acquire**: Landsat and Sentinel imagery
- **Preprocess**: imagery, composite bands, least cloudy single scene chosen
- **Compile**: a code in GEEl for NDVI classification using “greenest pixel”
- **Analyze**: NDVI yr. to yr. change in QGIS, virtually stack yrs. 2005, 2011, 2017
- **Create**: classified Roseau cane distribution map from CRMS points & aerial photos
- **Input**: in-situ data & extrapolated presence/absence pts. of cane into the SAHM model
- **Run**: SAHM model & perform statistical analysis
- **Forecast**: the spread of Roseau cane die-offs and predict future health of the marsh out to 2030

Objectives
- **Generate** NDVI maps to monitor marsh vegetative health between 2005-2017
- **Assess** land cover change in study area over the study period
- **Create** a series of annual NDVI change maps year to year from 2005-2017
- **Forecast** the vegetative health of the marsh to 2030
- **Perform** statistical analysis on Roseau cane die-offs
- **Determine** areas of high vulnerability and resilience to major disturbances

Study Area

Bird’s Foot Delta

![Map of Louisiana showing Southern Plaquemines Parish and Bird’s Foot Delta](image)

Earth Observations

- Landsat 5 TM
- Landsat 8 OLI
- Sentinel-2 MSI

Team Members

- Jen Schellman: Project Lead
- Michael Brooke
- Beck Saalts

National Wildlife Federation

项目合作伙伴

Conclusions
- **NDVI** compared over the study period indicate areas on the eastside of the Delta are more adversely affected by disturbances than on the westside.
- **Historic trends** and patterns emergent from the data show years following major disturbances (e.g. BP oil spill, Hurricane Katrina, El Niño yrs., Roseau cane scale infestation) had lower than average NDVI, but in the consecutive year thereafter, NDVI increased slightly, suggesting there’s resilience within the marsh (lag-time effects and thresholds should be further investigated).
- **SAHM** model results displayed a continued threat to Roseau cane out to 2030, increasing the rate of land-loss, exacerbated by subsidence and relative sea-level rise.
- **Errors** that may have impacted/skewed the data include: a gap year for 2012 (no cloud-free images for NDVI), image resolution, limited ground truth, “greenest pixel” bias, unknown phenology of the Roseau cane species and other factors unaccounted for (e.g. plant pathogens).