# CRMS Roadshow

March 2021

1. Website releases
2. Upcoming website functionality
3. Analytical team updates
4. Upcoming Programmatic Data Collection

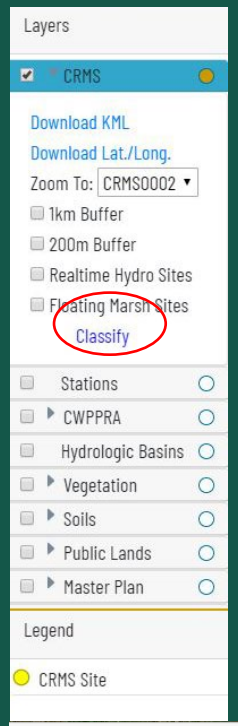
# Released on the Website

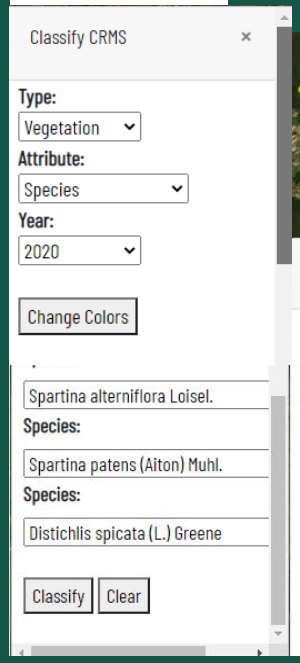
Any website issues, questions, or special data requests should be emailed to **CRMS@usgs.gov** for fastest resolution.

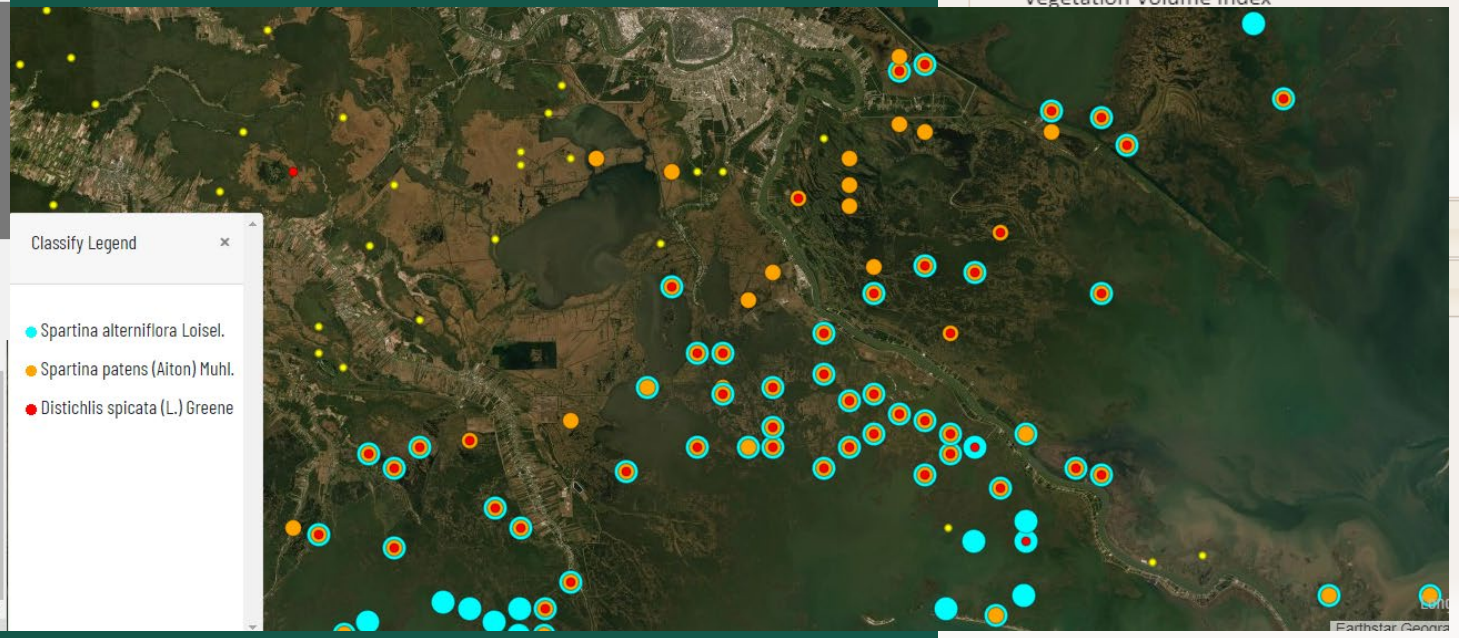
The website works best with Google Chrome.

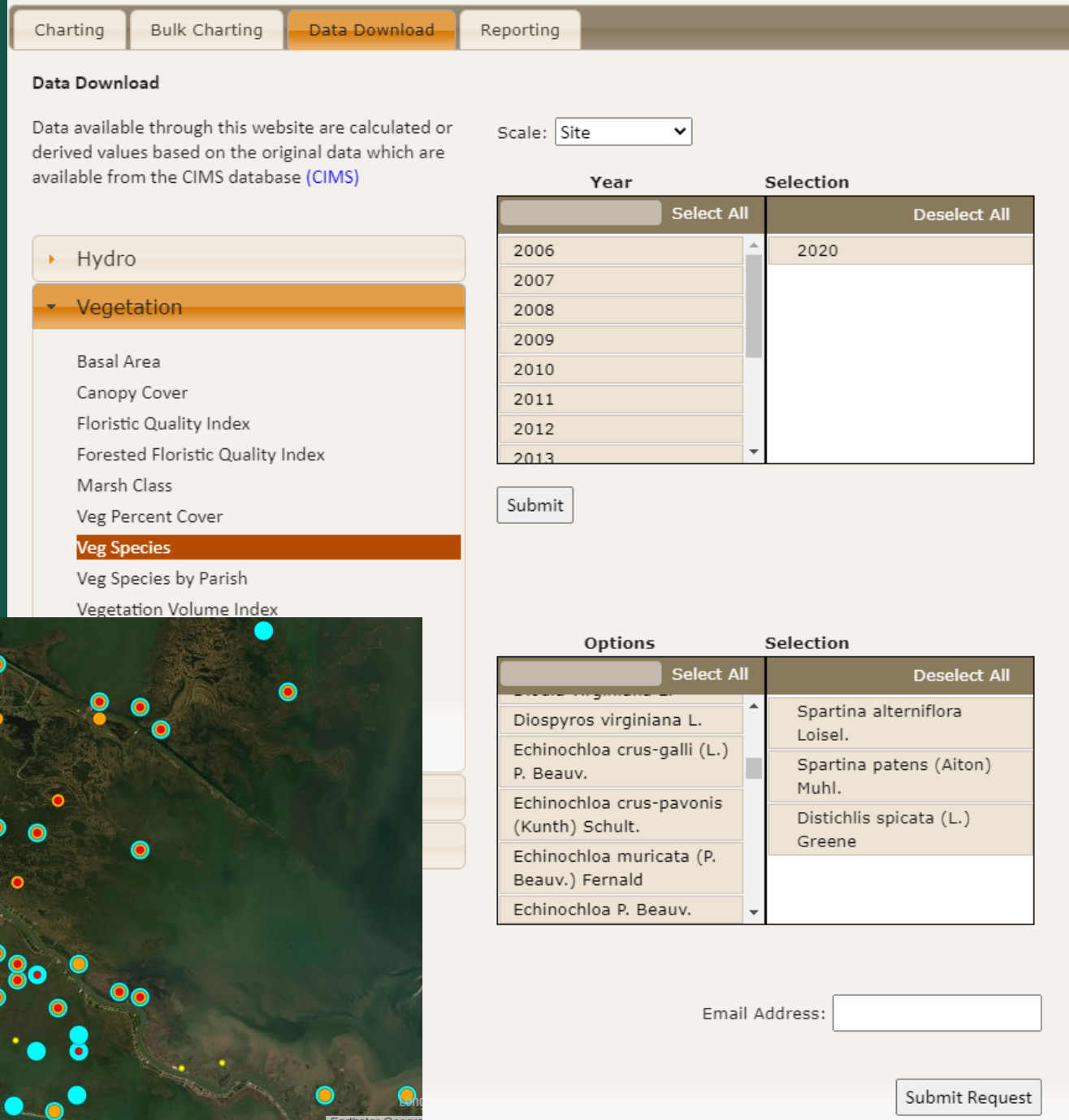
# Map Vegetation Species

- On the mapping viewer using the Classify Tool
- Based on query output
- Site level presence by year
- Limit of 3 species per visualization
- Pair with veg species in data download to get csv of the data you have visualized



# Canopy Cover Charts

Charting | Bulk Charting | Data Download | Reporting

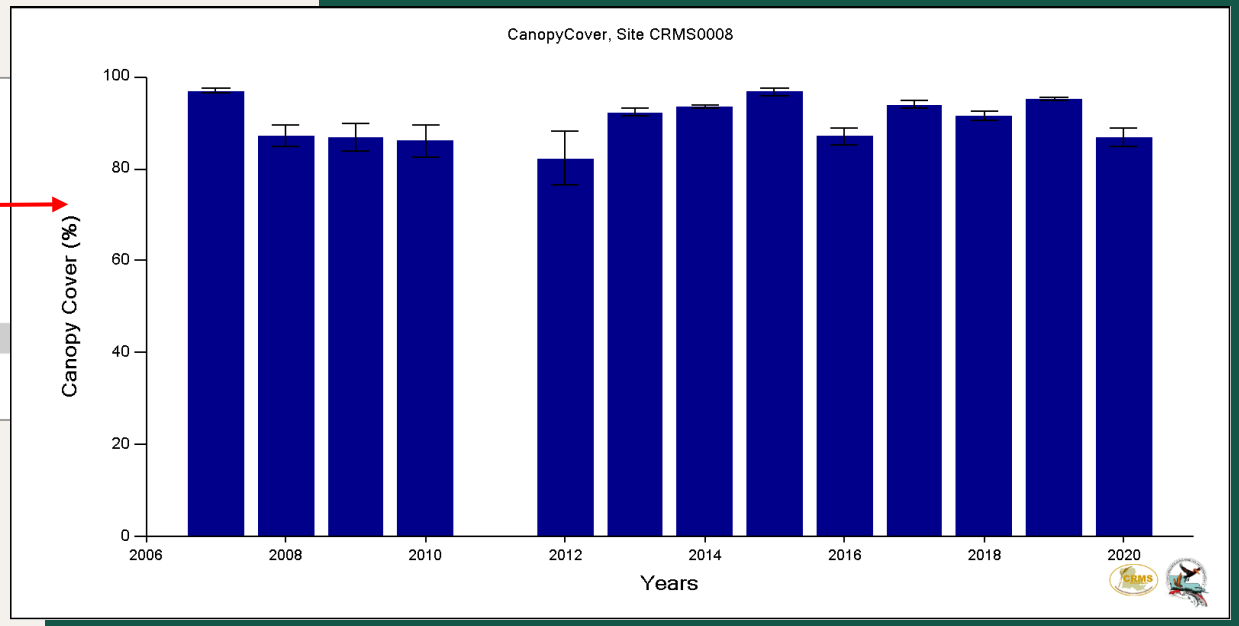
- Hydro
- Vegetation
  - Forested
  - Canopy Cover
  - Herbaceous
  - Site Floristic Quality Index
  - Project/Reference FQI
  - Forested Floristic Quality Index
  - Marsh Class
  - Vegetation Volume Index
  - Belowground Biomass
  - Total Biomass
  - Nutrients
  - Vegetation Community Type
  - Vegetation Community Classification
- Soil
- Spatial
- Report Card Charts

Clear Charts

Scale: Site

Scale: Select a scale (Select a scale, Site, Multi Site, Multi Station, Station)

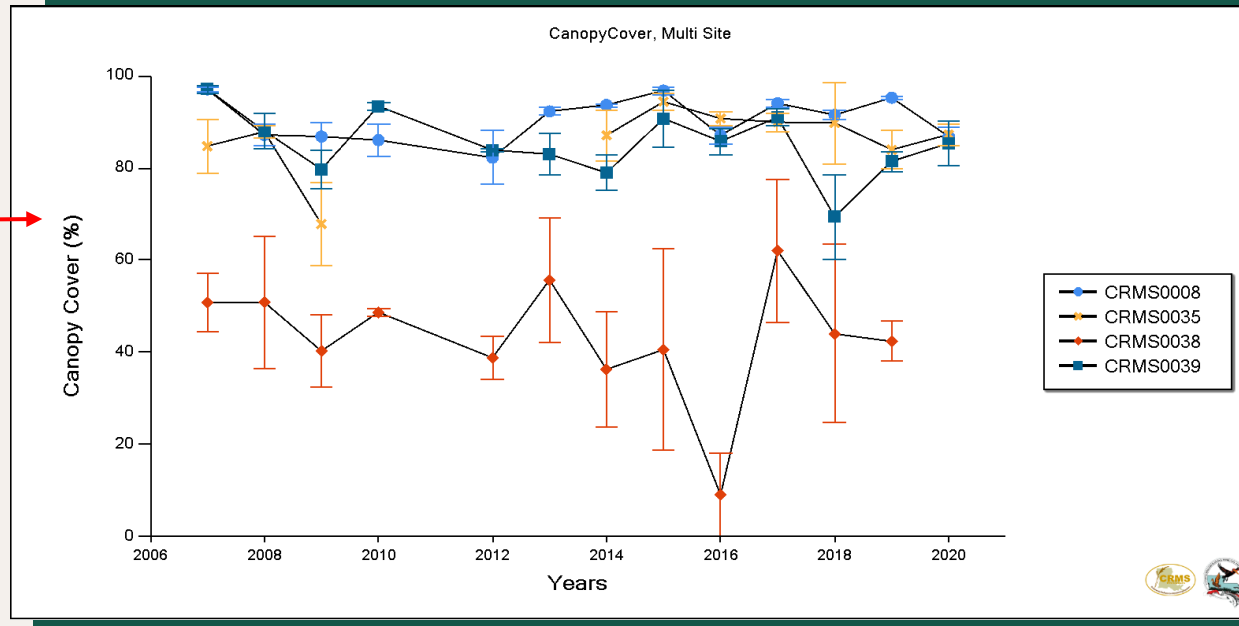
Selection: BA68-R04, BA68-R06, BA68-R08, BA68-R09, BA68-R11, BA68-R12, BA68-R13, BA68-R14, CRMS0008, CRMS0035, CRMS0038




Scale: Multi Site

Basin: All Basins  Project: All Projects  Selection limited to 12 items

| Options | Selection |
|---|---|
| BA68-R04 | CRMS0008 |
| BA68-R06 | CRMS0035 |
| BA68-R08 | CRMS0038 |
| BA68-R09 | CRMS0039 |
| BA68-R11 | |
| BA68-R12 | |
| BA68-R13 | |
| BA68-R14 | |



# Surrogate Sondes

Charting | Bulk Charting | Data Download | Reporting

- Hydro
  - Water Level Range
  - Hydro Completeness
  - Salinity
  - Water Level
  - Temperature
  - Flooding
  - Continuous
  - Site Hydro Index
  - Soil Porewater
  - Precipitation
  - Seasonal Precipitation
  - Interactive Hydro

Water Year is October 1 - September 30

Click here for Hydro Surrogates Info

Scale: Station

Date Range:
1/1/1992 - 2/24/2021
Min Date: 1/1/1992
Max Date: 2/24/2021
Apply Date Filter

Mean annual salinity
Mean growing season salinity

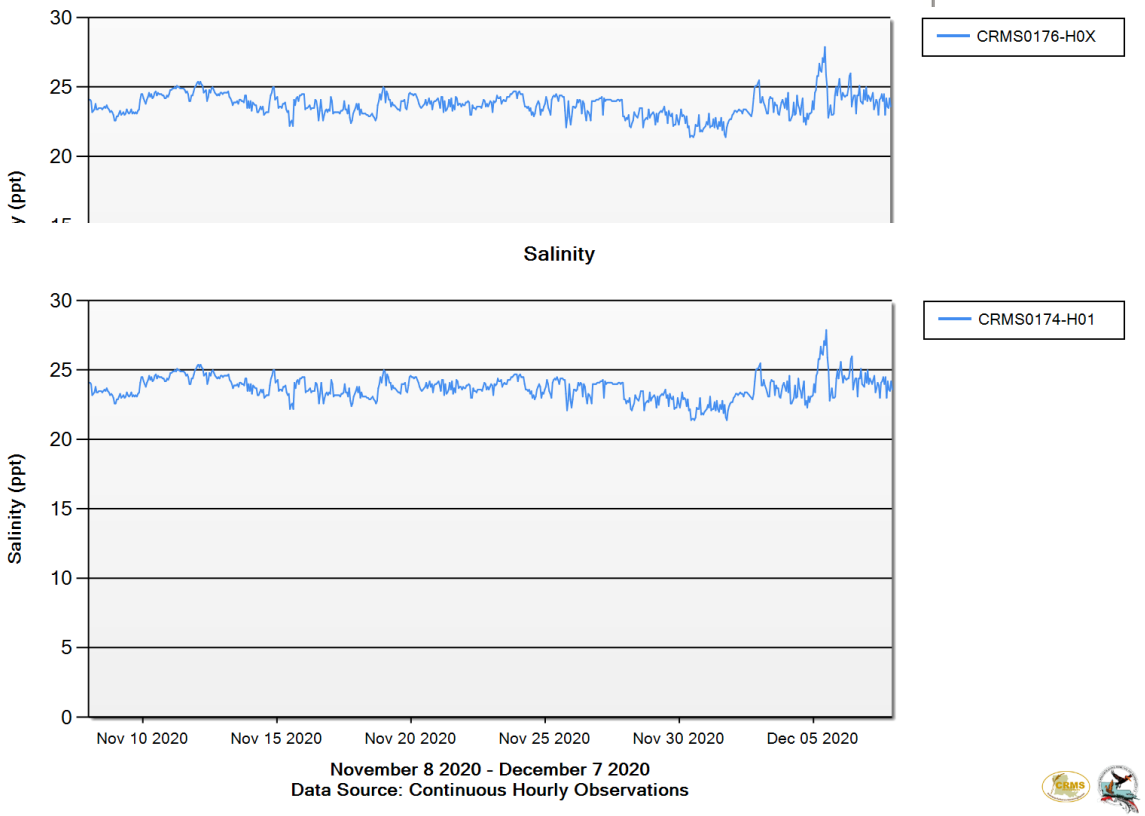
**Selection**

CRMS0176-H01
CRMS0176-H0X
CRMS0178-H01
CRMS0179-H01
CRMS0181-H01
CRMS0184-W01

CRMS MOVE CLOSE

Please note some hydrologic instrumentation was removed from the CRMS network on 10/1/2019. Surrogate data from a statistically equivalent hydrologic station will represent eliminated stations after 10/1/2019.
Hydrologic stations using surrogate data can be identified by the naming convention CRMSxxxx-H0X (ex., CRMS0176-H0X).

| Basin | Eliminated Station_ID 10/1/19 | Station_ID of surrogate 10/1/19 | New Station_ID 10/1/19 | New Station_ID Latitude | New Station_ID Longitude |
|---|---|---|---|---|---|
| BA | CRMS0176-H01 | CRMS0174-H01 | CRMS0176-H0X | 29° 23' 50.173" | -89° 45' 55.767" |
| BA | CRMS0220-H01 | CRMS0253-H01 | CRMS0220-H0X | 29° 33' 18.683" | -90° 4' 24.093" |
| TE | CRMS2881-H01 | CRMS0411-H01 | CRMS2881-H0X | 29° 29' 52.597" | -90° 57' 4.664" |
| ME | CRMS1409-H01 | CRMS0553-H02 | CRMS1409-H0X | 29° 50' 58.624" | -93° 0' 20.200" |
| ME | CRMS1446-H01 | CRMS0590-H01 | CRMS1446-H0X | 29° 55' 59.545" | -92° 49' 39.185" |
| CS | CRMS2154-H01 | CRMS0661-H01 | CRMS2154-H0X | 29° 50' 46.394" | -93° 37' 56.210" |
| CS | CRMS2156-H01 | CRMS0669-H01 | CRMS2156-H0X | 29° 52' 52.290" | -93° 43' 38.285" |




## In mapping viewer

Layers

- CRMS
  - Download KML
  - Download Lat./Long.
  - Zoom To: CRMS0176
  - 1km Buffer
  - 200m Buffer
  - Realtime Hydro Sites
  - Floating Marsh Sites
  - Classify
- Stations

Layer Info

Info | Water | Veg | Soil | Spatial | Rep. Card | Tools

**Mean 2020 Growing Season Salinity (March 1 - Oct. 31): 10.81 (ppt)**

Water Salinity (ppt) at the CRMS hydro station, CRMS0176-H0X.

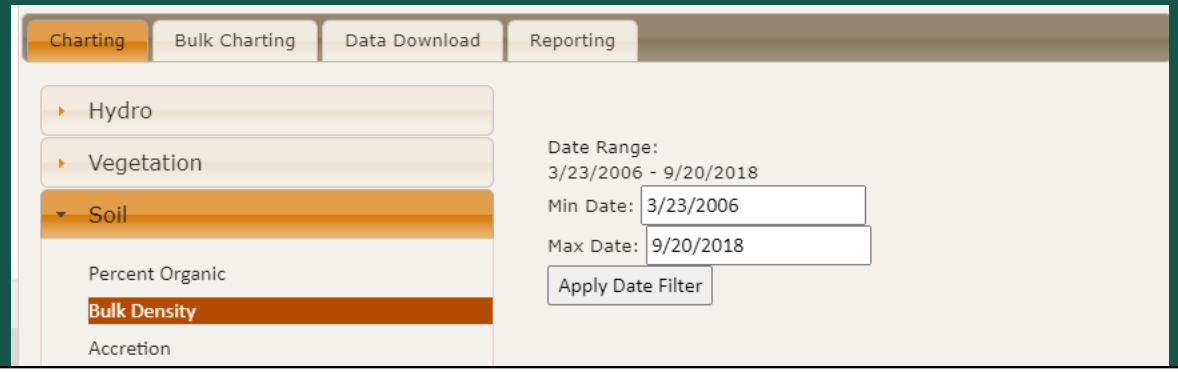
After 10/1/2019, this CRMS site's hydrologic conditions are being characterized using data collected at CRMS0174-H01

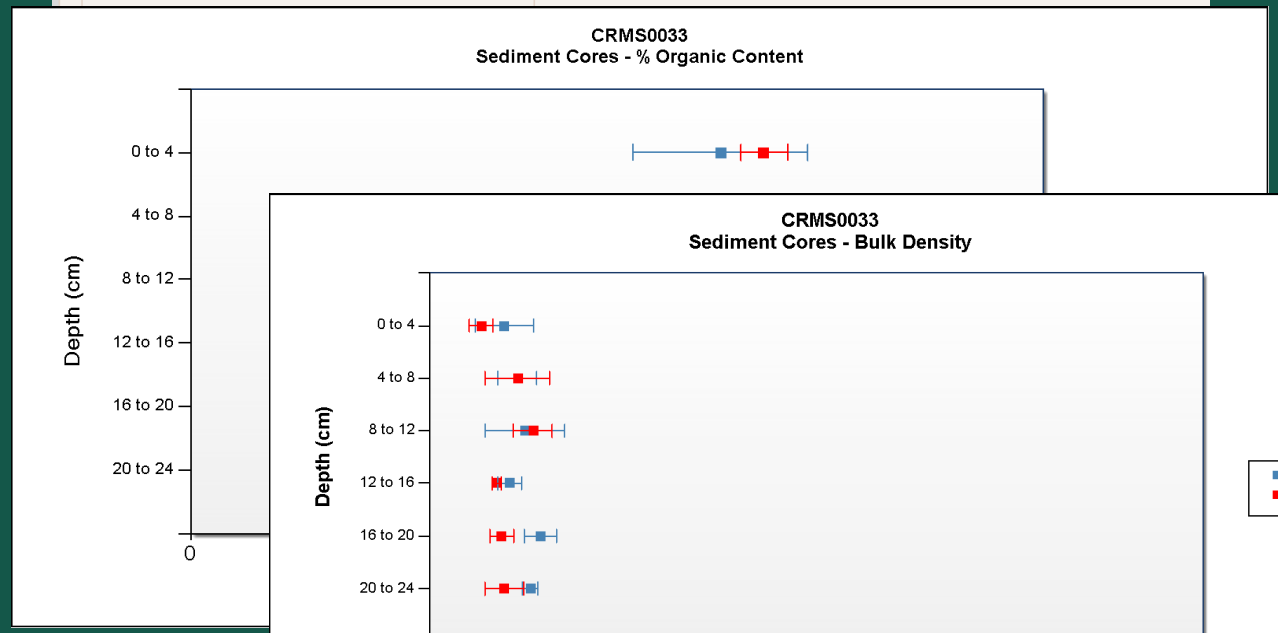
| | 10/2019 - 12/2020 | 12/2019 - 12/2020 | Mar 1 - Jun 30, 2020 | Jul 1 - Oct 31, 2020 | Nov 1 - Feb 28, 2020 |
|---|---|---|---|---|---|
| Min | 3.60 | 3.60 | 3.60 | 4.50 | 7.00 |
| Mean | 14.62 | 14.34 | 9.92 | 12.34 | 17.38 |
| Max | 27.90 | 27.90 | 21.90 | 22.20 | 27.20 |

# Soils, Above and Belowground Charts

CRMS soil profiles were collected in 2018.

- Updated soil profiles for OM and BD
- Soils "Read Me" file when downloading data or chart







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## Soils Data Information

### June 2020

As part of the CRMS program, soil characteristics are surveyed approximately every 6 to 10 years at all sites. Soil properties data can be downloaded either by project, by CRMS site or by station ID (CRMS0000-S0X). There have been two coastwide soil core data collection efforts; one during site construction where each site was sampled as it was established (2006 to 2008) and a second coastwide effort in 2018. Forested sites are sampled approximately every six years (2006-2008 and 2014).

Separately, and as part of the Systemwide Assessment and Monitoring Program (SWAMP), biomass and nutrient data are collected from a subset of CRMS sites. Biomass stations are associated with seven target taxa (*Spartina alterniflora, Spartina patens, Sagittaria latifolia, Sagittaria lancifolia, Zizaniopsis miliacea, Typha* spp., and *Phragmites* spp). At each biomass station, vegetation data are collected from a 2m x 2 m plot in the same manner as is done for all CRMS vegetation stations (% Cover, Height). Within the vegetation plot, a 0.5m x 0.5m area is harvested for aboveground vegetation and two cores are extracted, one for belowground biomass and one for soil nutrients (Figure 1). Three replicate plots are collected at each CRMS site for this effort.

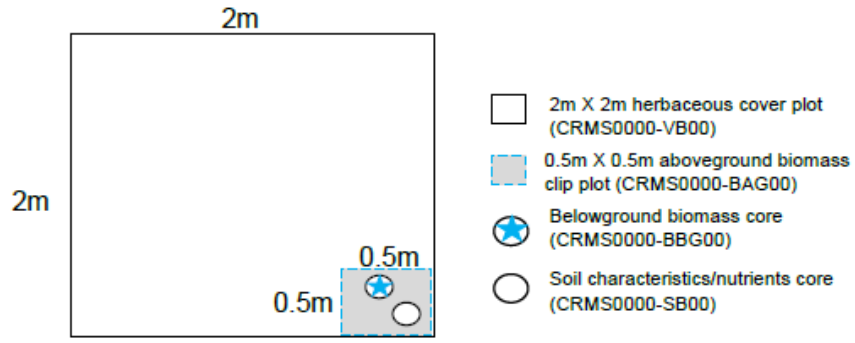
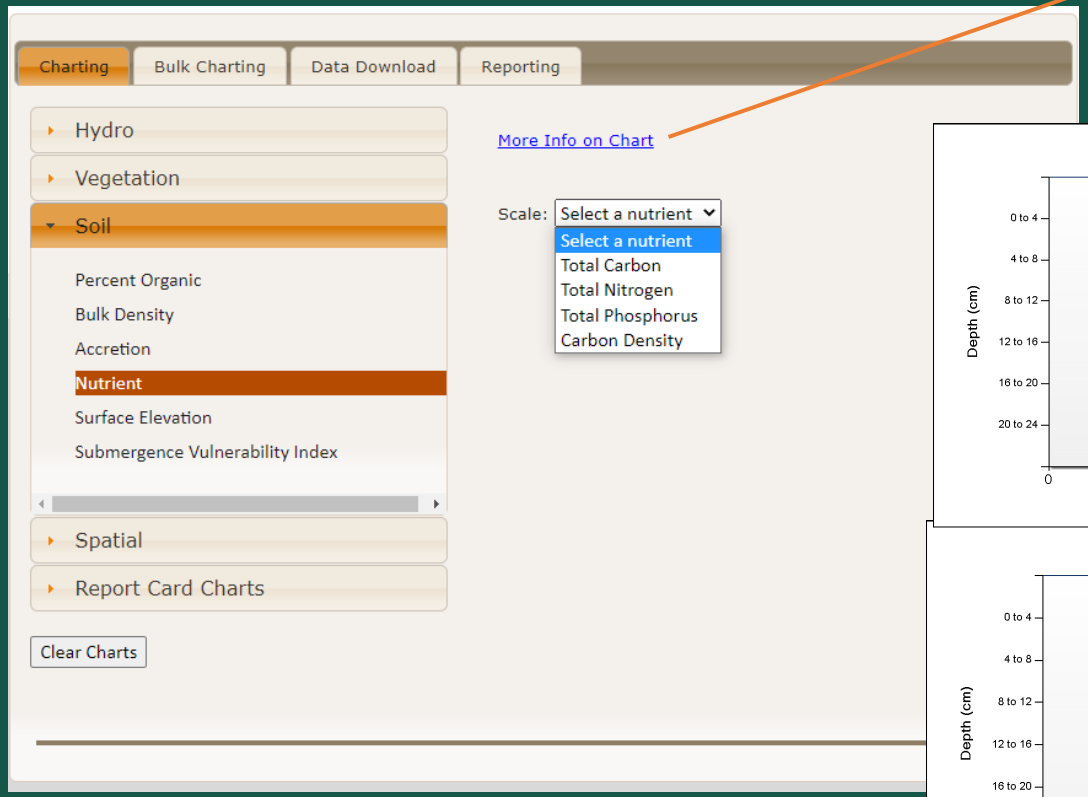


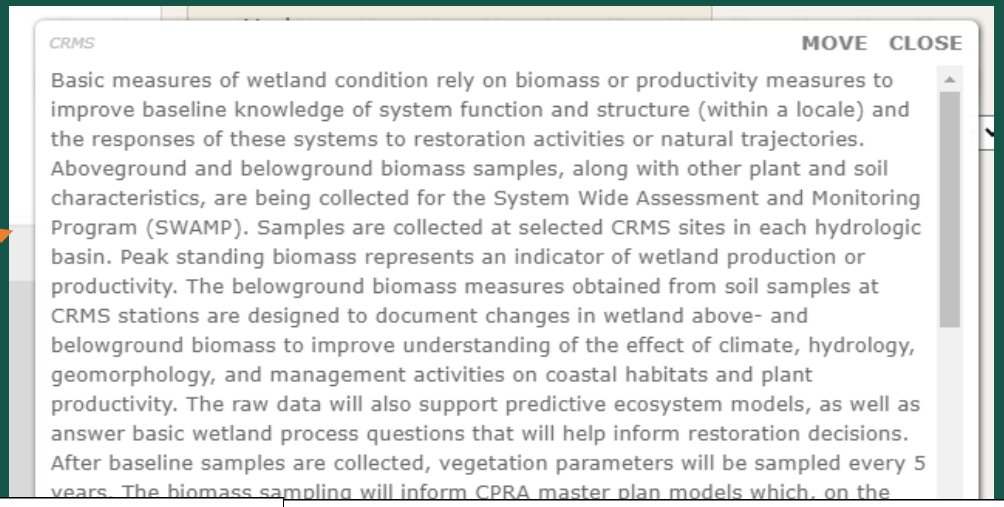

Figure 1. Diagram of the nested herbaceous biomass cover plot, aboveground and belowground biomass sampling area, and soil core collected at a subset of CRMS sites associated with the SWAMP effort. Three replicate samples of each are collected per sampling event. Note that a 10m buffer is maintained around the CRMS data collection area (i.e., boardwalk area) as well as the CRMS vegetation transect for this sampling effort.

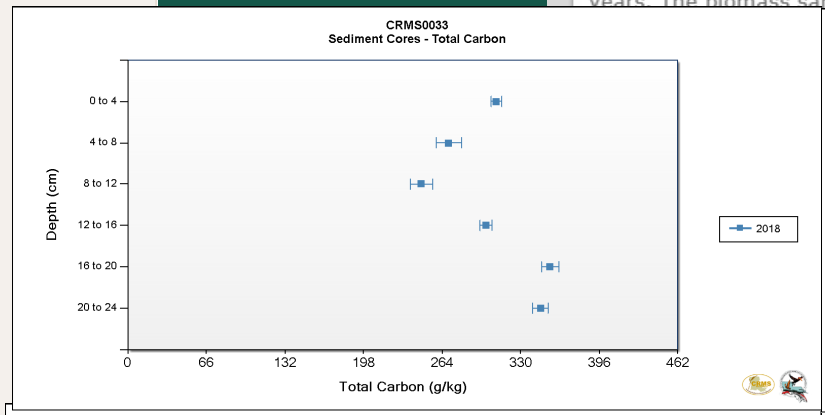
# Soils, Above and Belowground Charts, cont.

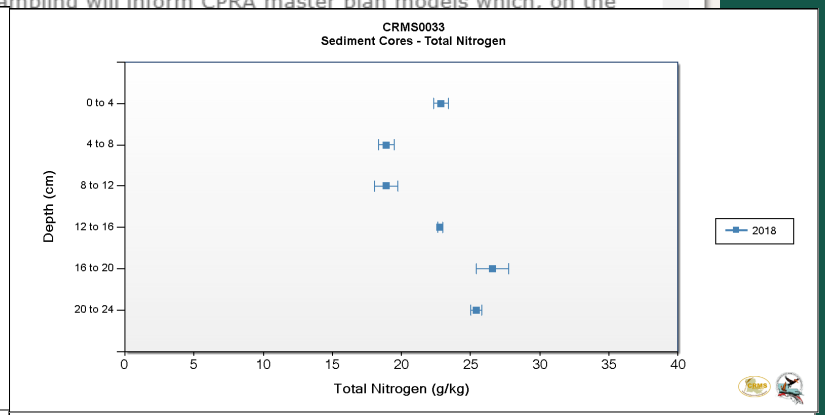
Soil nutrient profiles collected through SWAMP at a subset of CRMS sites (162) in a yearly rotation by basin from 2016-2021.

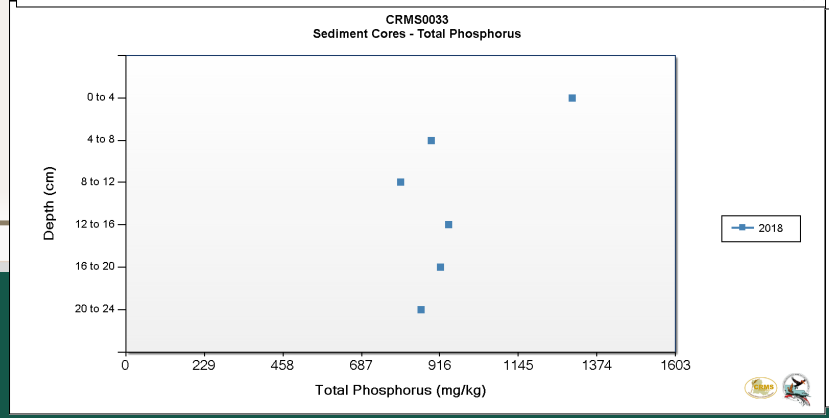
- Soil nutrient profiles for TN, TP, TC
- Carbon density profile

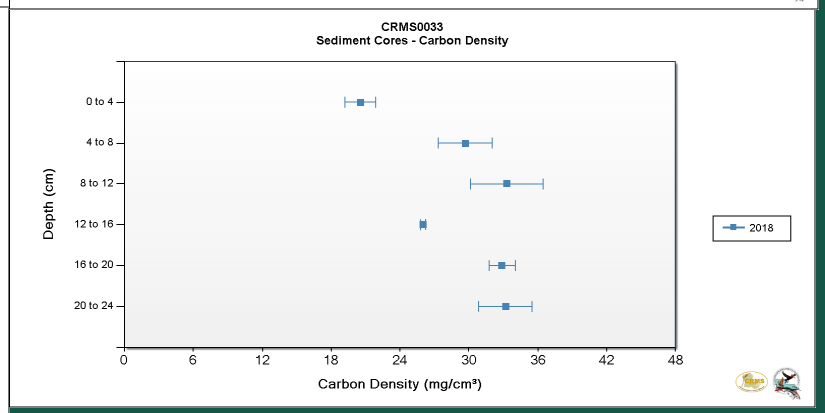


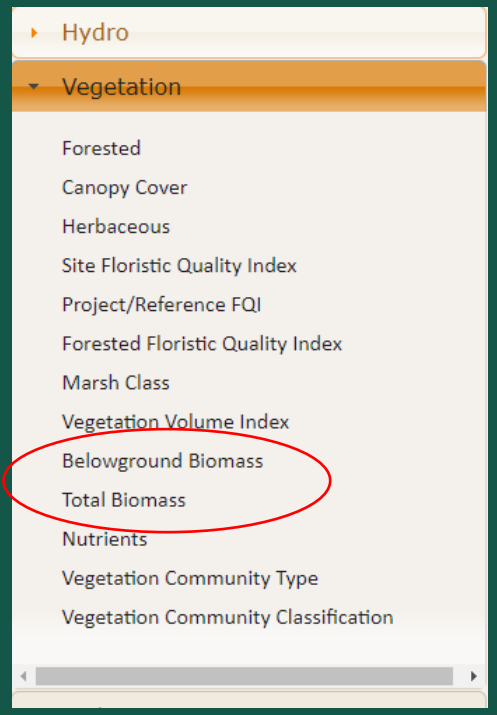



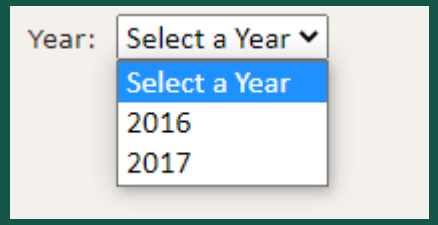



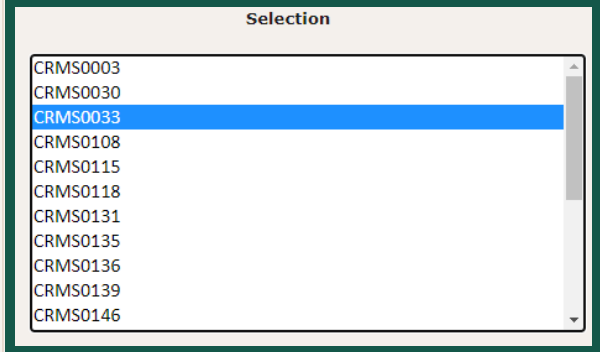
# Soils, Above and Belowground Charts, cont.

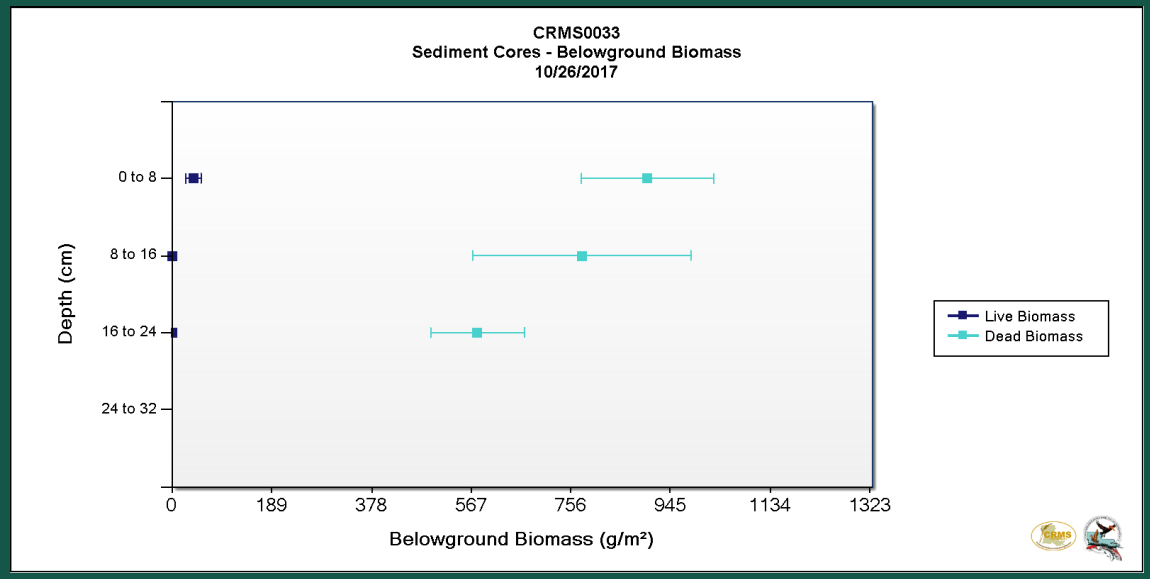
Above and belowground biomass and vegetation nutrients collected by basin in a yearly rotation from 2016-2021.

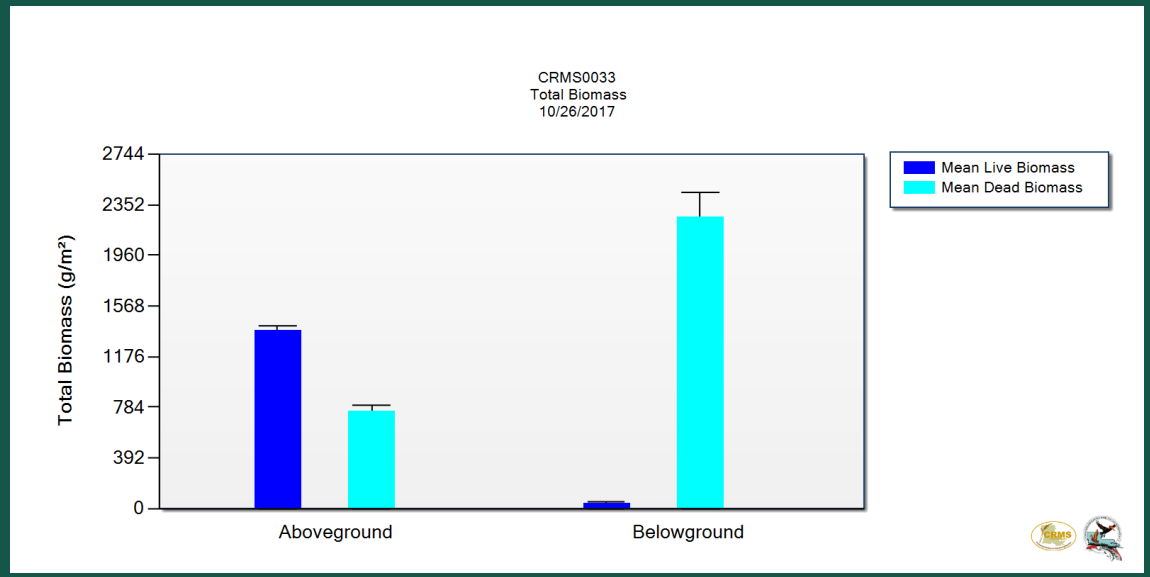
- Above and belowground biomass (live and dead)
- More data coming!



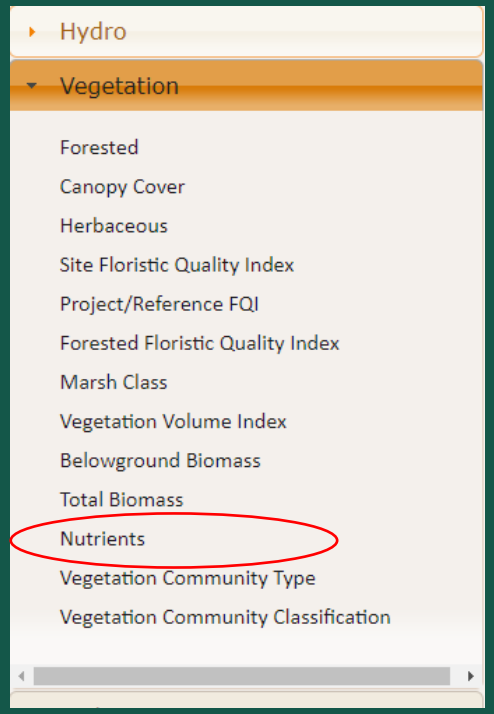



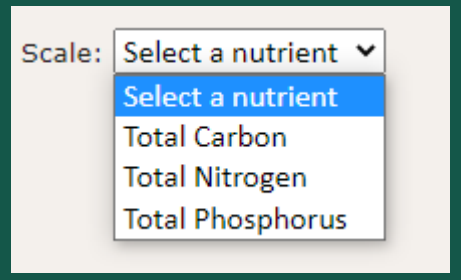



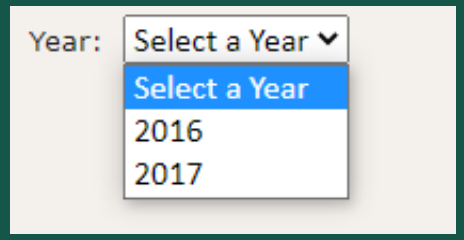
# Soils, Above and Belowground Charts, cont.

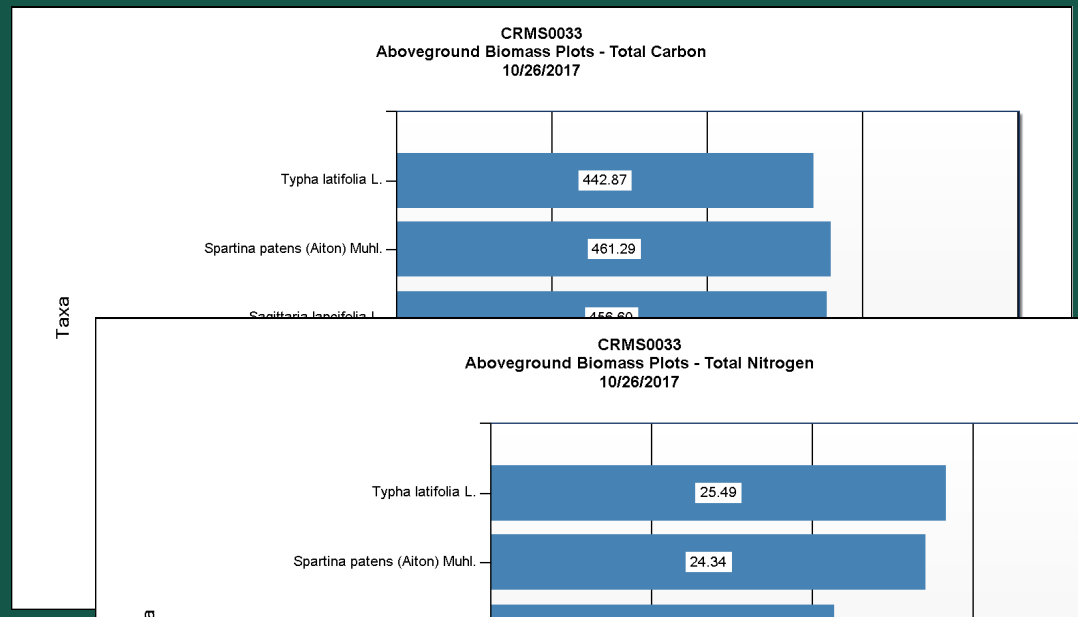
Above and belowground biomass and vegetation nutrients collected by basin in a yearly rotation from 2016-2021.

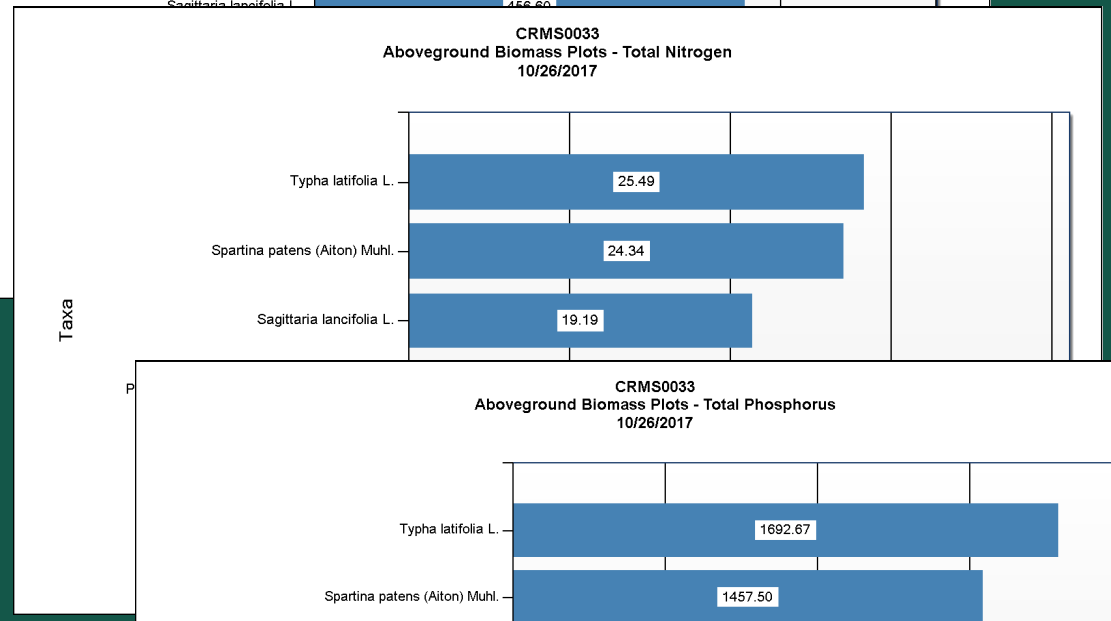
- Aboveground vegetation nutrient content

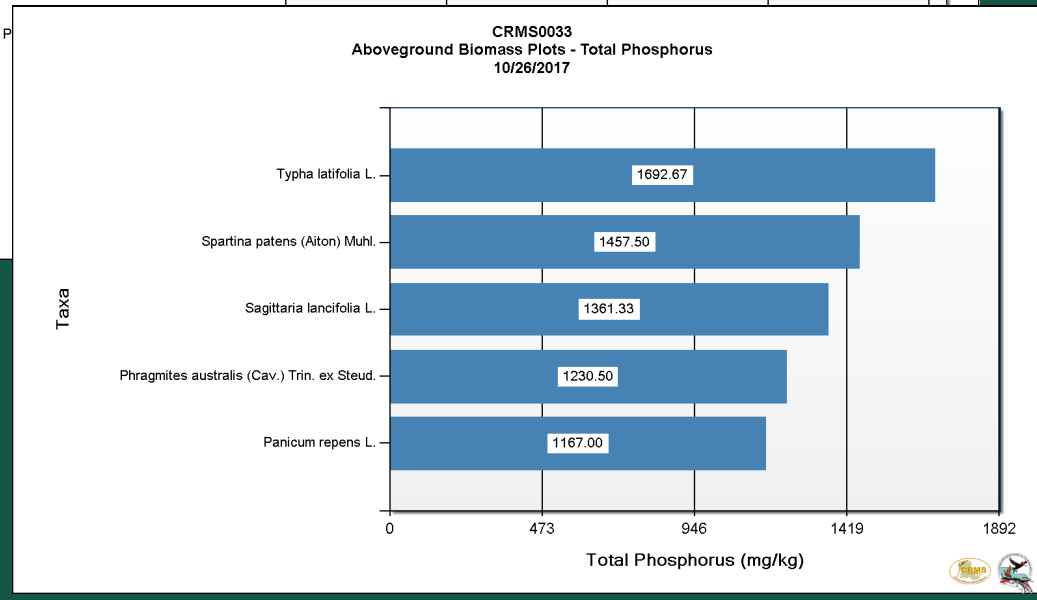


# Vegetation Community Type

Received: 22 June 2018 | Revised: 7 December 2018 | Accepted: 14 December 2018
DOI: 10.1111/avsc.12425

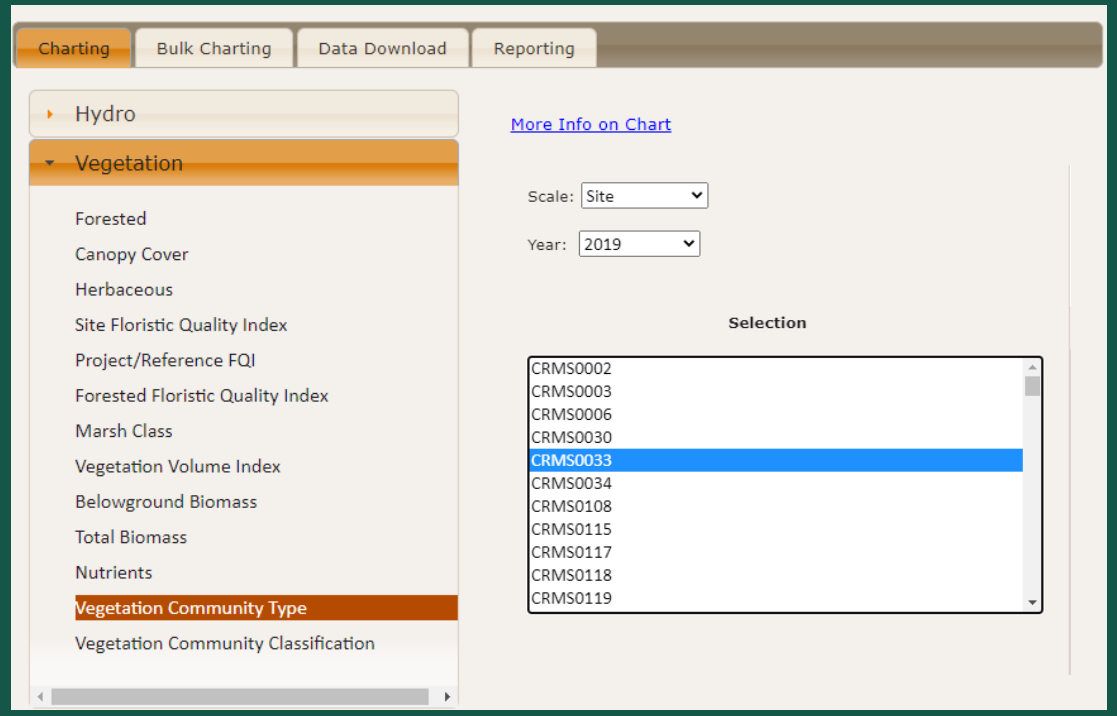
RESEARCH ARTICLE

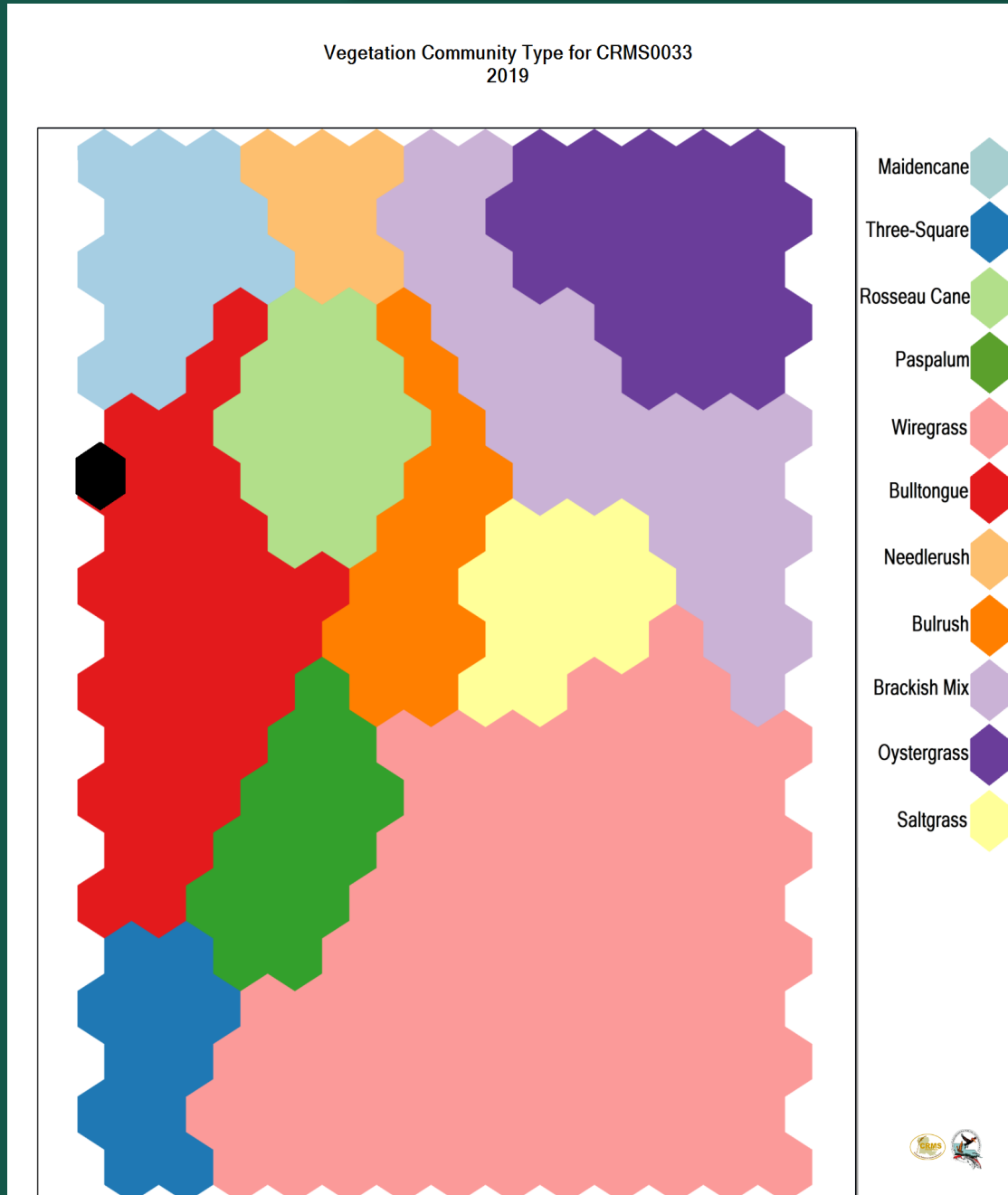
Applied Vegetation Science
IAVS

## Patterning emergent marsh vegetation assemblages in coastal Louisiana, USA, with unsupervised artificial neural networks

Gregg A. Snedden

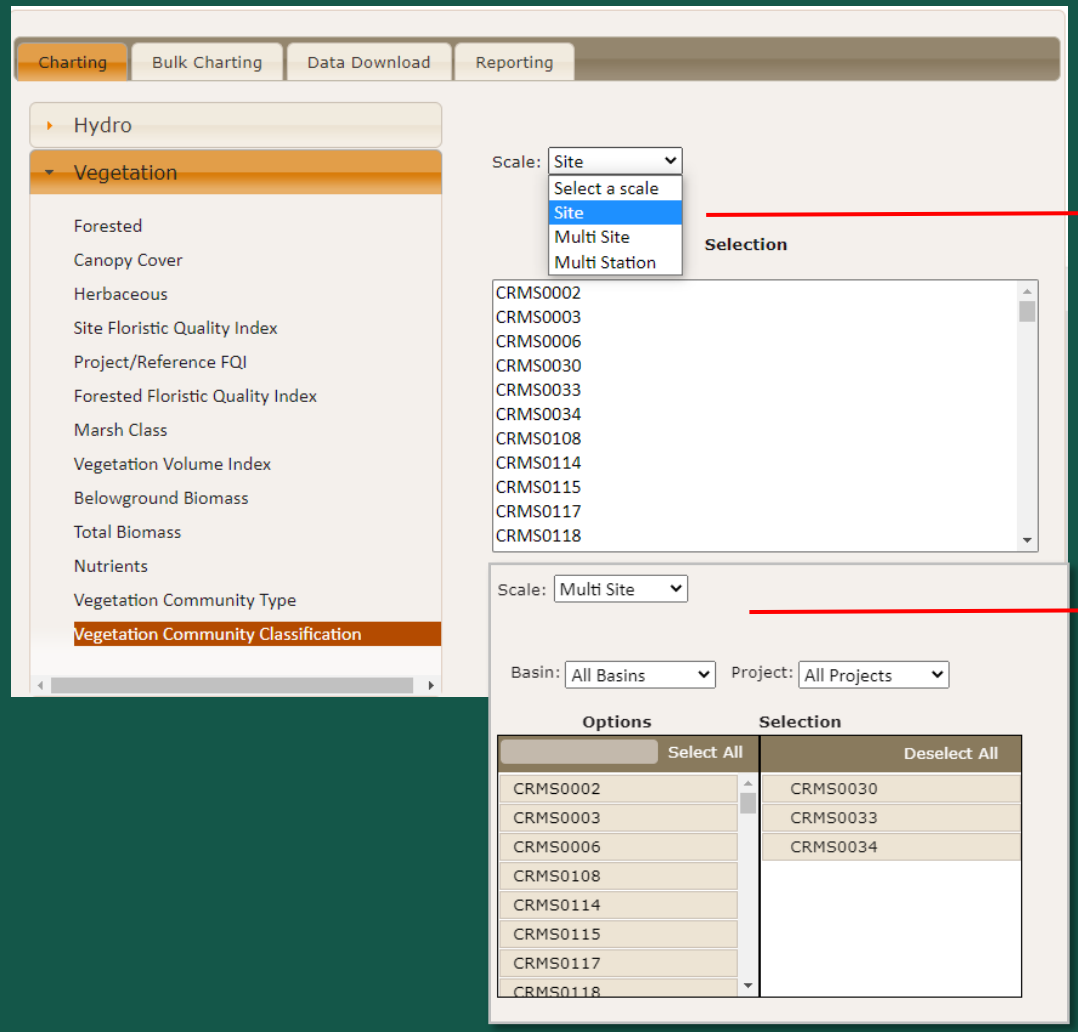
One of 11 community types is assigned to CRMS marsh sites using the species composition (relative cover) data collected annually from the sites.

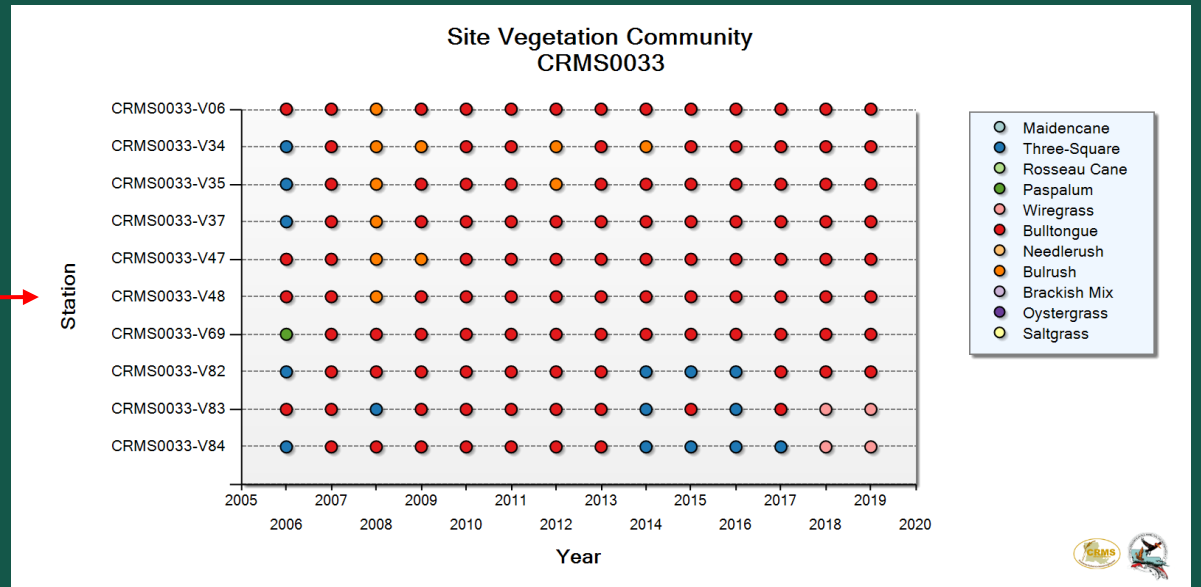


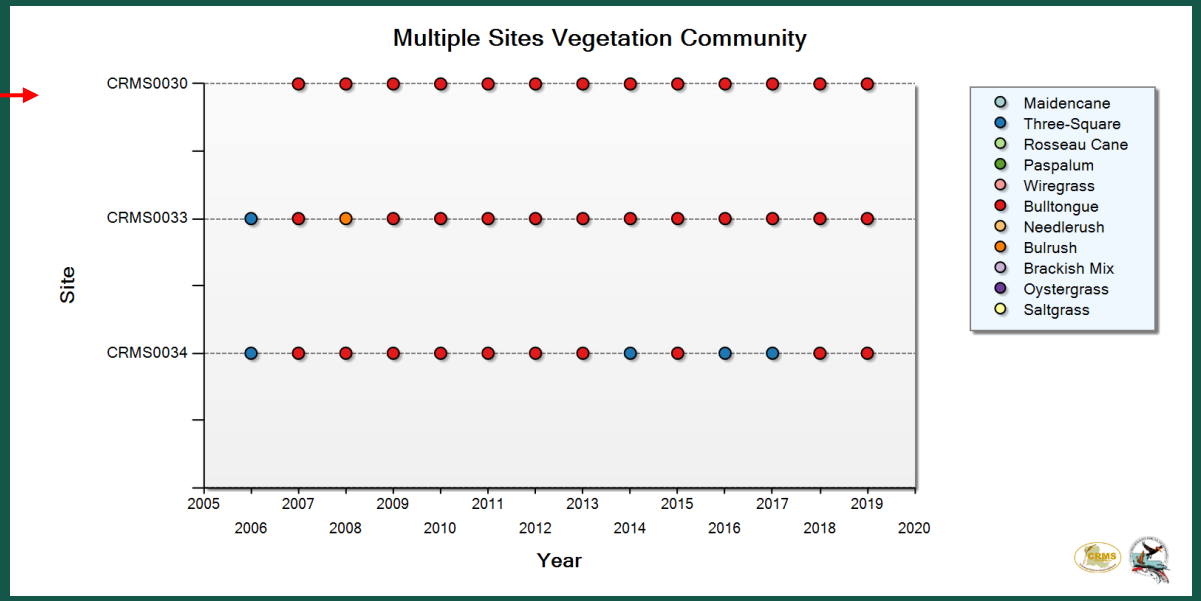



# Vegetation Community Classification

## Site/Multi-site/Multi-station level charting



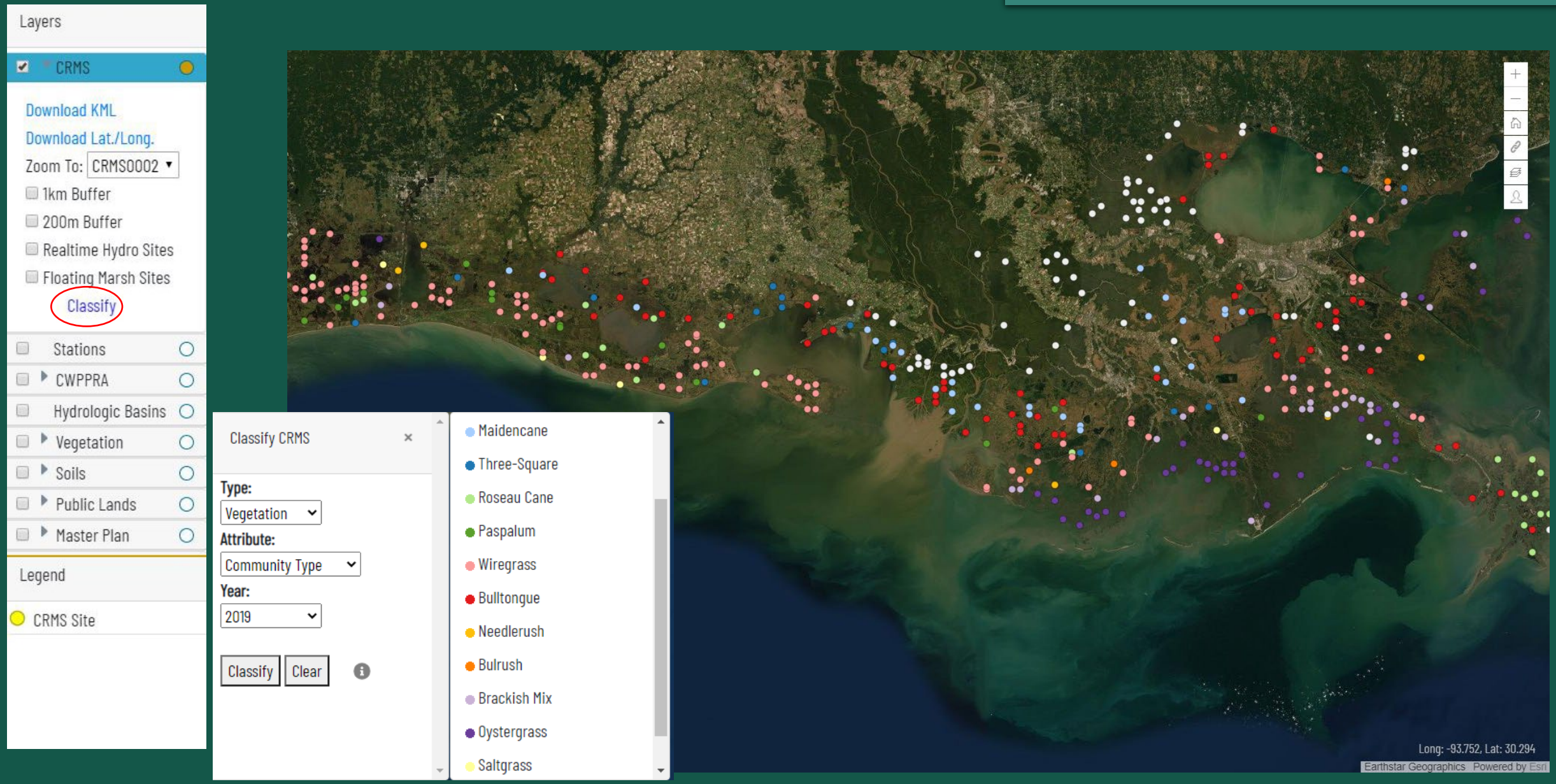




Snedden, G.A., 2019. **https://doi.org/10.1111/avsc.12425**

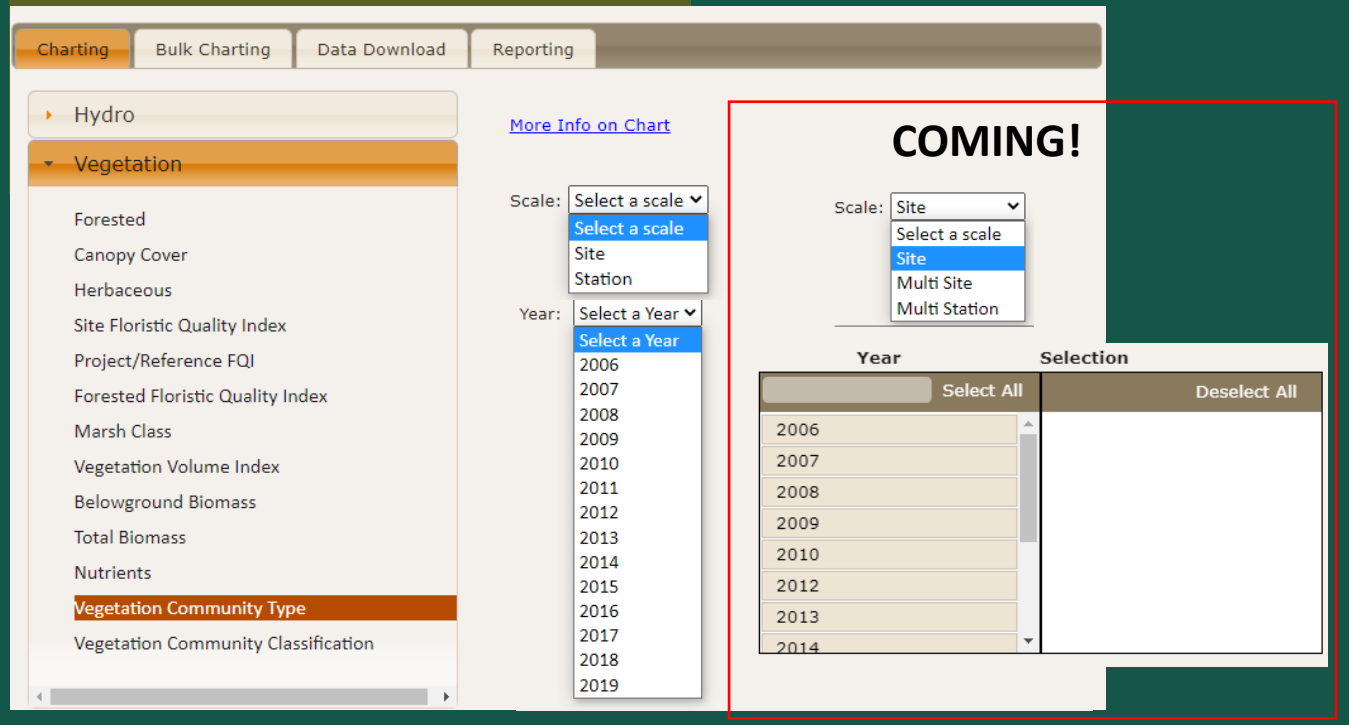
On the mapping viewer using the Classify Tool

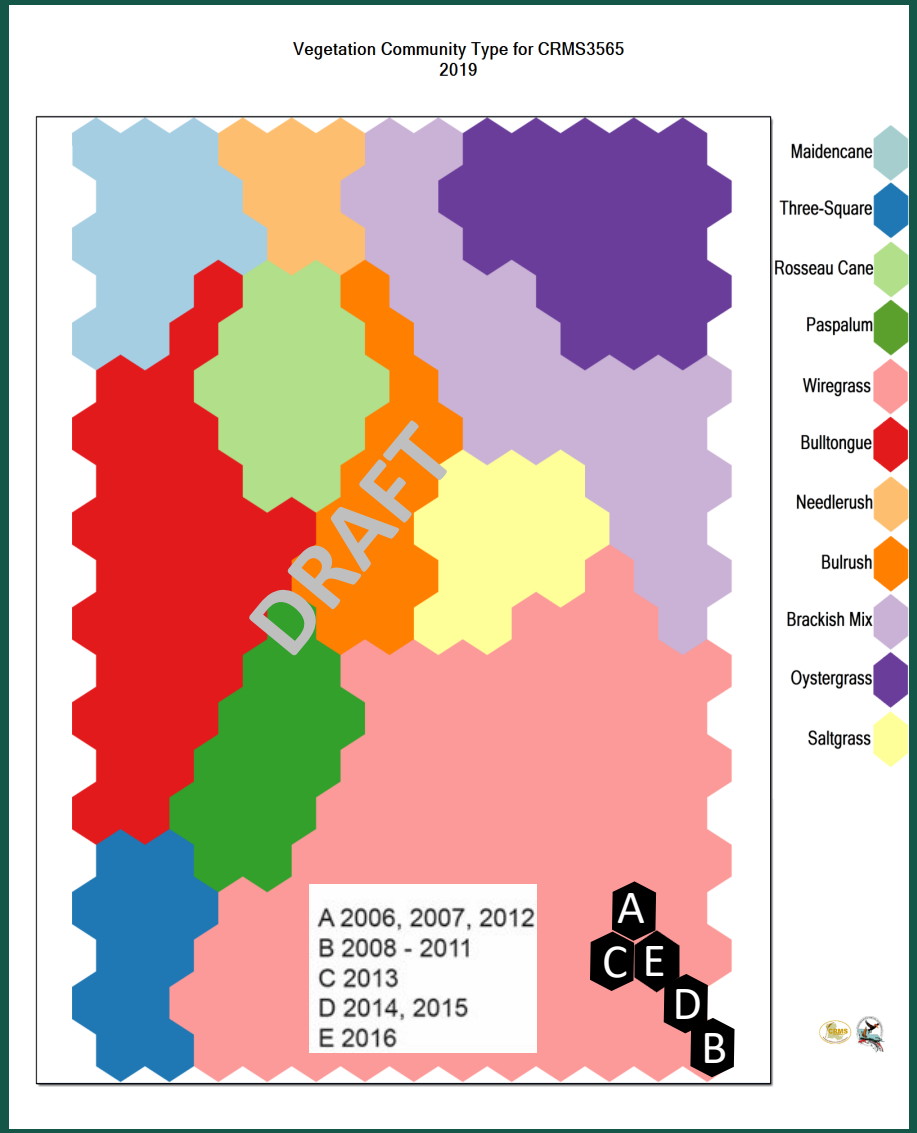
# Vegetation Community Classification: Classify CRMS sites on CRMS Viewer



# Upcoming Functionality

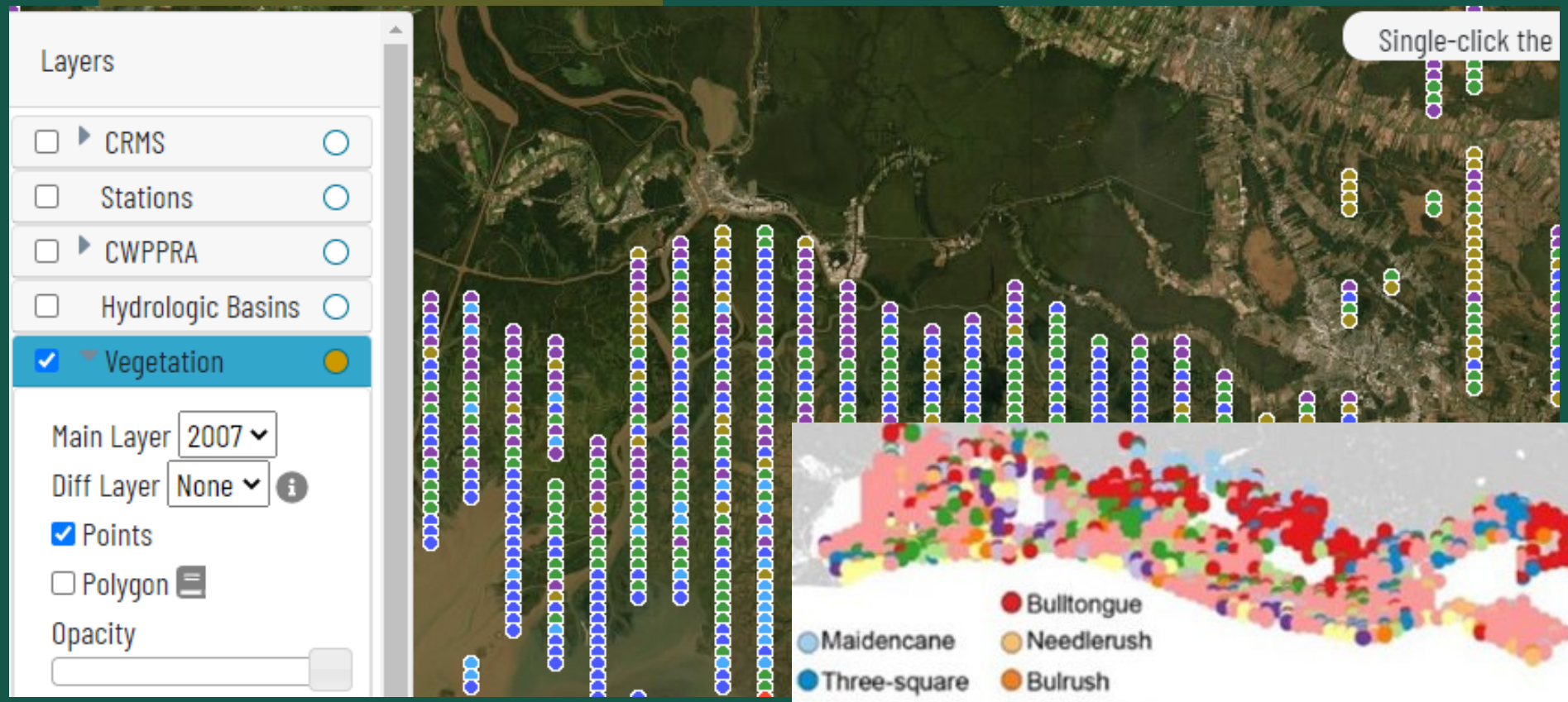
## Vegetation Community Type: Multi-year visualization

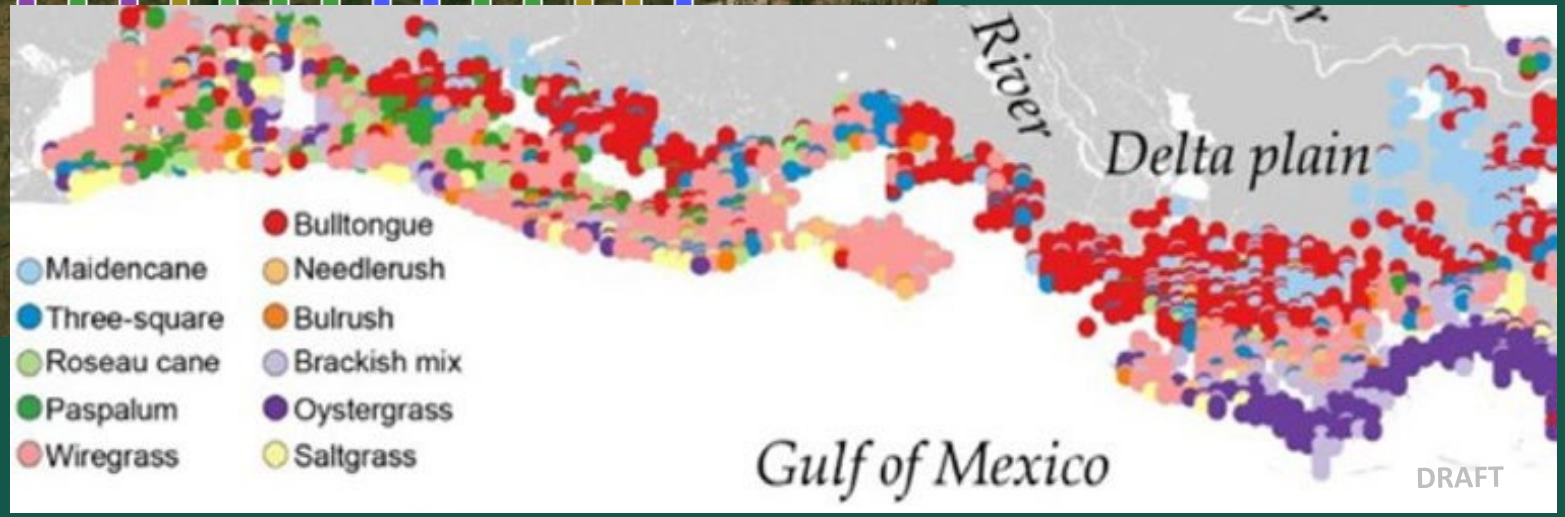


# Upcoming Functionality

## Vegetation Community Classification: Helicopter Data on CRMS Viewer



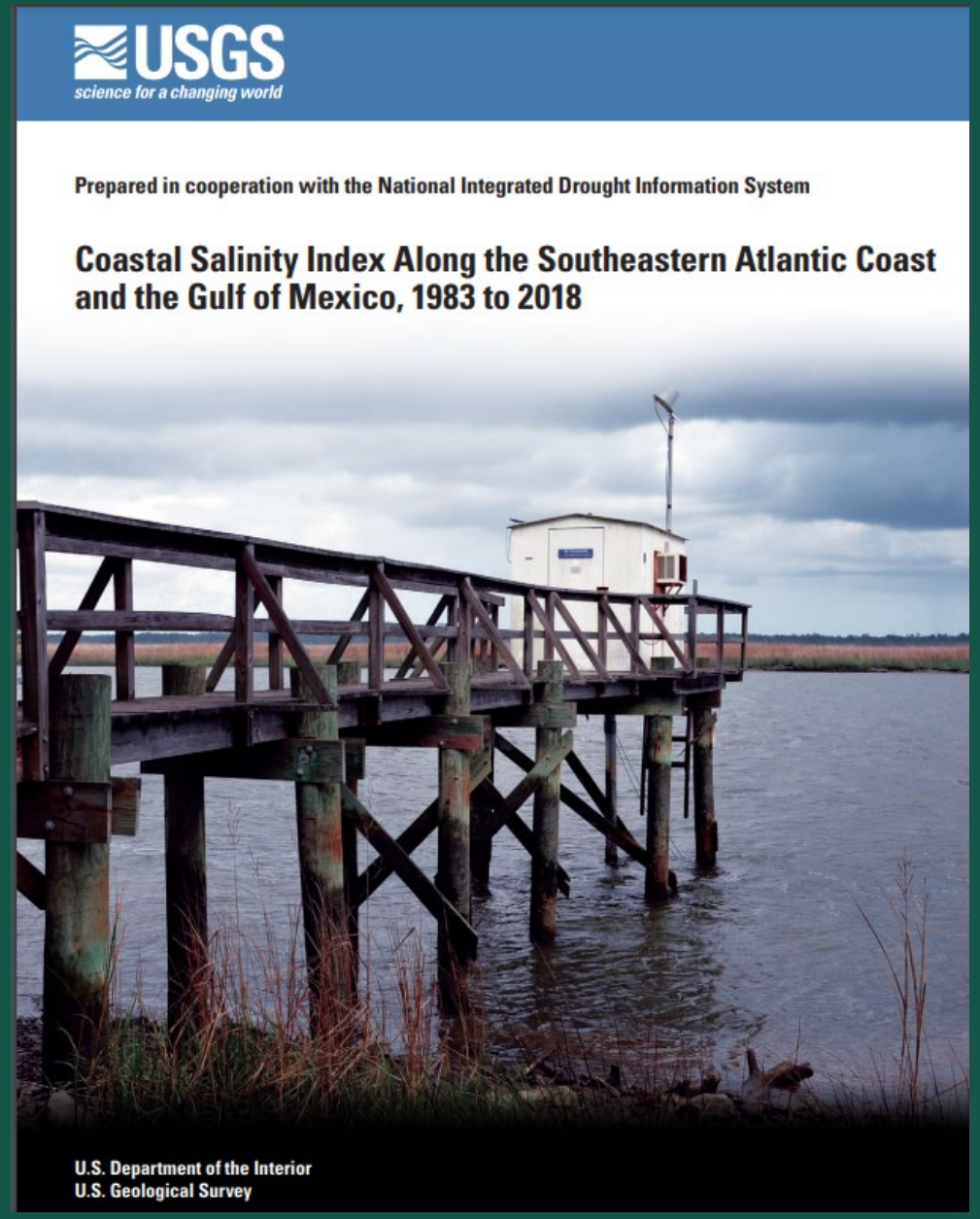



# Website Questions & Analytical Team Updates

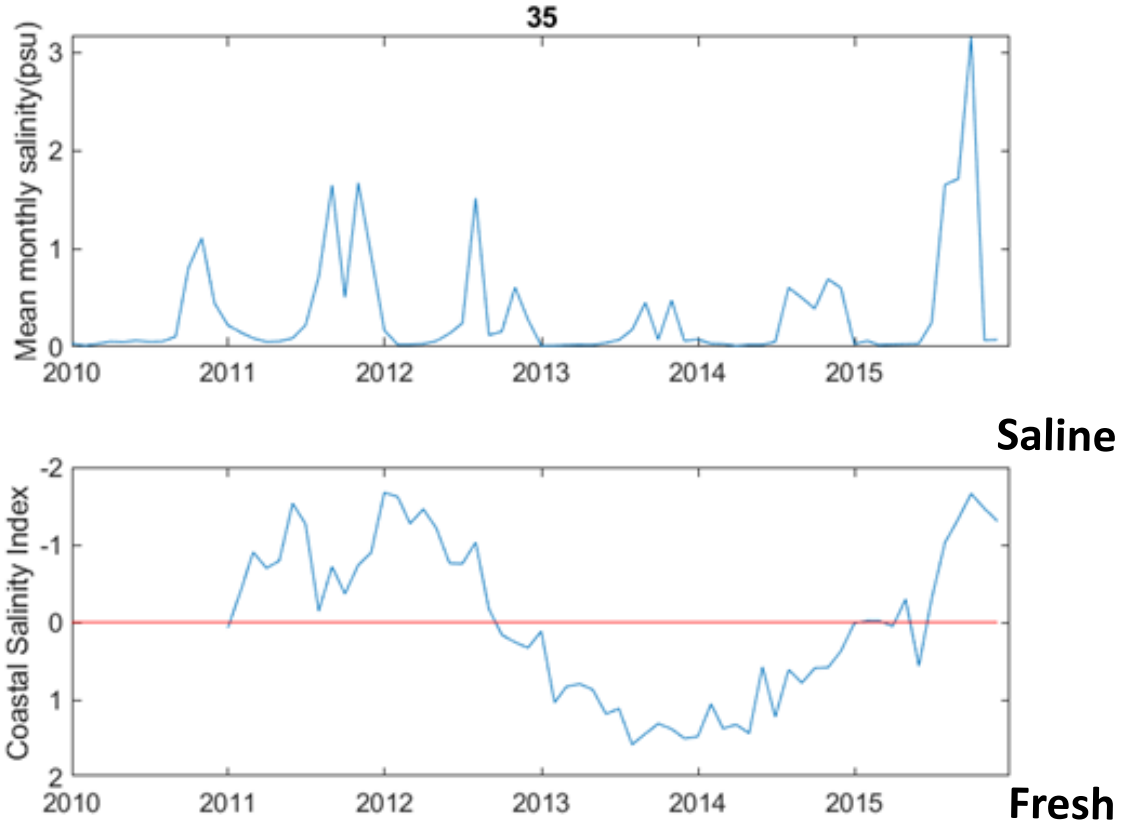
CRMS0090, South of Lake Maurepas

# Coastal Salinity Index (CSI)

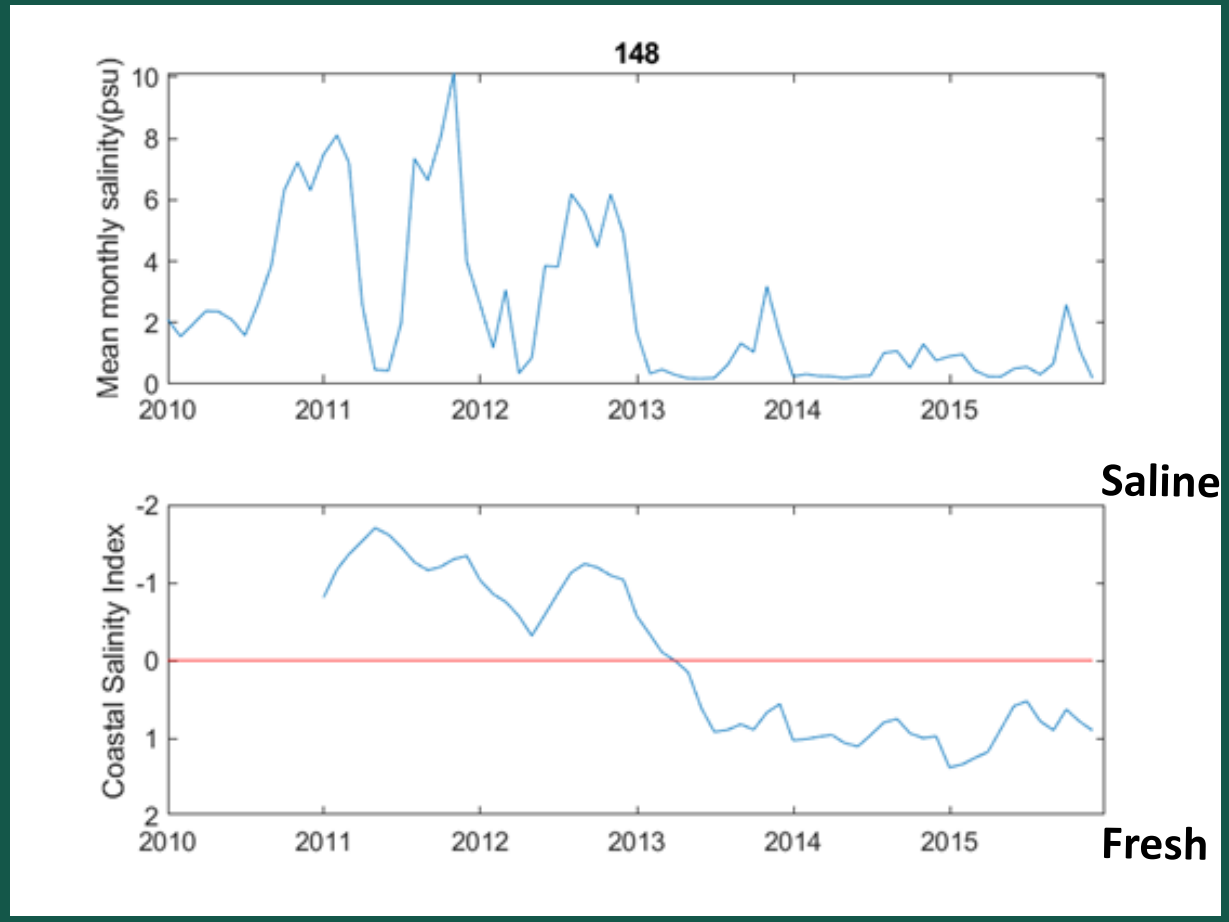
- Index time-integrates recent history of salinity conditions to quantify salinity stress as experienced by vegetation
- Index is site specific, ranging from -2 (salty) to +2 (fresh), with a value of zero indicating normal conditions
- Can be calculated over different timescales, from a few months to several years
- Originally developed for Atlantic coast salt marshes, historical CRMS dataset is now sufficient to begin applying it in LA



# CSI Examples – CRMS0035



# CSI Examples – CRMS0148

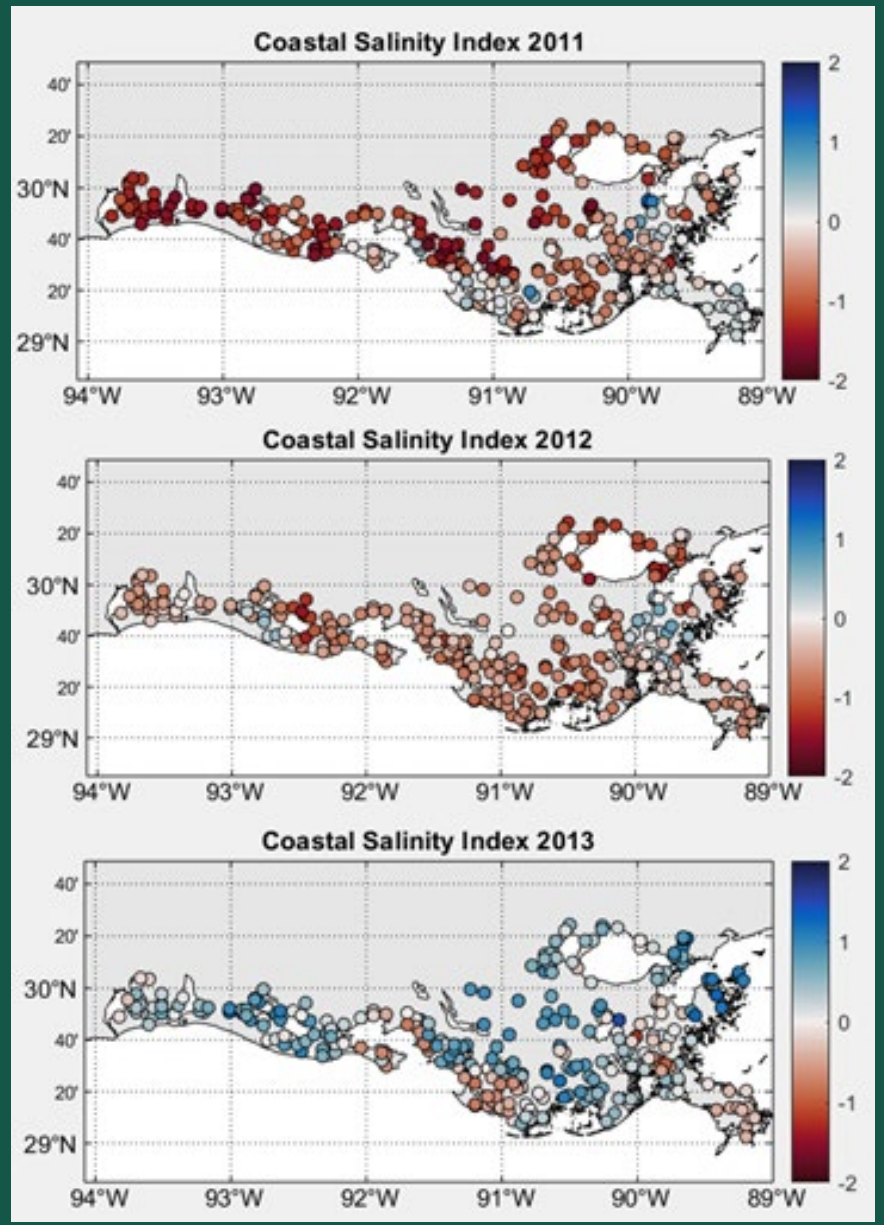


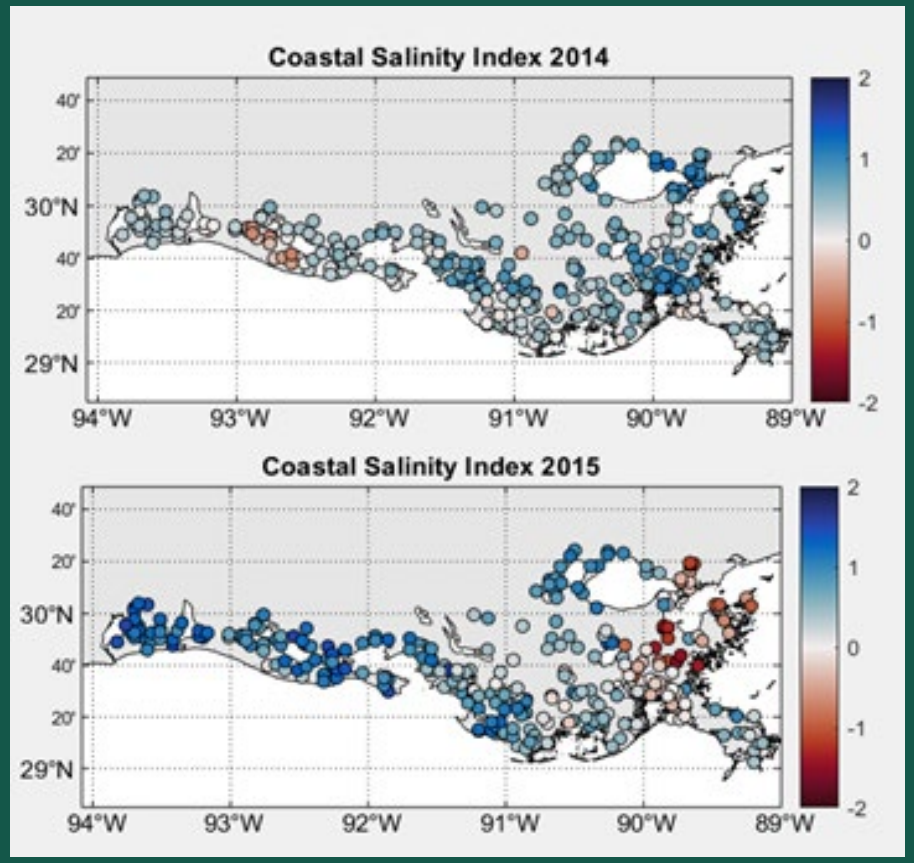
# Mapping the Coastal Salinity Index

2011

2012

2013



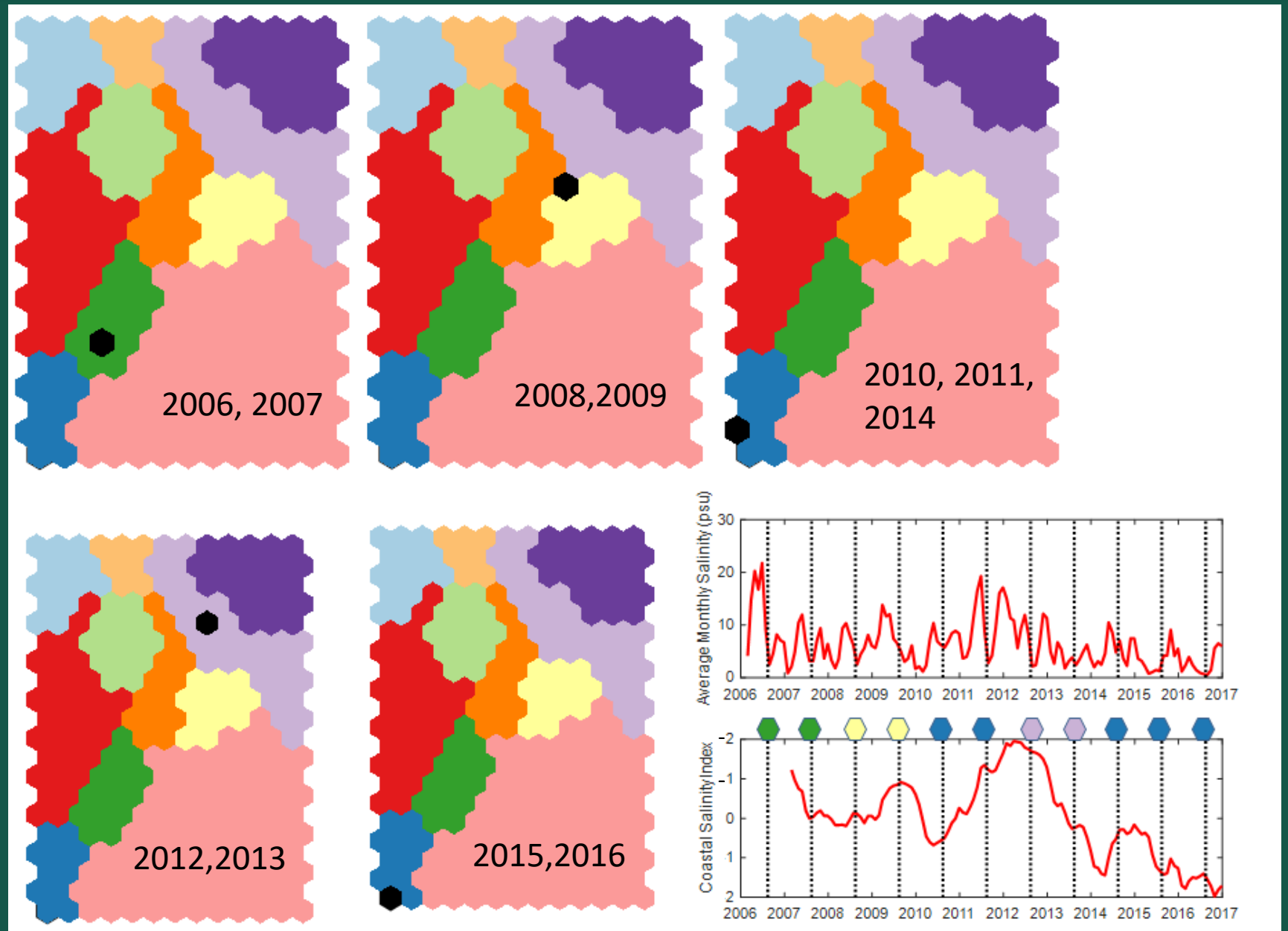

2014

2015

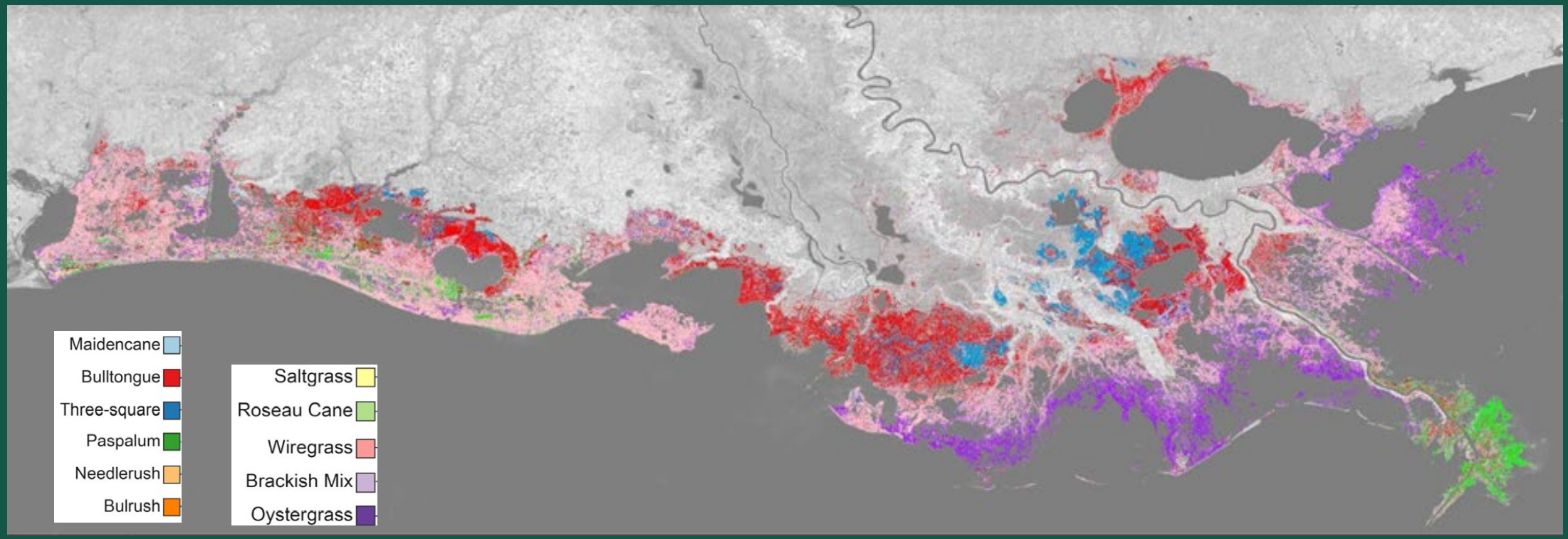
**Saline**

**Fresh**

# CSI and Plant Community Type -CRMS0400



# Classifying Vegetation Communities with Satellite Imagery




- We are currently developing method to classify the same community types using Sentinel 2 satellite imagery (10m)
- Preliminary analyses indicate a correct classification rate approaching 80%
- If successful, this approach would enable continuous maps of vegetation zonation on an annual basis
- The next step will be to determine if the same approach can be used to classify Landsat imagery (30m) into the vegetation communities. If successful, we may be able to map vegetation zonation going back to 1985

# CRMS Design

- Original CRMS design was structured to capture the variability of site conditions across a broad landscape with unique characteristics based on hydrology, vegetation, and soil dynamics.
- Some areas of the coast, which are disconnected spatially, serve as the reference for others
- Data inform future restoration project locations (long-term) and how the landscape responds to current projects
- Continuing with the full network design is scientifically sound

- However, we recognize funding can be a limiting factor for any project.

# Quantitative Approach to Site Elimination

- Developed a potential approach to modify the network design if future budget limitations necessitate
- To finalize the approach the CRMS team would work with the MWG
- Current sites are not producing redundant data, the budget would dictate the number of sites to remove.

# Quantitative Approach to Site Elimination

- **Step 1: Determine how site removal will be distributed. Focus on maintaining proportional # of sites across basins and veg types within basins**

Proportion of sites by basin

| BASIN | FREQ |
|---|---|
| CALCASIEU/SABINE | 0.12 |
| MERMENTAU | 0.14 |
| TECHE/VERMILION | 0.10 |
| ATCHAFALAYA | 0.05 |
| TERREBONNE | 0.19 |
| BARATARIA | 0.17 |
| MISSISSIPPI RIVER | 0.03 |
| BRETON SOUND | 0.05 |
| PONTCHARTRAIN | 0.15 |

Proportion of sites by veg type within basin

| | CS | ME | TV | AT | TE | BA | MR | BS | PO |
|---|---|---|---|---|---|---|---|---|---|
| Brackish Mix | 0.02 | 0.02 | 0 | 0 | 0.08 | 0.12 | 0 | 0.1 | 0.05 |
| Bulltongue | 0 | 0.23 | 0.18 | 0.3 | 0.15 | 0.08 | 0.15 | 0.3 | 0.09 |
| Bulrush | 0 | 0.02 | 0.02 | 0 | 0.03 | 0 | 0 | 0 | 0 |
| Maidencane | 0 | 0.04 | 0.12 | 0.2 | 0.13 | 0.17 | 0 | 0 | 0 |
| Needlerush | 0.04 | 0 | 0 | 0 | 0.01 | 0.03 | 0 | 0.05 | 0.03 |
| Oystergrass | 0.02 | 0 | 0 | 0 | 0.24 | 0.14 | 0 | 0 | 0.09 |
| Paspalum | 0.07 | 0.08 | 0 | 0 | 0.01 | 0 | 0 | 0.1 | 0 |
| Roseau Cane | 0.02 | 0.06 | 0.02 | 0 | 0.01 | 0 | 0.85 | 0.1 | 0 |
| Saltgrass | 0.02 | 0.04 | 0 | 0 | 0.01 | 0.03 | 0 | 0 | 0 |
| Three Square | 0.04 | 0.04 | 0.22 | 0 | 0.03 | 0.05 | 0 | 0 | 0.03 |
| Wiregrass | 0.76 | 0.49 | 0.35 | 0 | 0.21 | 0.23 | 0 | 0.35 | 0.24 |
| Swamp | 0 | 0 | 0.08 | 0.5 | 0.08 | 0.17 | 0 | 0 | 0.47 |

Ex: Remove 100 sites

- 12 from CS (100*0.12)
- 9 of 12 from Wiregrass (12*0.76=9.12)

Ex: Remove 50 sites

- 6 from CS (50*0.12)
- 4 of 6 from Wiregrass (6*0.76=4.56)

# Quantitative Approach to Site Elimination

- **Step 2: Determine which sites within basin/veg to remove**

**Consideration factors:**

1) Membership in SWAMP program (162)
2) Real-time hydro (10)
3) Is hydro a surrogate for another site (7)
4) Frequency of data download relative to other sites (demand compared to other sites)
5) Uniqueness of hydro dynamics (water elevation and salinity)
6) Uniqueness of veg dynamics (species specific cover)

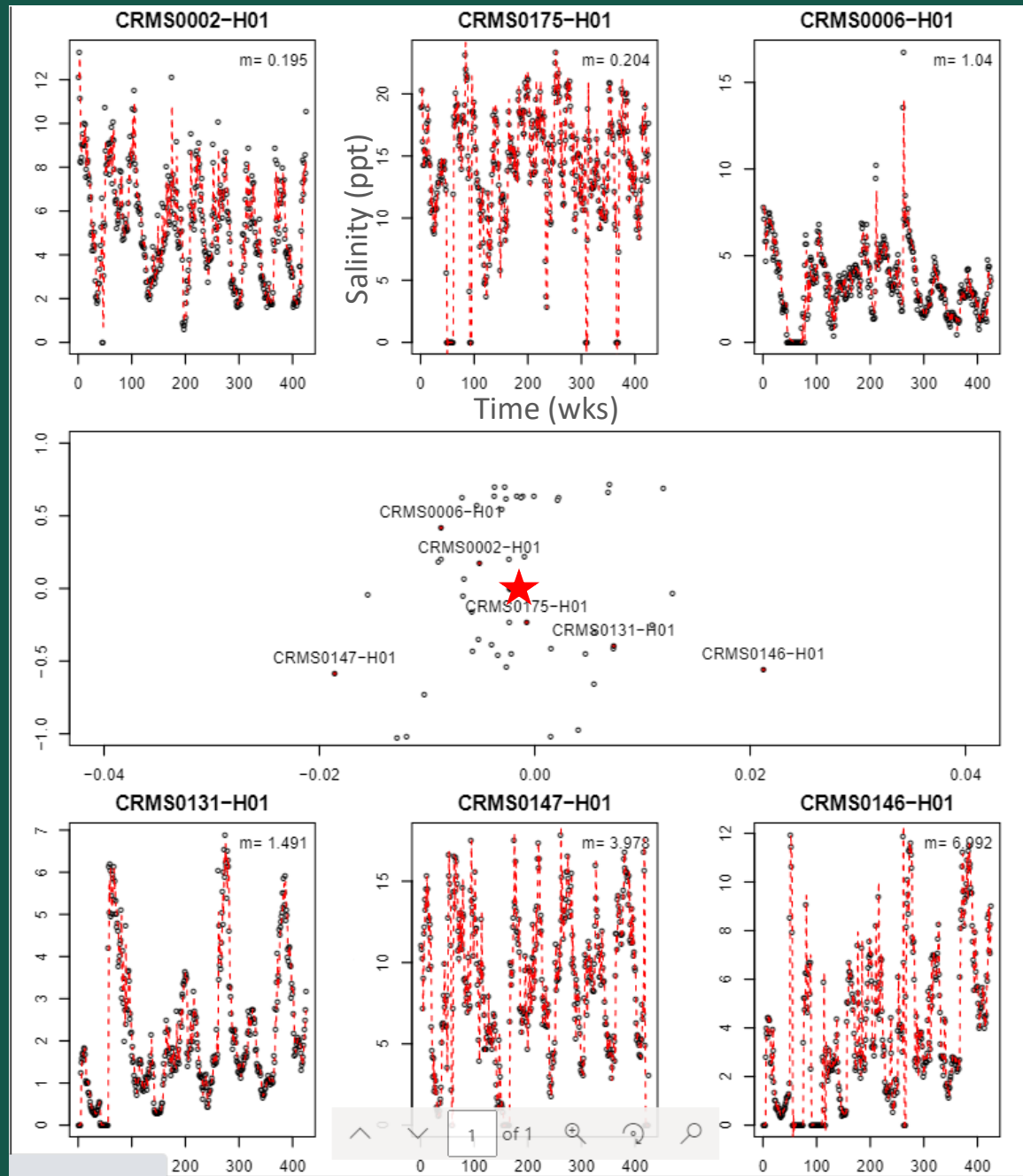
# Quantitative Approach to Site Elimination

**Step 2: Determine which sites within basin/veg to remove, continued**

5) Uniqueness of hydro dynamics
- Time-series of water elevation and salinity, 6 parameter models
- Time-series plots show mahalanobis distance (M)
- Center is average of all sites ★
- Sites farthest from center are more unique, therefore important

6) Uniqueness of veg dynamics
- Similar to hydro, but estimated on veg trajectory, directionality, and final annual variation in species specific cover
- Sites farthest from center are unique, therefore important

Simplified Hydro Dynamics



# Quantitative Approach to Site Elimination

- **Step 3: Determine subset for removal**

**Assign weights to:**
1) Membership in SWAMP program
2) Real-time hydro
3) Is hydro a surrogate for another site
4) Frequency of data download relative to other sites
5) Uniqueness of hydro dynamics
6) Uniqueness of veg dynamics

To reach a final selection for removal, importance weights would be assigned for each of the 6 categories and multiplied by the scaled values for each factor. Then resulting products would be summed to give a final ranking of the subsets of sites. Those with the lowest total importance rankings would be flagged for removal.

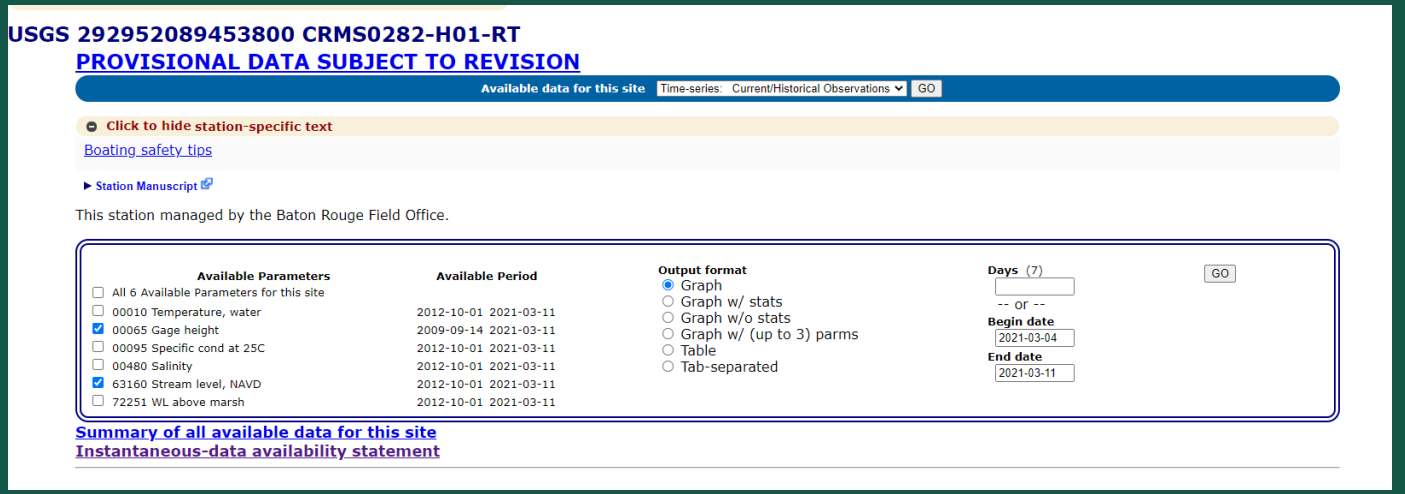
# Real-time Hydro Network Expansion

- Contractor included real-time telemetry units in cost proposal to modernize the network and inform site visit logistics

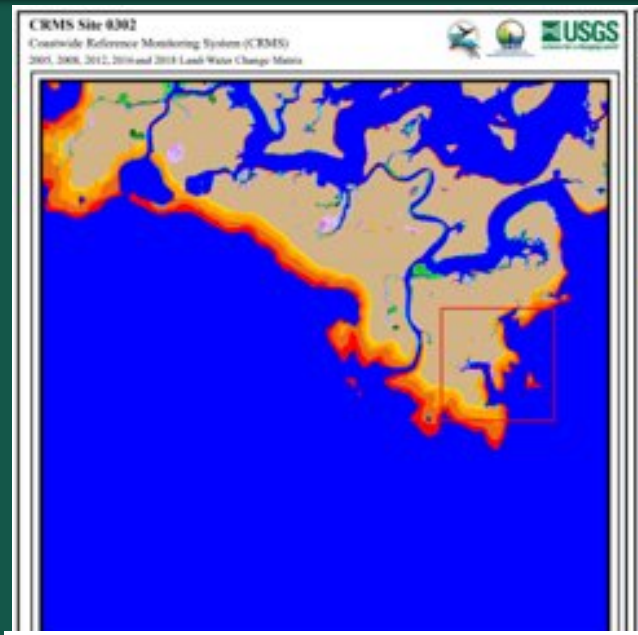
- Developing a plan for implementation, considering many site level factors:
  - Uniqueness of hydro and veg
  - Data downloads
  - Status as current surrogate
  - Data completeness
  - Site restrictions
  - CPRA input
  - CWPPRA/NRDA input
  - CES input
  - LDWF input

# Real-time Hydro Network Expansion

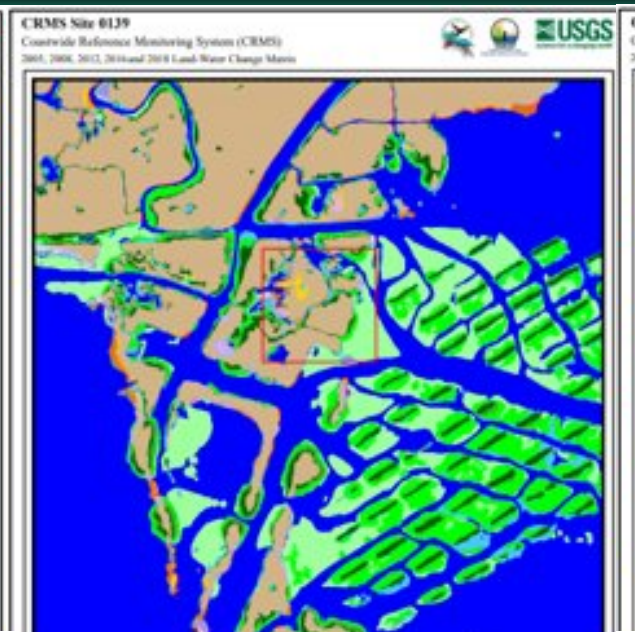
- Working with contractor and telemetry manufacturer on data transmission
- CIMS database has experience pulling in real-time hydro data from various satellite feeds
- Adjustments will be needed to CIMS and CRMS data feeds and resulting visualizations
- Intend for end users to visualize provisional data in near real-time
- Data will then go through official QA and acceptance into the CIMS database
- Once data are accepted into CIMS it will be transferred to CRMS website for visualization



# Observations from 2018 Land Change Analysis

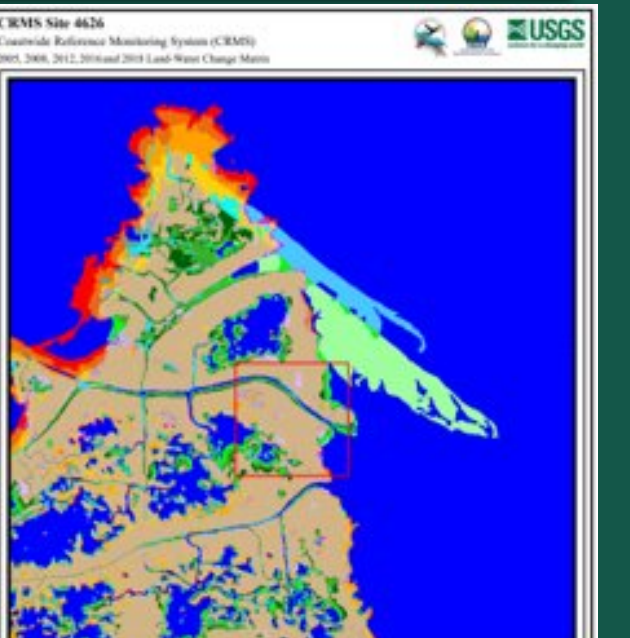



Erosion

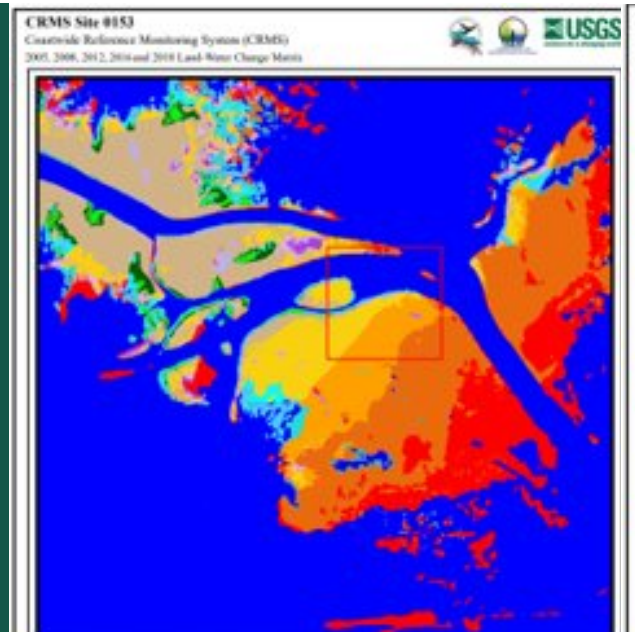


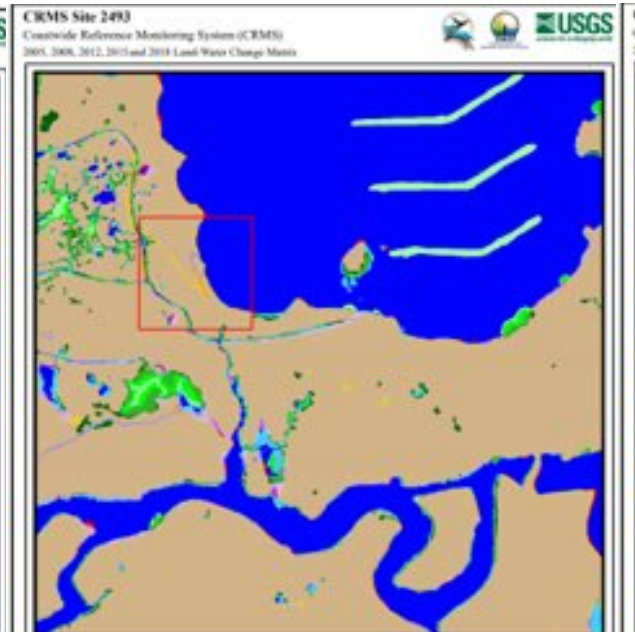

Restoration Projects

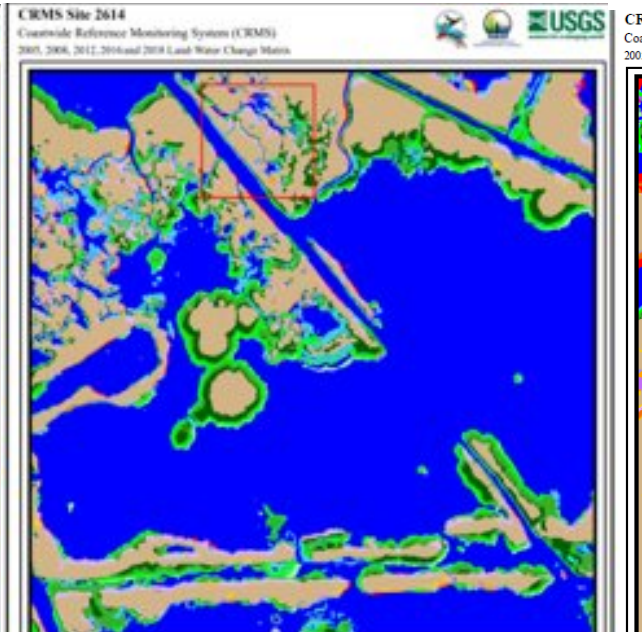
Wetland Gain

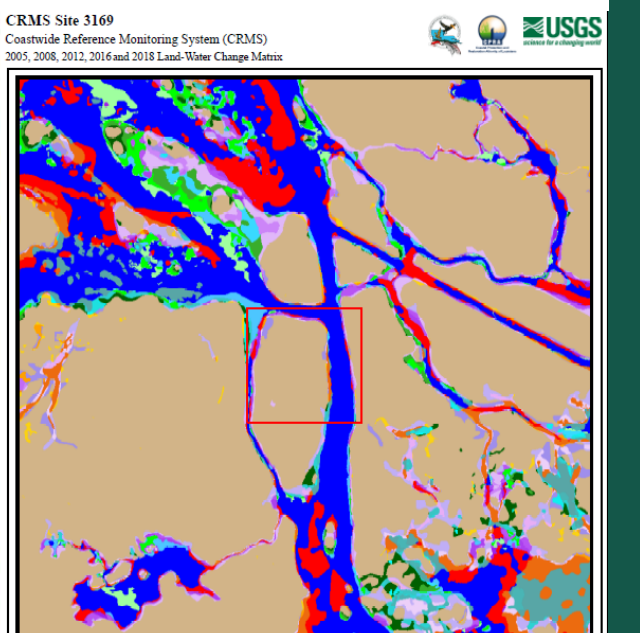



Other Processes/Features



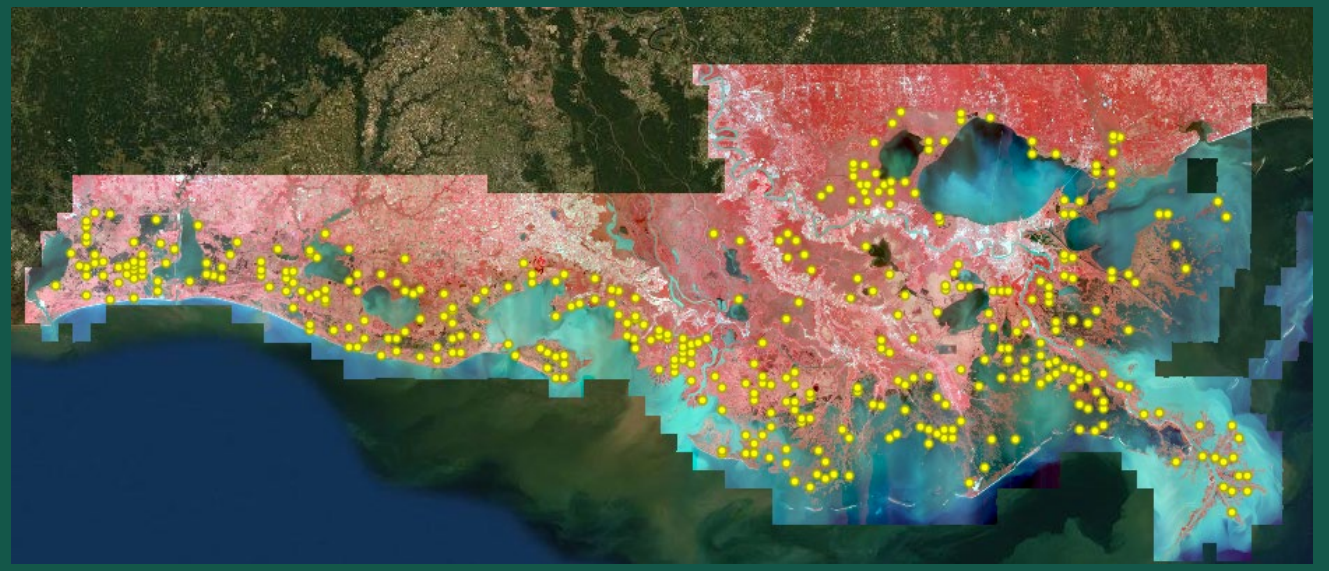



# Coastwide Aerial Photography

- High resolution land change analyses at the 1km site scale
- Benefit of being collected below clouds and atmosphere
- Final flight in CRMS programmatic budget, Fall 2024
- Plan to transition to high resolution commercial satellite imagery after 2021/2024



# Coastwide imagery 2024 & beyond

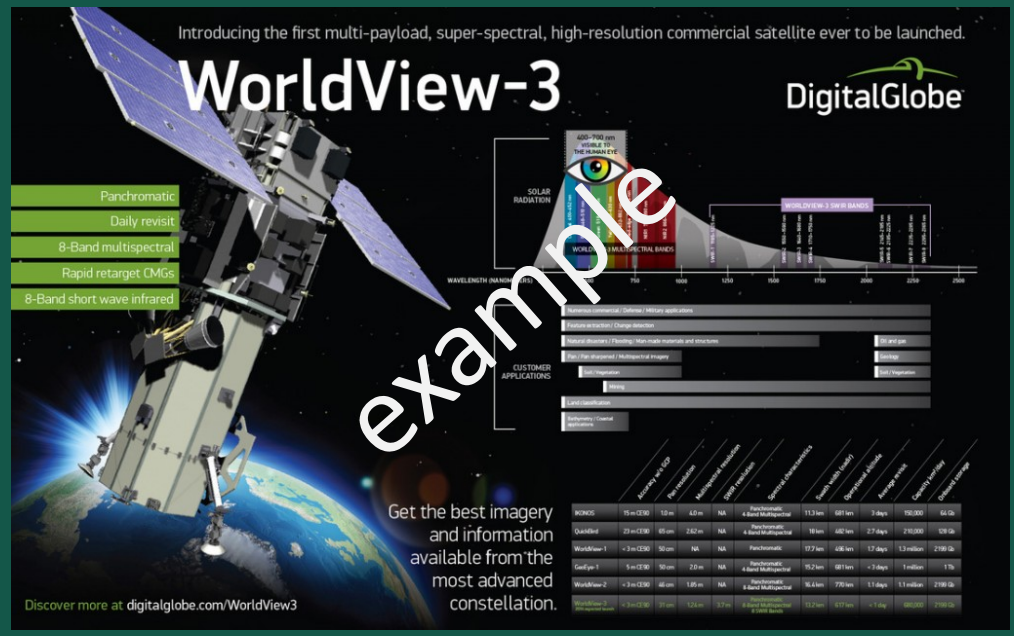
- Commercial satellites were collecting high resolutions, but were too expensive or footprints too small
- Constellations of satellites are beginning to provide data with greater temporal resolution, thereby increasing the likelihood of coverage of the entire coast in a shorter period of time.
- USGS can request commercial imagery for research applications at no cost.
- USGS can share this imagery with federal, state and local government agencies, but is not allowed to release the original imagery for commercial applications.
- Derived products, future CRMS and project specific land change products, can be shared without restrictions.
- USGS is requesting commercial satellite imagery concurrent with the Fall 2021 aerial acquisition for comparison to the traditional aerial imagery.
- Intend to move away from coastwide aerial flight acquisitions

**Data Set Message**

You have selected a dataset that may have restricted access. Restricted data are subject to terms and conditions as specified by the data provider. Examples of restrictions include but are not limited to:

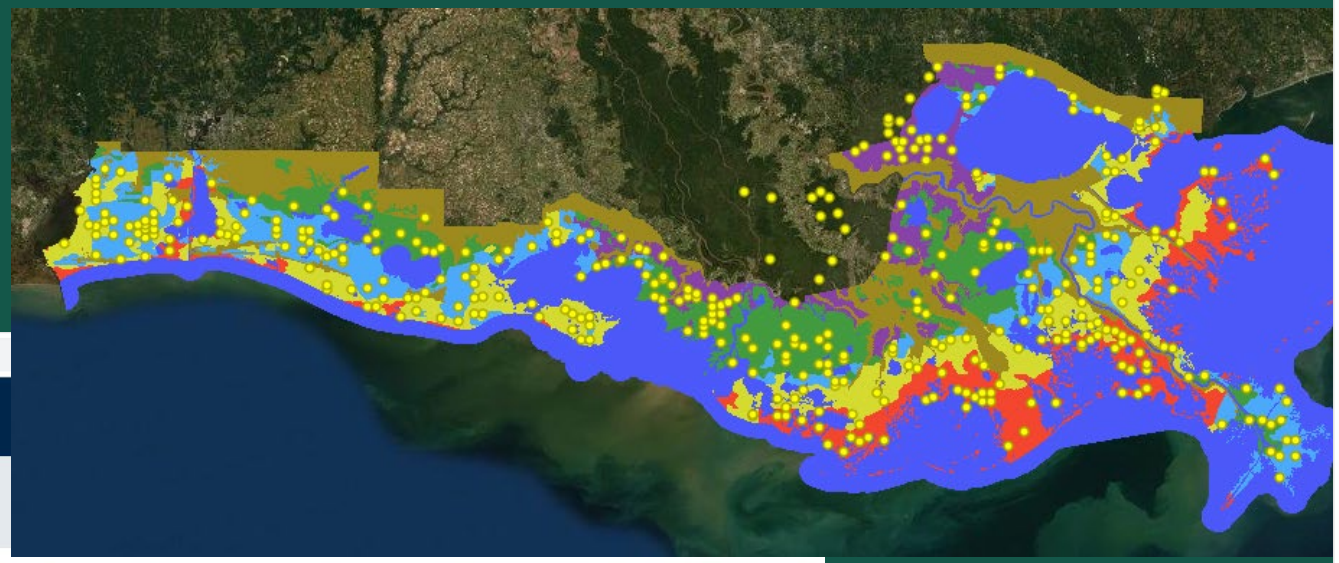
- Use of data may be restricted to federal, state, and local government agencies and their cooperators.
- Use of the data in published work shall be attributed to the original data provider.
- Any redistributed data shall include copies of the specific license/use agreement originally provided with the data.

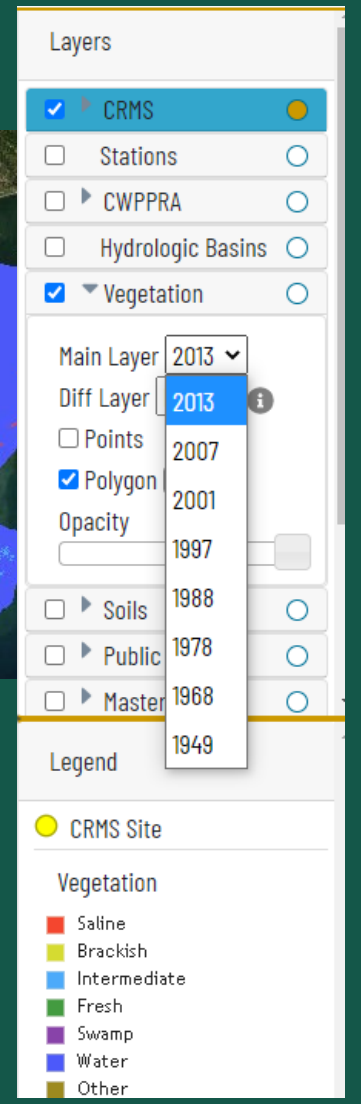
For each dataset, a specific license/use agreement is provided with the data describing the terms and conditions.
The USGS will not be held responsible or liable for misuse or misrepresentation by the end users and is not required to enforce these provisions beyond communicating them to the user. It is the responsibility of the user to adhere to these terms and conditions.
If you agree to these terms, click OK to proceed.

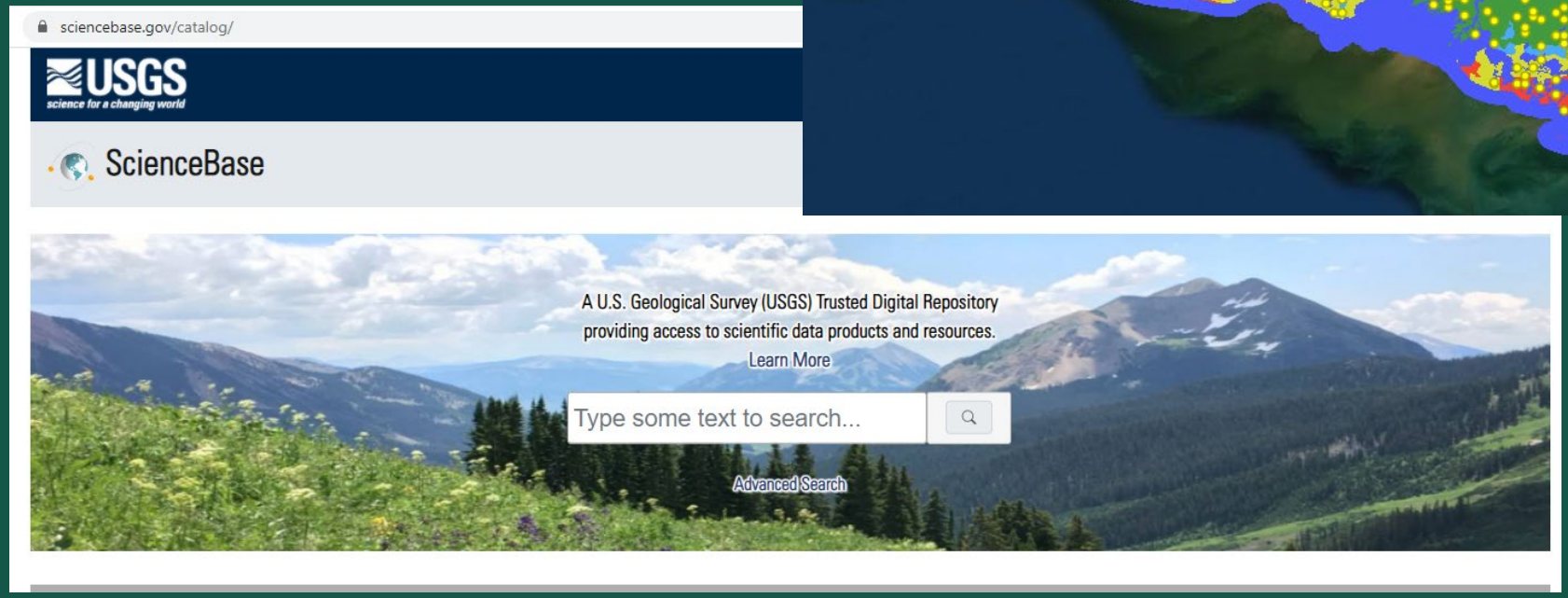


# Upcoming Programmatic Data Collection

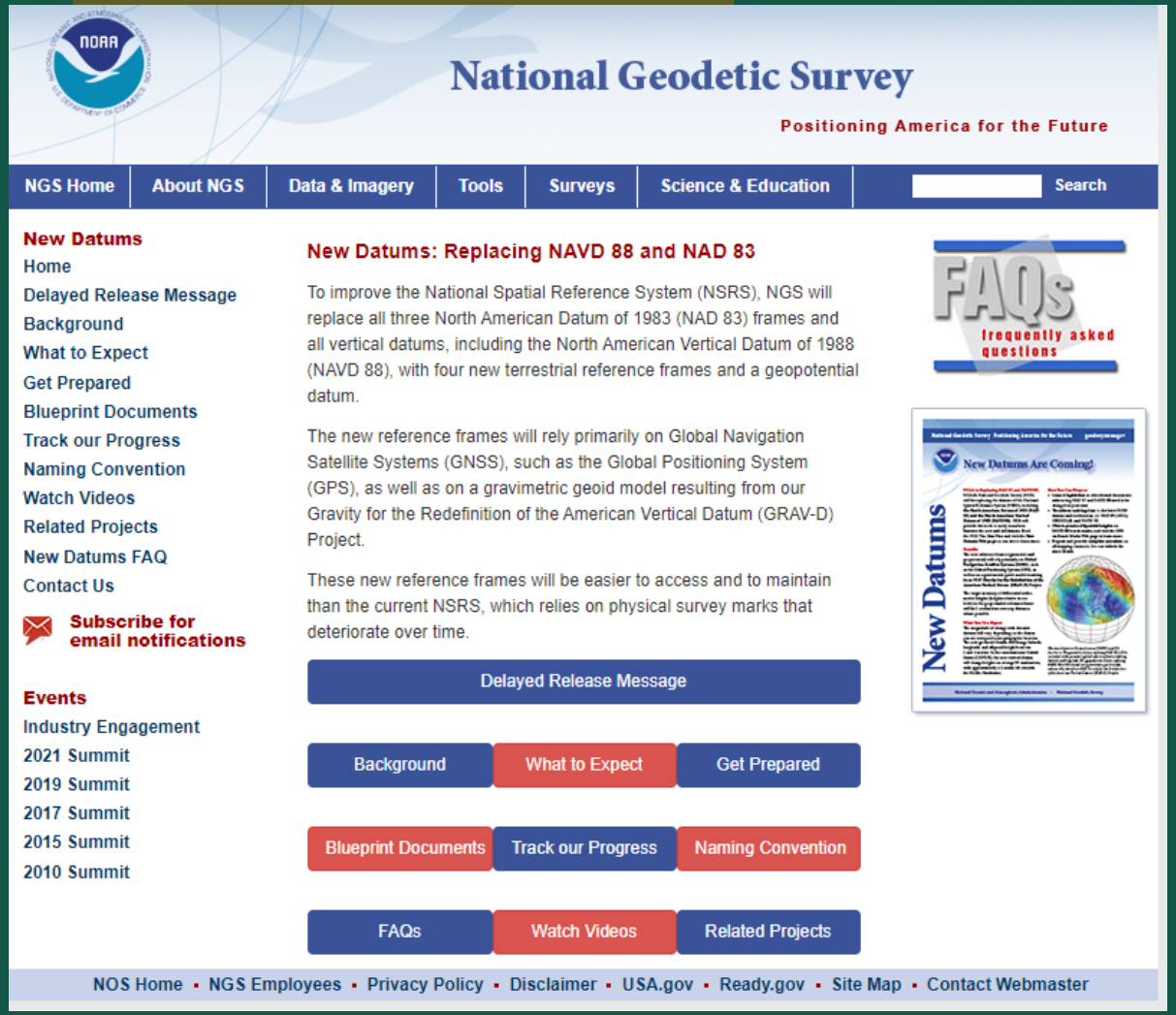
1) Coastwide vegetation survey via helicopter, summer 2021
   - Data release on ScienceBase.gov & visualized on CRMS website





# Upcoming Programmatic Data Collection




2) Coastwide aerial photography acquisition, fall 2021

3) Coastwide elevation survey being initiated, will continue to use GEOID12a/b until national transfer to new reference frame which is delayed until 2025

https://geodesy.noaa.gov/datums/newdatums/index.shtml

# Questions??

**CRMS help**
**CRMS@usgs.gov**

**Sarai Piazza**
**piazzas@usgs.gov**

**Presentation will be posted on the website under Library/Presentations**