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

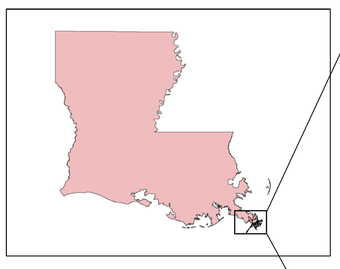

## Abstract

The Roseau cane mealy bug (*Nipponaclerda biwakoensis*) 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.


## 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

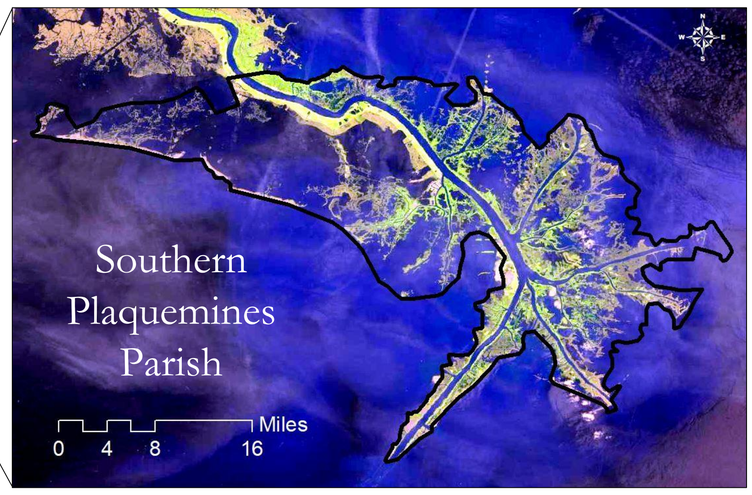
## Study Area



Louisiana

Southern Plaquemines Parish, LA

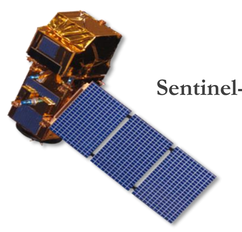
Bird's Foot Delta




## Earth Observations

**Landsat 5** TM

**Landsat 8** OLI



**Sentinel-2** MSI

## Team Members

Jen Schellman
Project Lead

Michael Brooke

Beck Saults

## Project Partner

National Wildlife Federation

## Methodology

**Acquire** Landsat and Sentinel imagery

**Preprocess** imagery, composite bands, least cloudy single scene chosen

**Compile** a code in GEE for NDVI classification using "greenest pixel"

**Analyze** NDVI yr. to yr. change in QGIS, virtually stack yrs. 2005, 2011, 2017

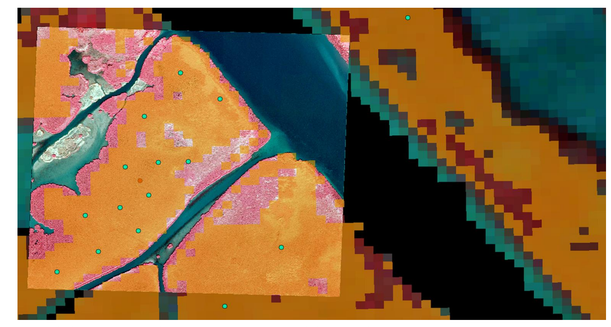
**Create** classified Roseau cane distribution map from CRMS points & aerial photos

**Input** *in-situ* data & extrapolated presence/absence pts. of cane into the SAHM model

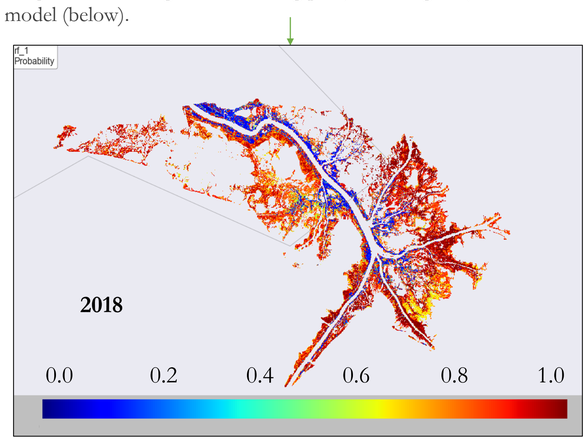
**Input** NDVI, CoNED DEM & climate data into SAHM

**Run** SAHM model & perform statistical analysis

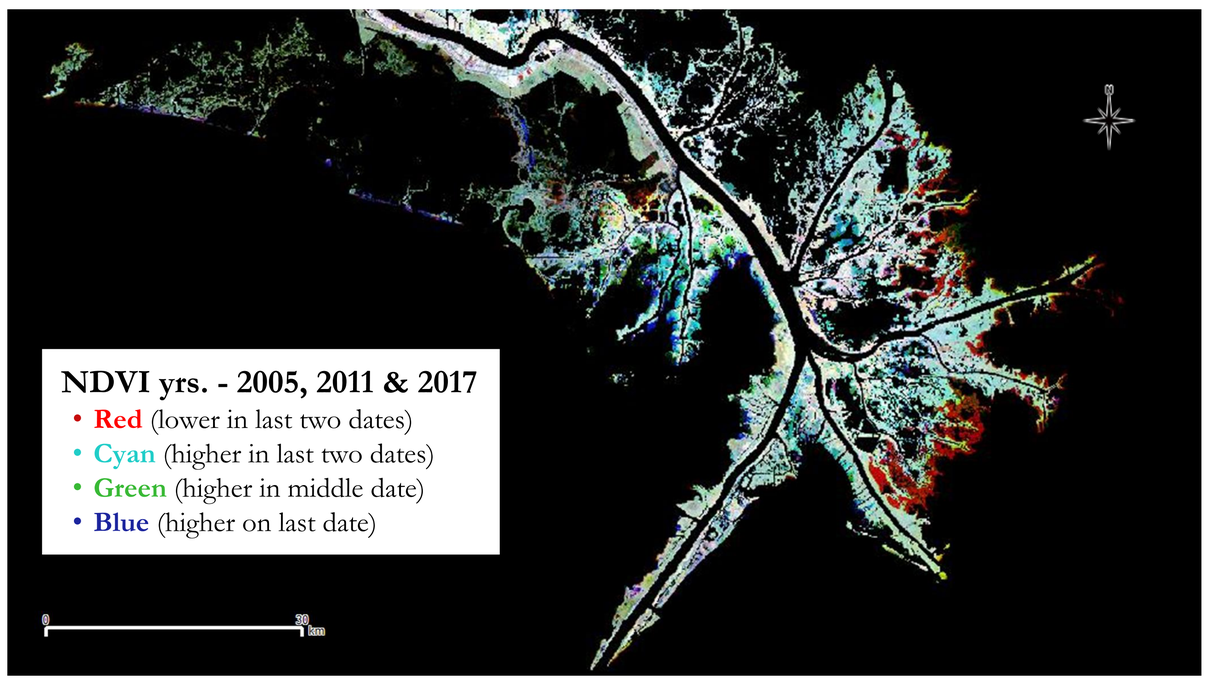
**Forecast** the spread of Roseau cane die-offs and predict future health of the marsh out to 2030



Aerial photos from the Coastwide Reference Monitoring System (CRMS) were used to classify areas of Roseau cane; the classified image was used to generate training pts (above in green) for SAHM model (below).




## Results




## 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 scale and other factors unaccounted for (e.g. plant pathogens).


## Acknowledgements

**Joseph Spruce**, Science Systems & Applications, Inc.
**Dr. L. DeWayne Cecil**, NOAA National Center for Environmental Information, Global Science & Technology, Inc.
**Bob VanGundy**, The University of Virginia's College at Wise
**Dr. Marguerite Madden**, University of Georgia
**Dr. Kenton Ross**, NASA Langley Research Center
**Brooke Colley**, Center Lead, NASA DEVELOP National Program, Virginia – Wise
**Eric White**, Former Center Lead NASA DEVELOP National Program, Virginia – Wise





*This material is based upon work supported by NASA through contract NNL16AA05C and cooperative agreement NNX14AB60A. Any mention of a commercial product, service or activity in this material does not constitute NASA endorsement. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Aeronautics and Space Administration and partner organizations.*