CRMS Website Roadshow

May 2019

855.547.8255
836170#

1 **Website releases**

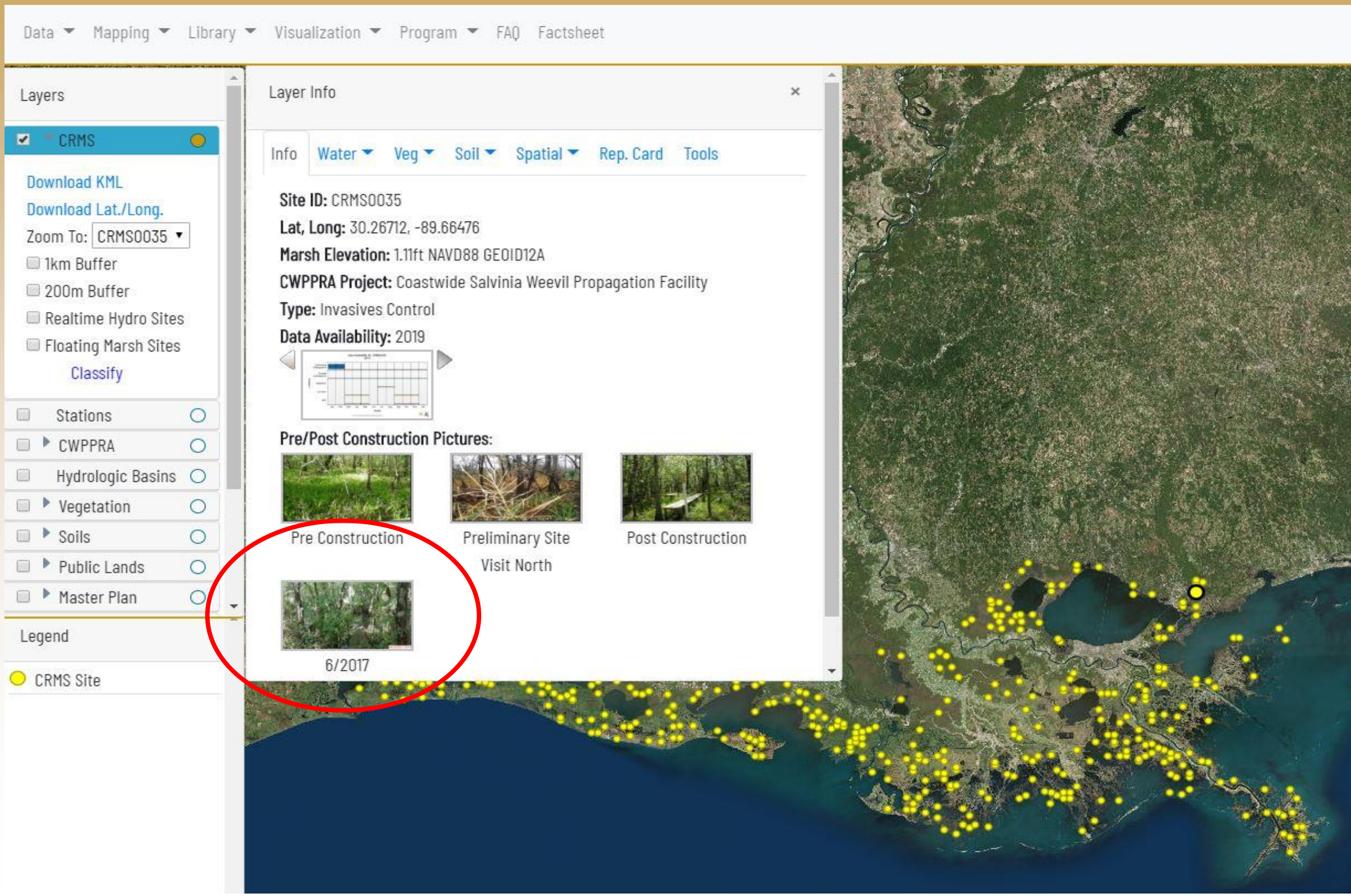
2 **Upcoming website functionality**

3 **Analytical team updates**

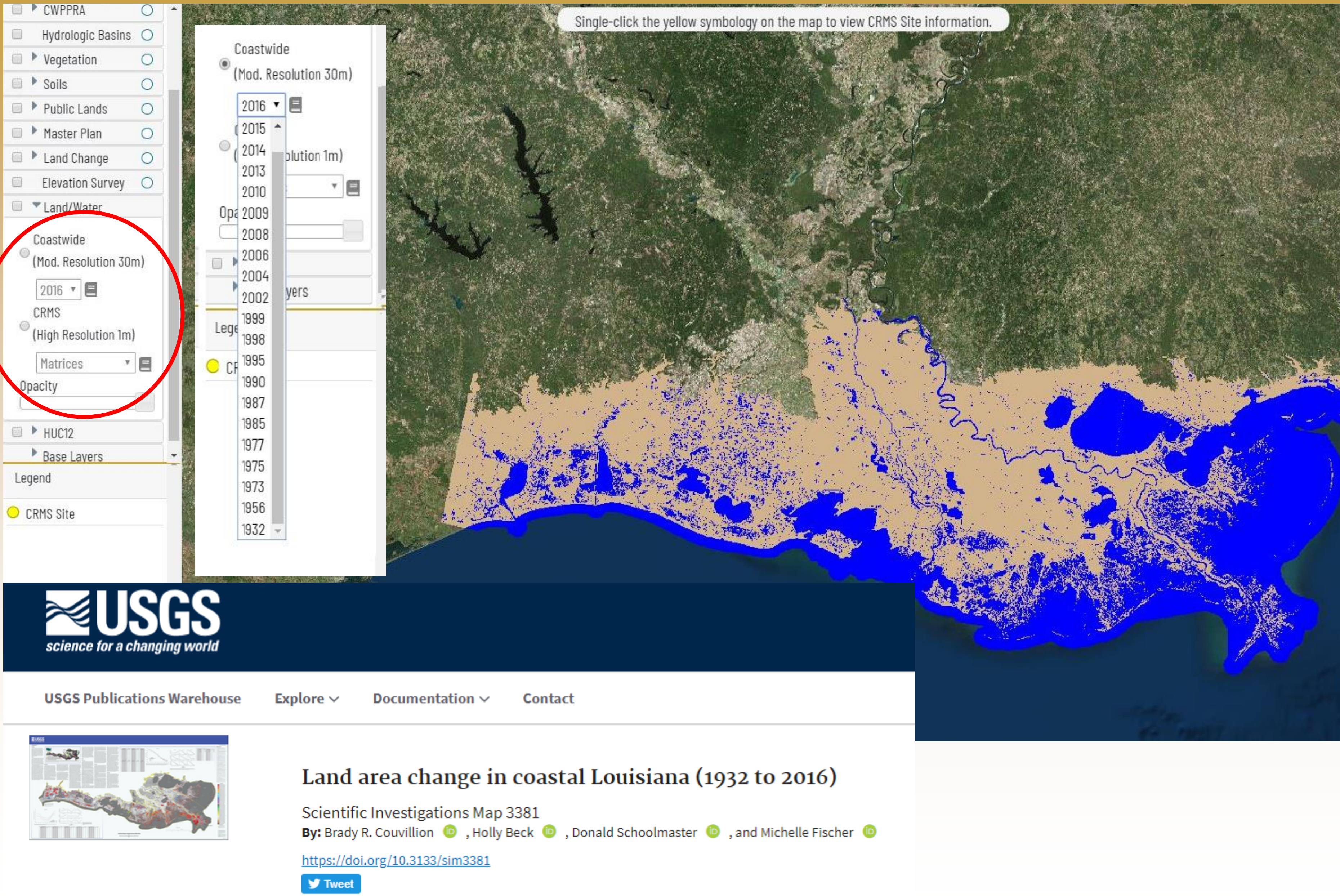
Any website issues, questions, or special data requests should be emailed to CRMS@usgs.gov for fastest resolution.

The website works the best with Google Chrome.

Released on the "New" Website
Updated Site Photos

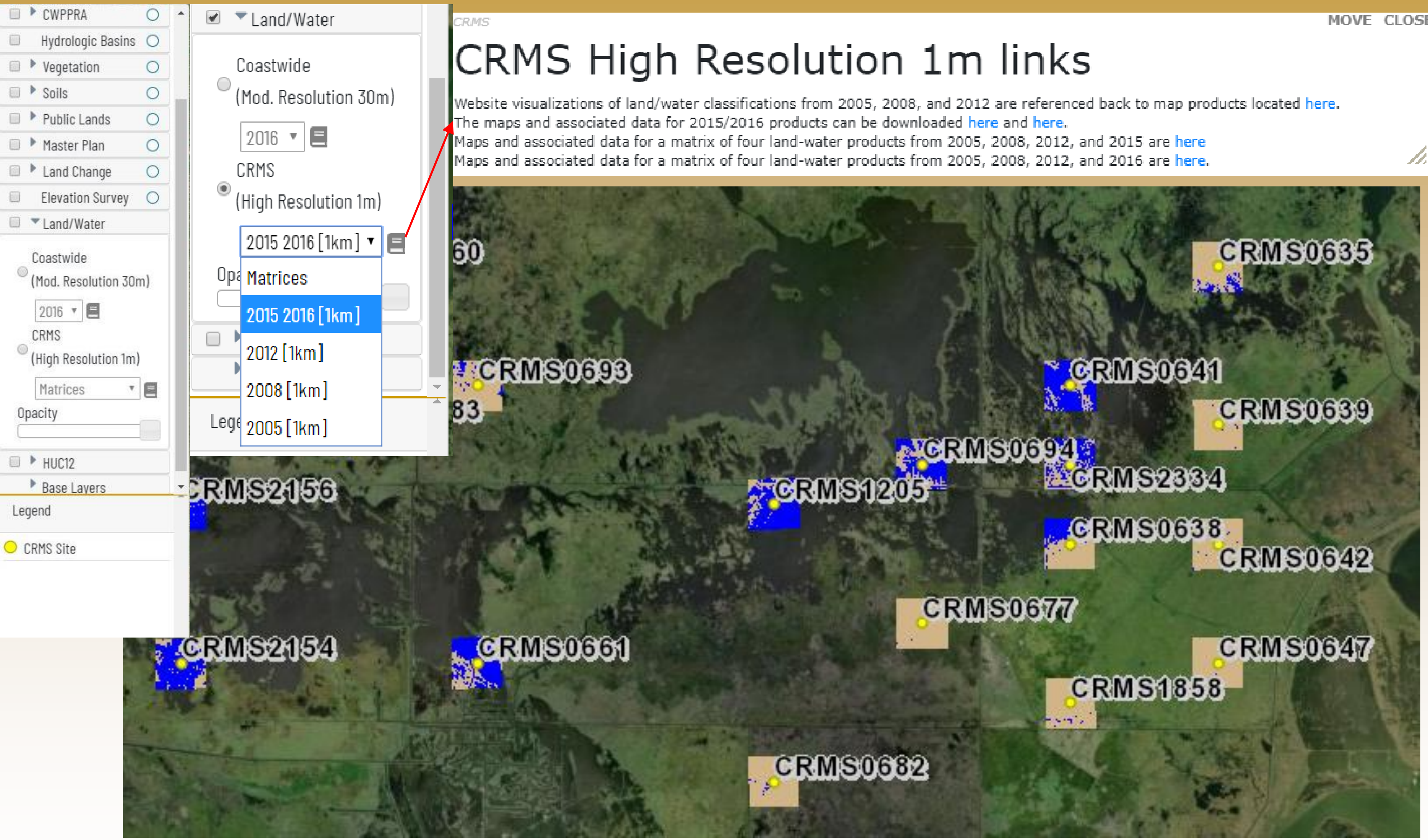


Released on the Website
Updated Land/Water, Moderate Resolution, 30m

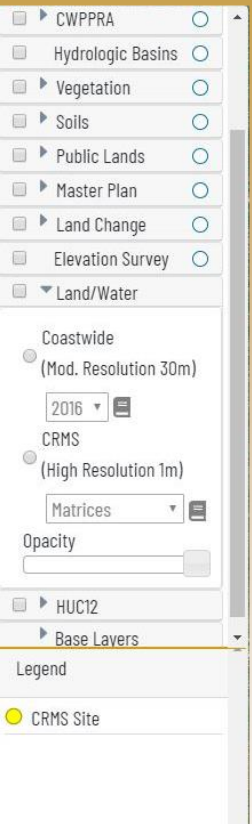


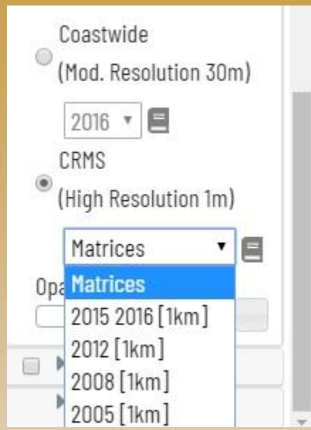
Released on the Website

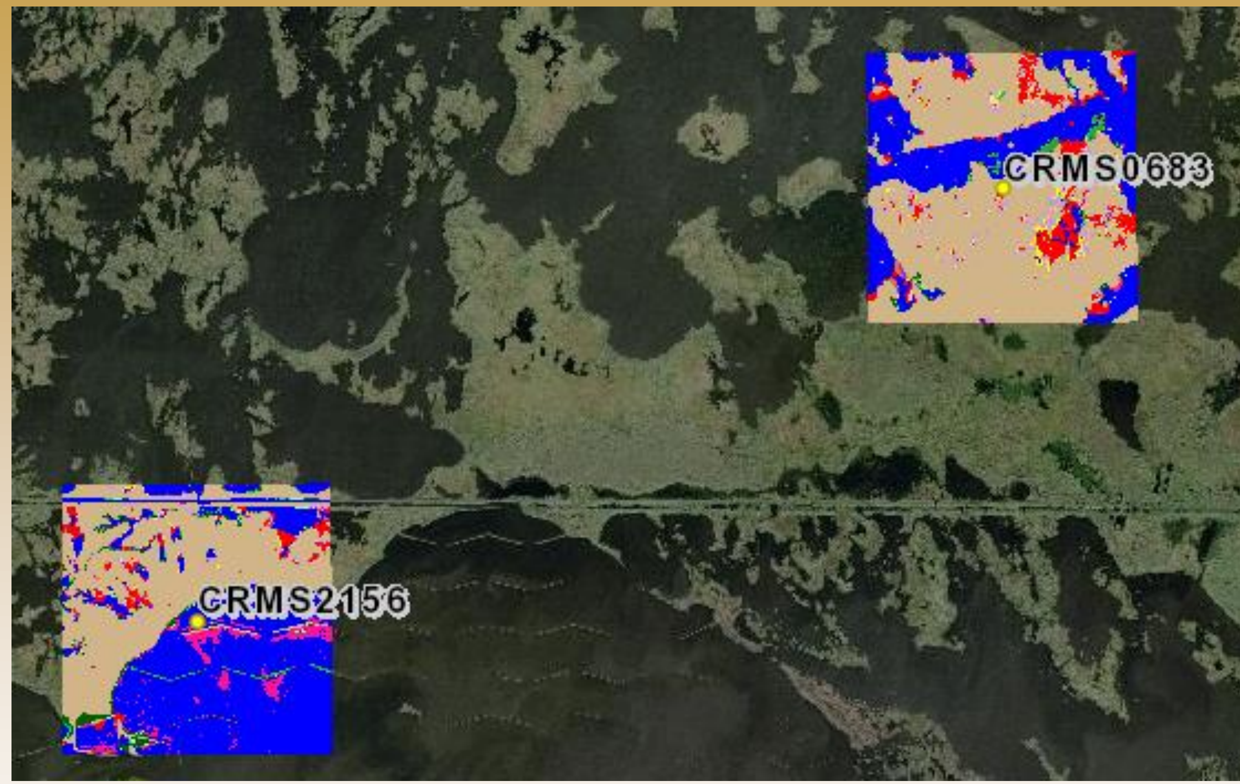
Updated Land/Water, High Resolution, 1m



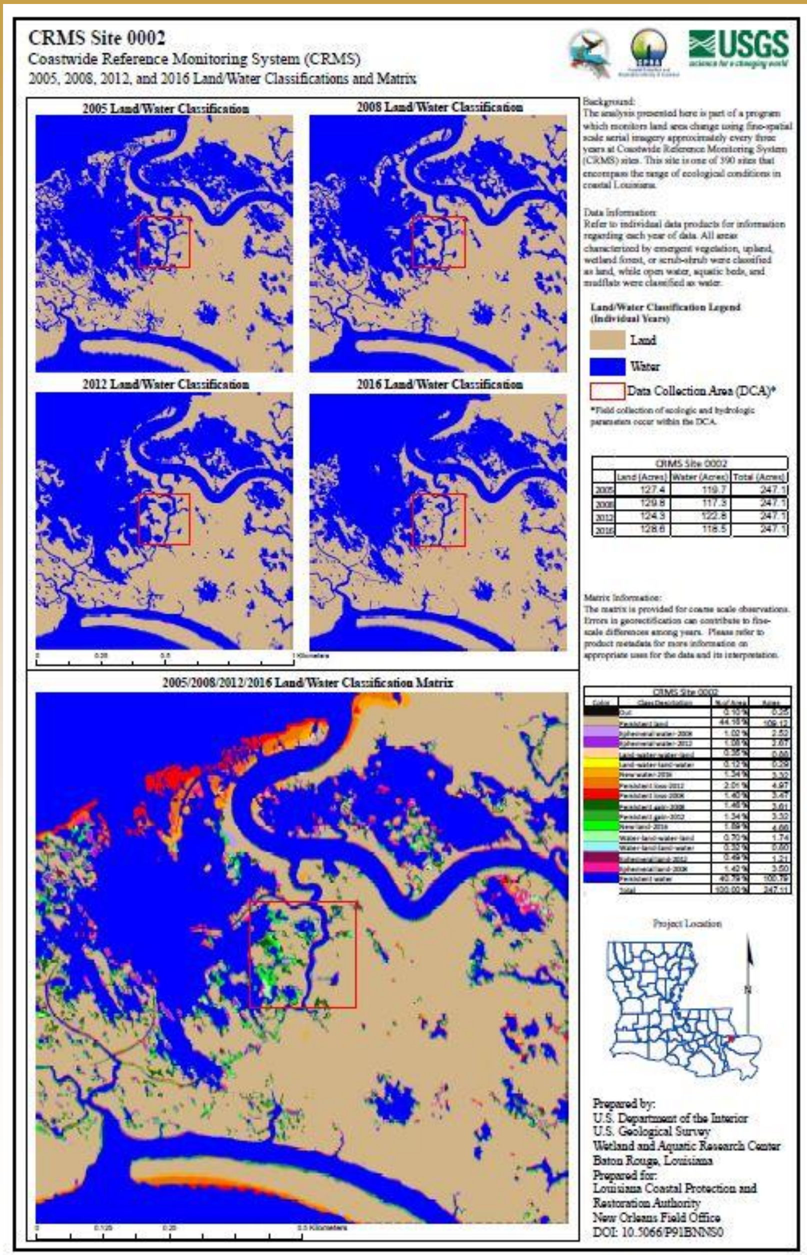
Released on the Website
Updated Land/Water, High Resolution, 1m







Released on the Website
Updated Land/Water, High Resolution, 1m



PDF available for download: Library > Maps

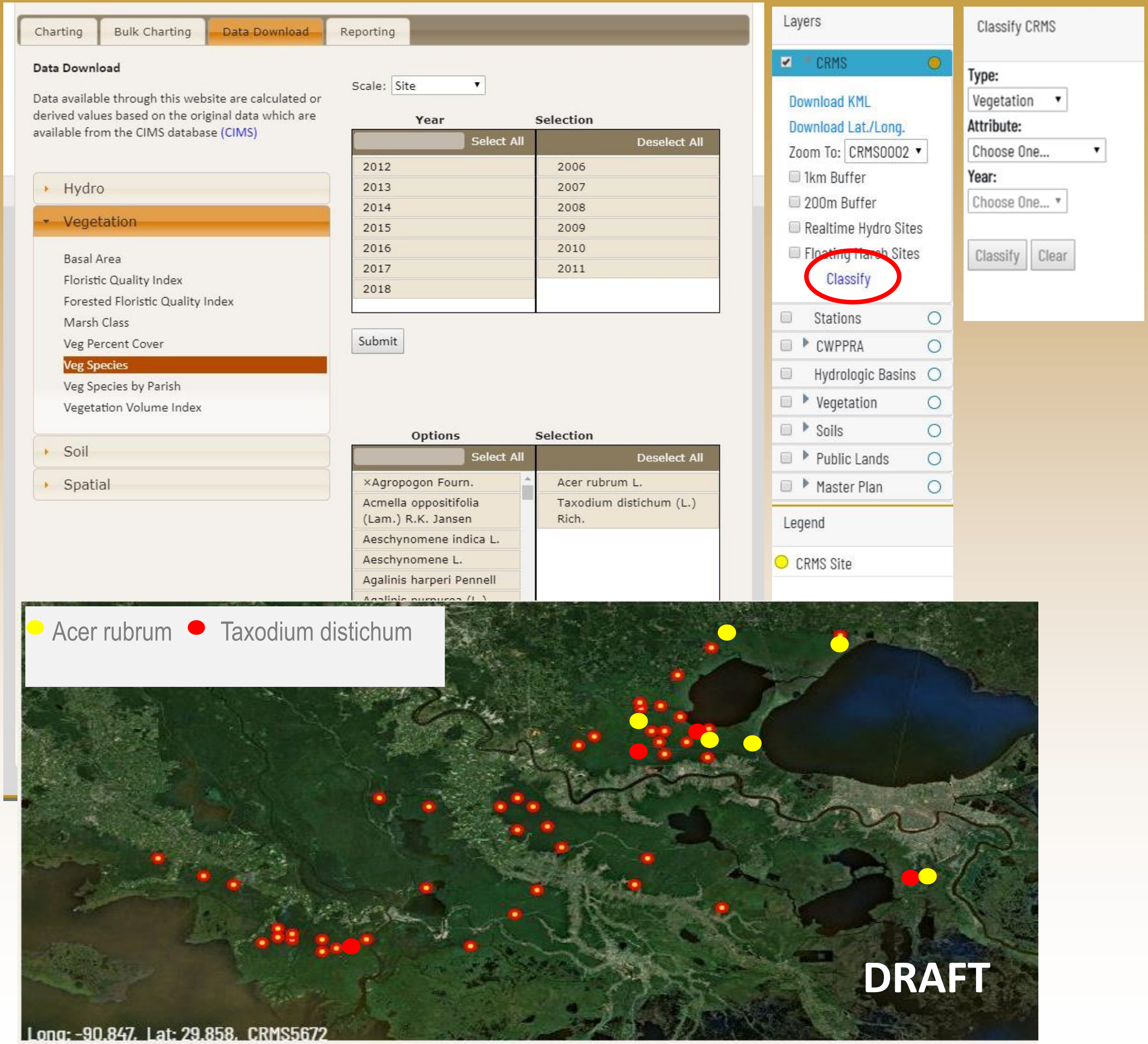
Classifications for 2005, 2008, 2012, 2015/2016 and then a matrix of land change presented in one map product.

Data and metadata available through Sciencebase.

CRMS High Resolution 1m links

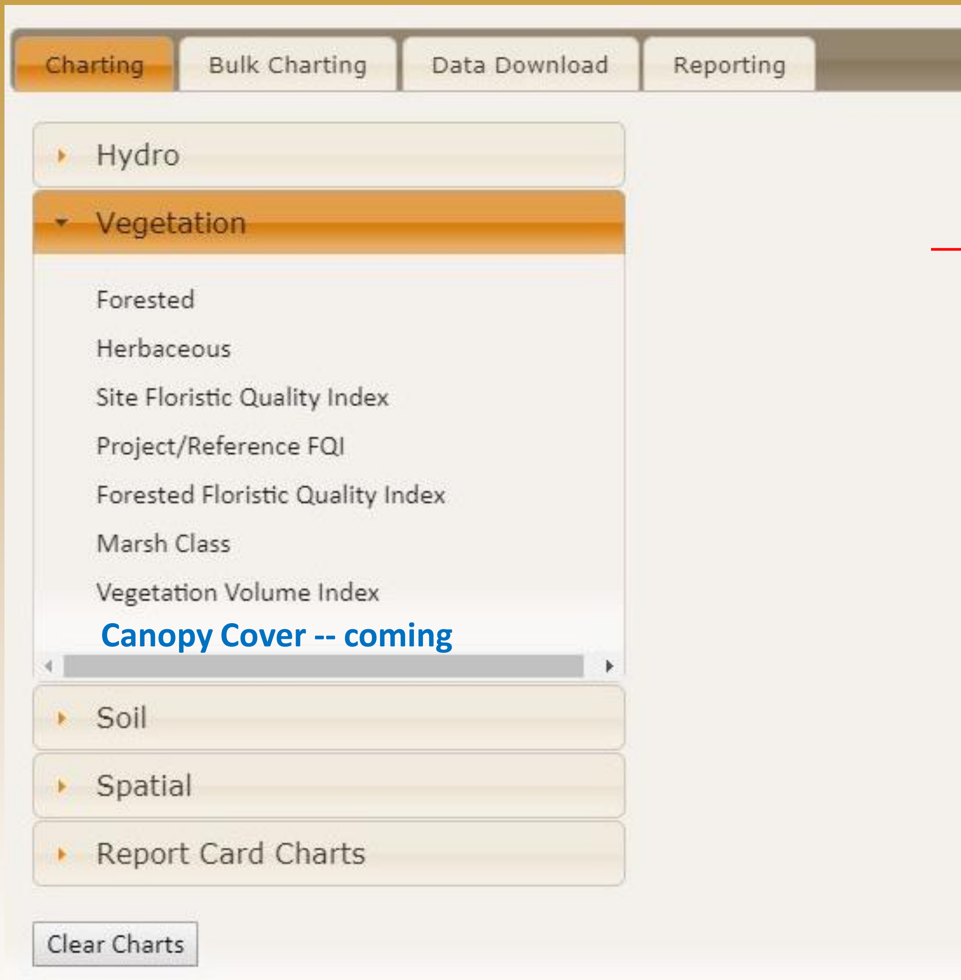
Website visualizations of land/water classifications from 2005, 2008, and 2012 are referenced back to map products located here.
The maps and associated data for 2015/2016 products can be downloaded here and here.
Maps and associated data for a matrix of four land-water products from 2005, 2008, 2012, and 2015 are here
Maps and associated data for a matrix of four land-water products from 2005, 2008, 2012, and 2016 are here.

In Development
Map Vegetation Species

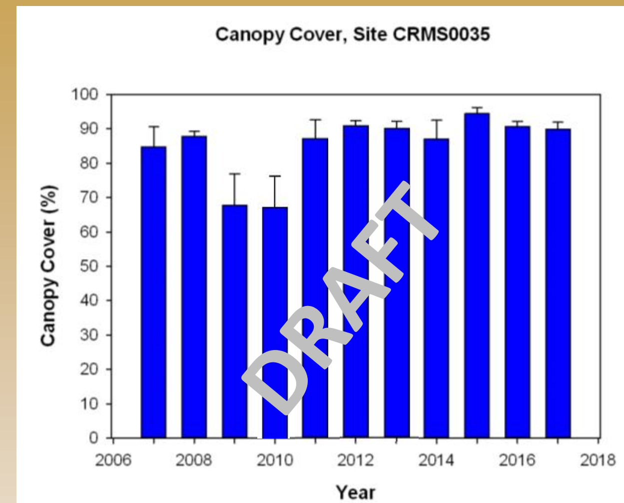


- On the mapping viewer using the Classify Tool
- Based on query output
- Site level presence by year
- Limit of 3 species per visualization

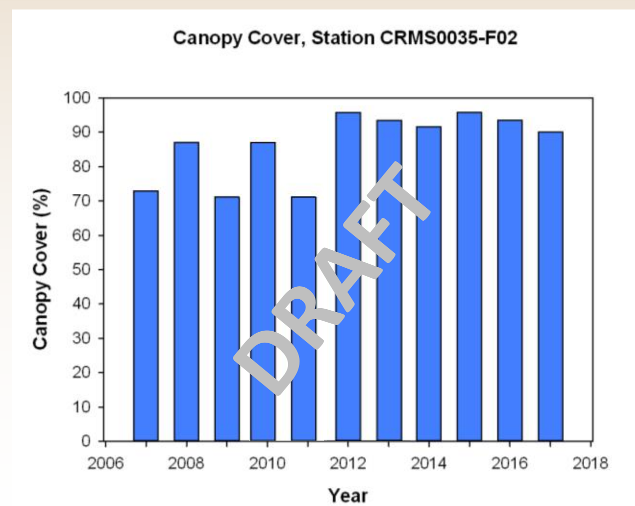
In Development
Canopy Cover Charts



Site:



Station:

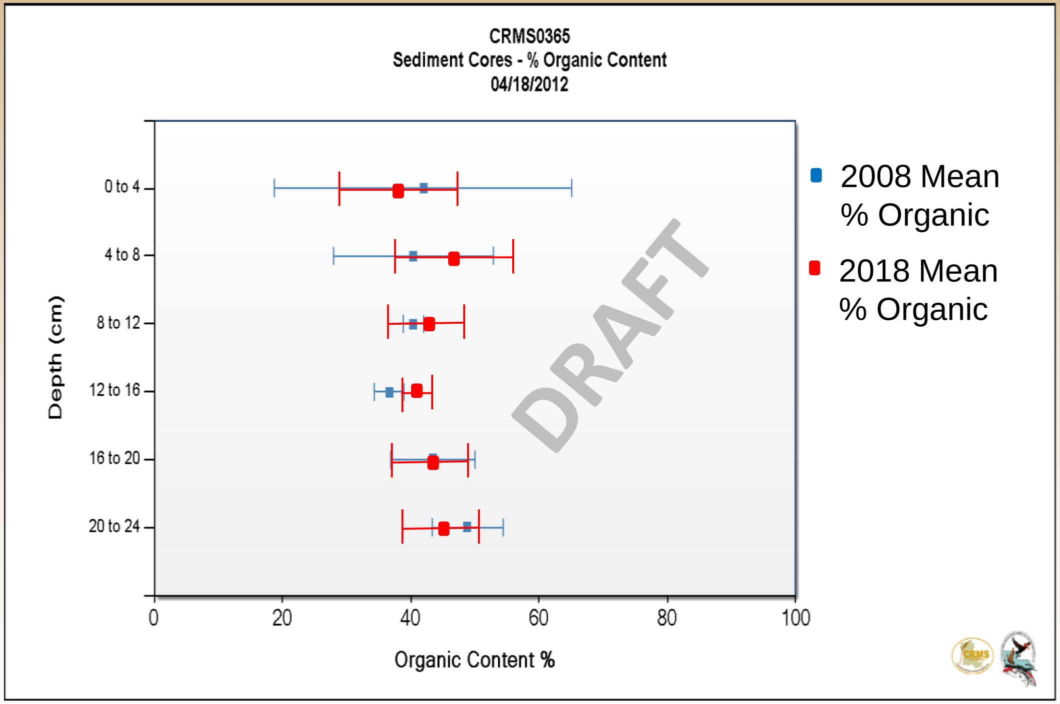


In Development
Soils, Above and Belowground Charts

CRMS soil profiles were collected in 2018.

Above and belowground biomass and vegetation nutrients collected by basin in a yearly rotation from 2016-2021. New series of charts (10+) in development.

- Updated soil profiles for OM and BD
- Soil nutrient profiles for TN, TP, TC
- Carbon density profile
- Above and belowground biomass (live and dead)
- Aboveground vegetation nutrient content



Analytical Team Updates

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

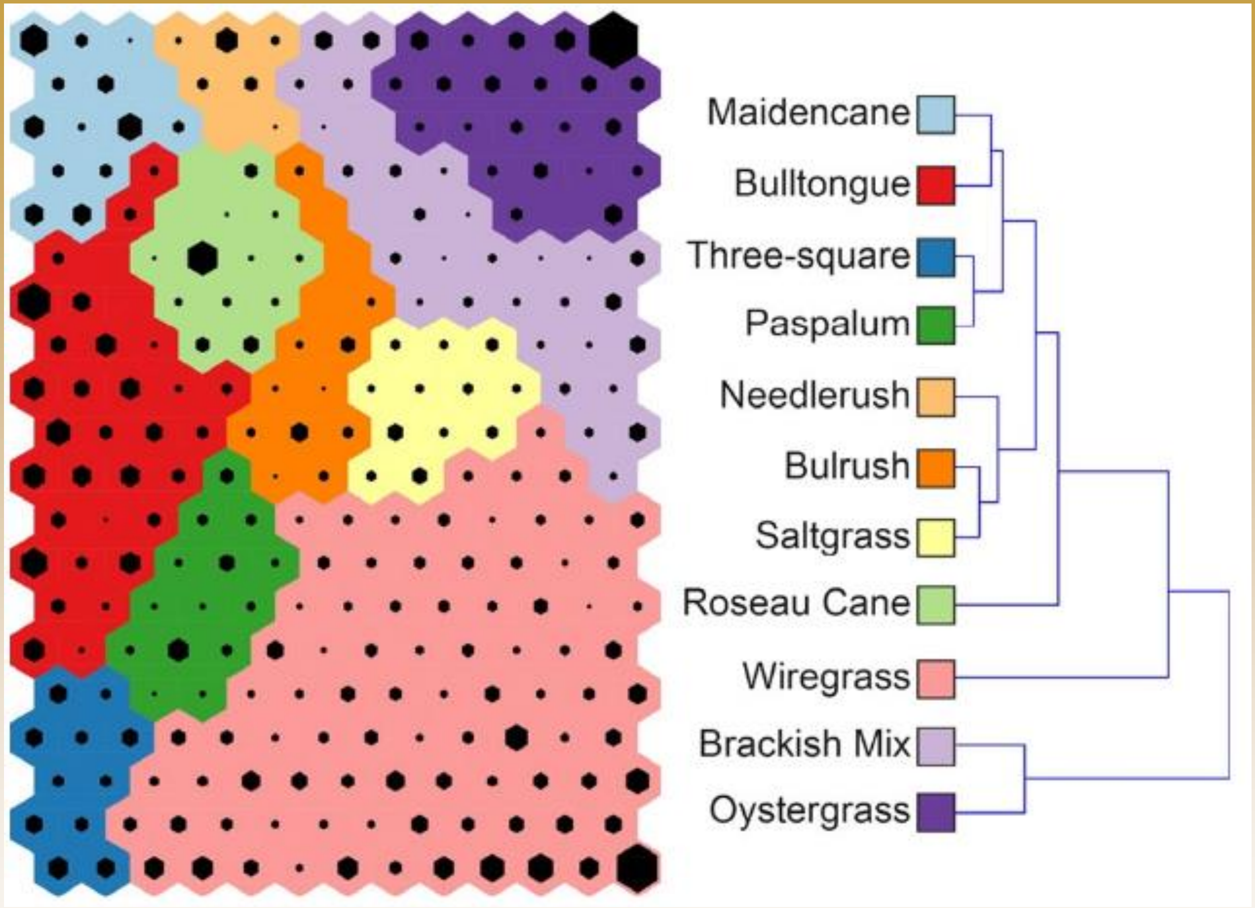
New Publication
Gregg Snedden

Limitations of classical clustering techniques

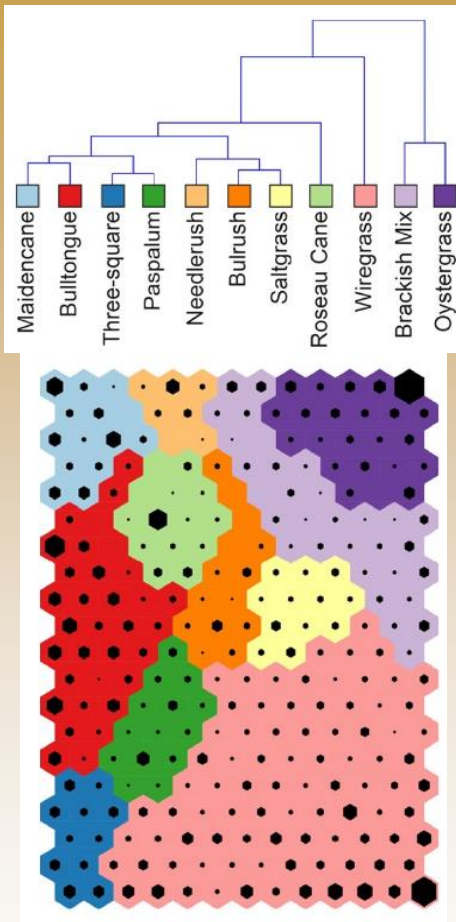
- Species abundance data are usually messy
  - Outliers, missing data
  - Sparse matrices – most cells are zeros
  - Strongly nonlinear
  - These are all violations of traditional multivariate clustering approaches
- <u>Unstable to the addition of new samples</u>
  - This can be problematic for ecological monitoring programs where new samples continuously become available
  - Eliminates need for different classifications spatially and temporally
    - Chenier vs Delta, number of classes changes with each classification

Input data and resulting classes

- 343 sites over 9 years of CRMS data
- Quantitatively determined breaks in dendrogram
- Groups named after dominant species but include more than the dominant
- Each cell in the SOM has a defined species composition
- Size of black dots represent the number of samples in the training data set



Species composition of each class



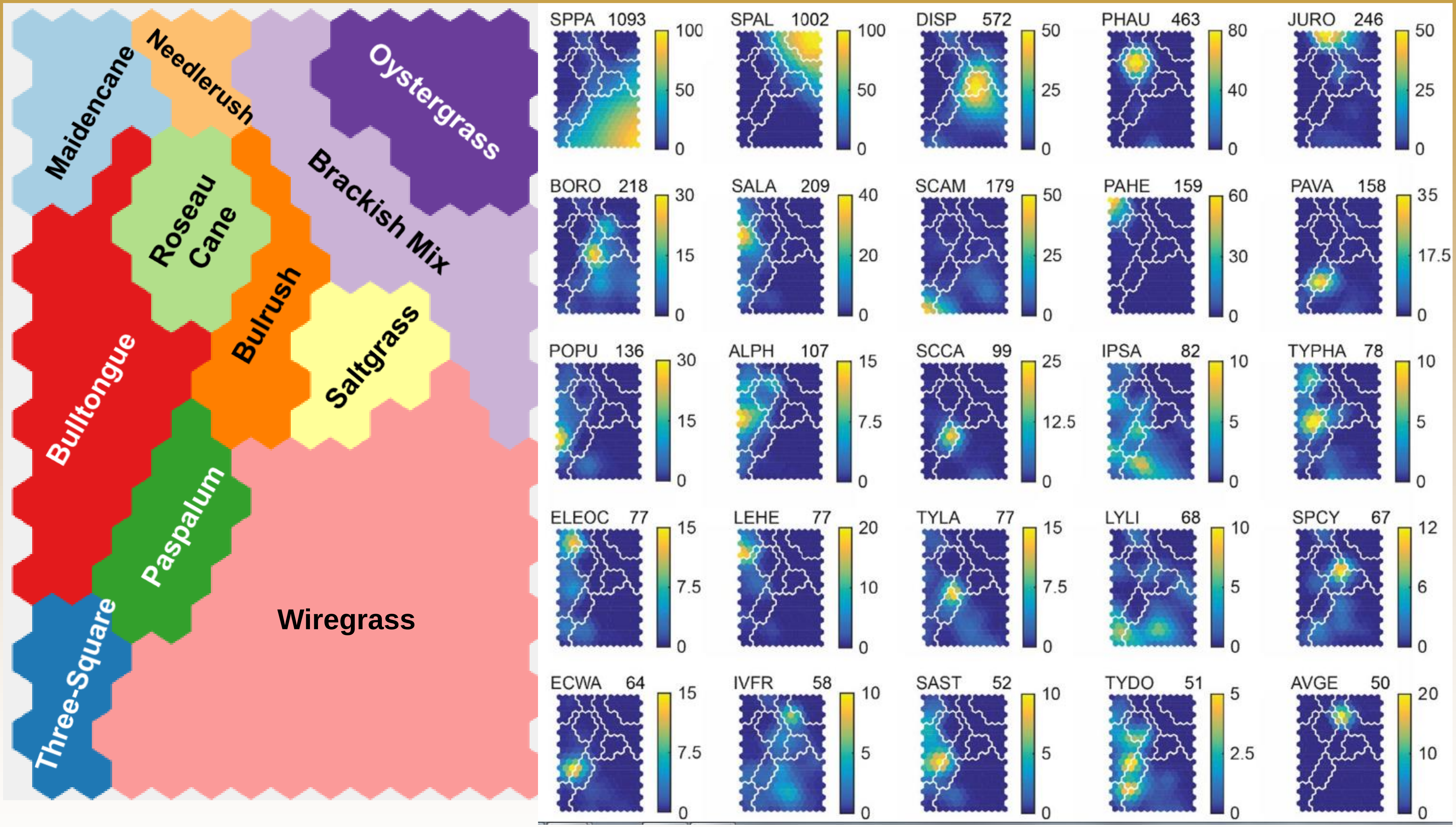
Maidencane		Three-square		Roseau Cane		Paspalum	
Panicum hemitomon	**34**	***Schoenoplectus americanus***	**27**	***Phragmites australis***	**71**	***Paspalum vaginatum***	**24**
Leersia hexandria	**11**	*Spartina patens*	19	*Spartina patens*	5	***Schoenoplectus californicus***	**13**
Sagittaria lancifolia	10	*Sagittaria lancifolia*	6	*Alternanthera philoxeroides*	4	*Spartina patens*	11
Eleocharis	**7**	***Lythrum lineare***	**5**	*Spartina alterniflora*	3	***Typha latifolia***	**10**
Thelypteris palustris	**5**	***Cladium mariscus***	**4**	*Typha domingensis*	2	***Ipomoea sagittata***	**6**
Alternanthera philoxeroides	4	***Eleocharis macrostachya***	**4**	*Zizaniopsis miliacea*	2	*Distichlis spicata*	3
Typha	**4**	*Distichlis spicata*	4	*Polygonum punctatum*	2	***Echinochloa walteri***	**3**

Wiregrass		Bulltongue		Needlerush		Bulrush	
Spartina patens	**65**	***Sagittaria lancifolia***	**16**	***Juncus roemerianus***	**54**	***Schoenoplectus robustus***	**24**
Distichlis spicata	7	***Polygonum punctatum***	**11**	*Spartina alterniflora*	15	*Distichlis spicata*	16
Schoenoplectus americanus	5	***Alternanthera philoxeroides***	**7**	*Spartina patens*	8	*Spartina patens*	13
Schoenoplectus robustus	3	***Ludwigia grandiflora***	**4**	*Distichlis spicata*	8	***Spartina cynosuroides***	**8**
Ipomoea sagittata	2	*Typha*	4	*Lythrum lineare*	2	*Spartina alterniflora*	7
Lythrum lineare	2	***Colocasia esculenta***	**3**	*Phragmites australis*	2	***Paspalum distichum***	**5**
Spartina alterniflora	2	***Sacciolepsis striata***	**3**	*Schoenoplectus robustus*	2	*Juncus roemerianus*	5

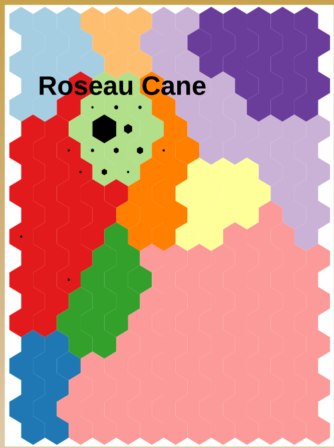
Brackish Mix		Oystergrass		Saltgrass	
Spartina alterniflora	53	***Spartina alterniflora***	**93**	***Distichlis spicata***	**49**
Spartina patens	20	*Juncus roemerianus*	4	*Spartina patens*	21
Juncus roemerianus	10	*Spartina patens*	1	*Spartina alterniflora*	15
Distichlis spicata	7	*Distichlis spicata*	1	*Schoenoplectus robustus*	6
Schoenoplectus robustus	3	*Batis maritima*	<1	*Schoenoplectus americanus*	2
Avicennia germinans	**3**	*Schoenoplectus robustus*	<1	*Iva frutescens*	1
Iva frutescens	2	*Avicennia germinans*	<1	*Juncus roemerianus*	1

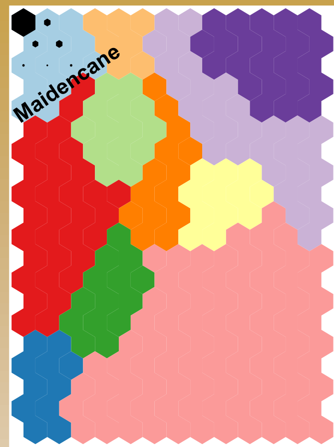
Numbers represent mean % relative cover of 7 most abundant taxa in each class

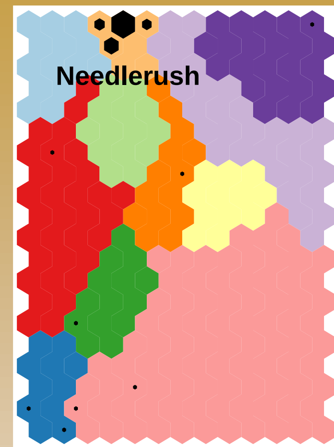
Louisiana's top 25 species

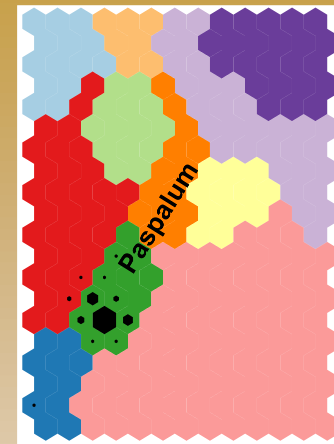


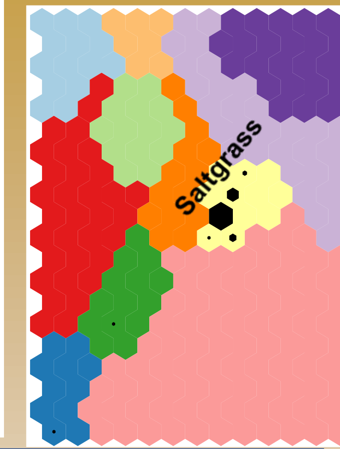
Congruence to Previous Classifications
2007 Heli data







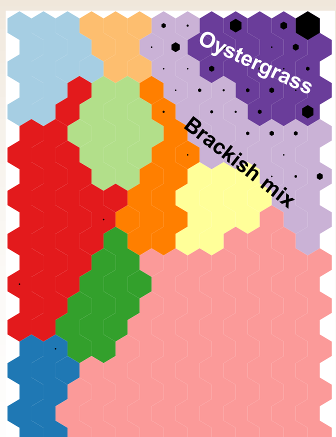


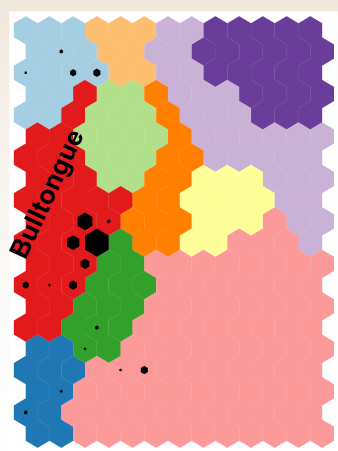


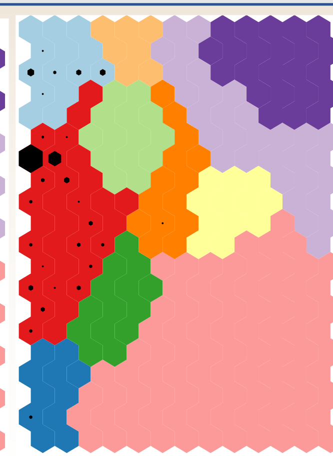
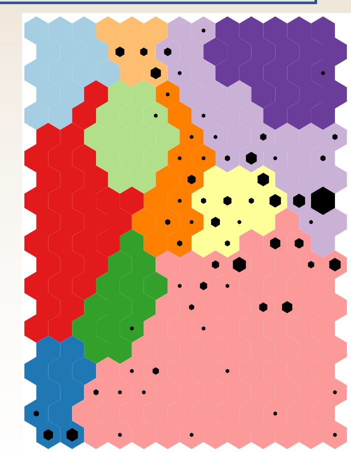
Roseau Cane | Maidencane | Needlerush | Paspalum | Saltgrass

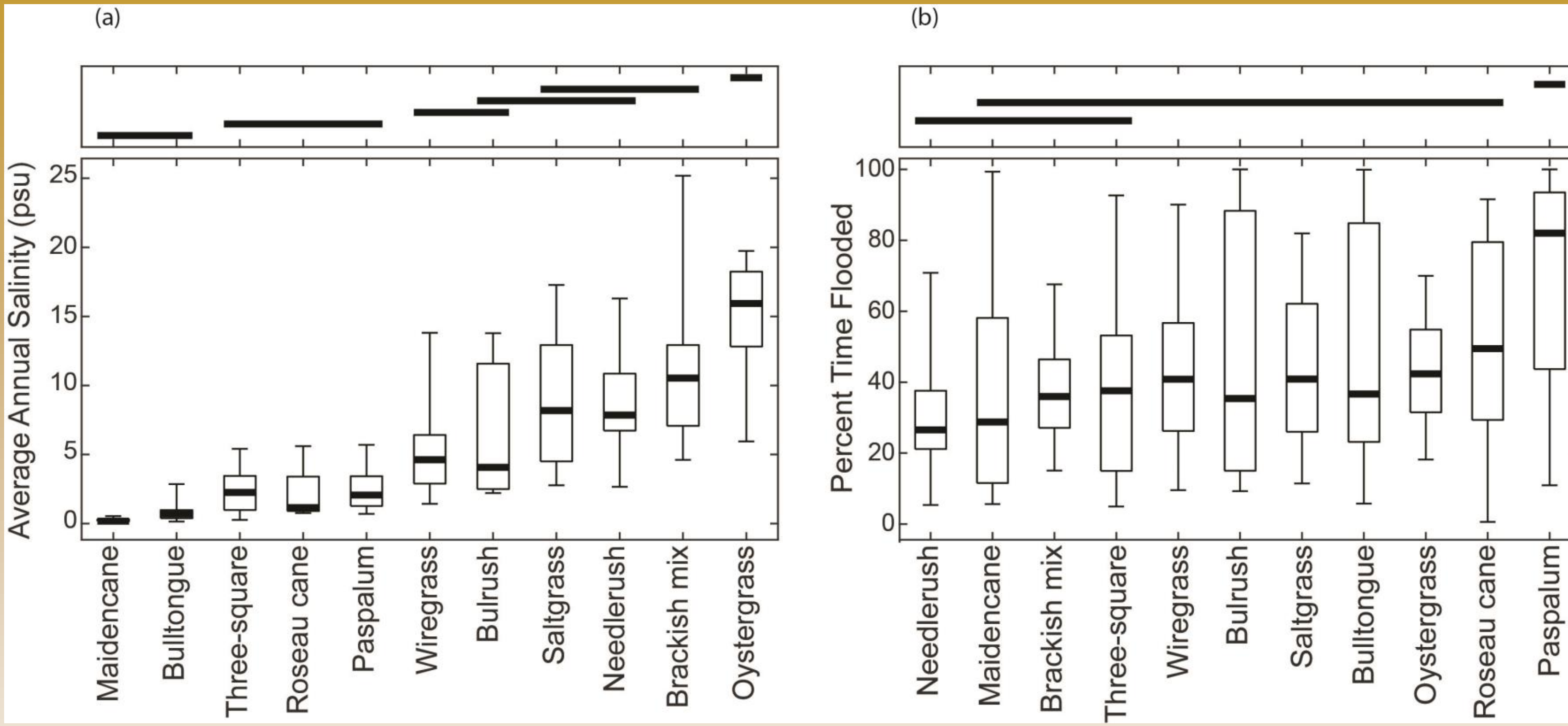
Visser Classes (20 total)

Wiregrass | Oystergrass | Cattail | Bulltongue | Brackish Mix






(a)
Average Annual Salinity (psu)
0
5
10
15
20
25
Maidencane
Bulltongue
Three-square
Roseau cane
Paspalum
Wiregrass
Bulrush
Saltgrass
Needlerush
Brackish mix
Oystergrass
(b)
Percent Time Flooded
0
20
40
60
80
100
Needlerush
Maidencane
Brackish mix
Three-square
Wiregrass
Bulrush
Saltgrass
Bulltongue
Oystergrass
Roseau cane
Paspalum

Mapping CRMS sites from 2013 survey

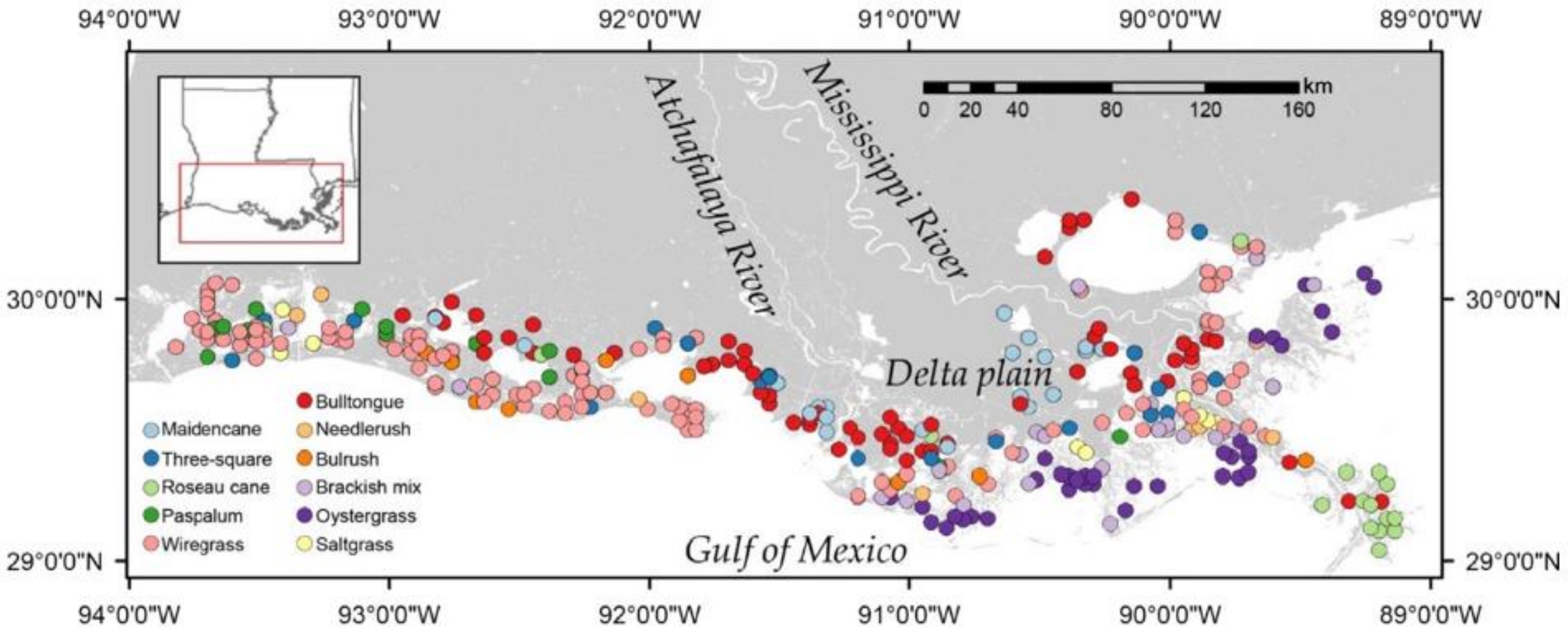


FIGURE 1 Location of 343 sites where vegetation cover, salinity, and water level were collected. Color indicates vegetation community type, as classified by the self-organizing map, based on taxa composition observed during the 2013 Coastwide Reference Monitoring System (CRMS) vegetation survey

Mapping 2013 heli data

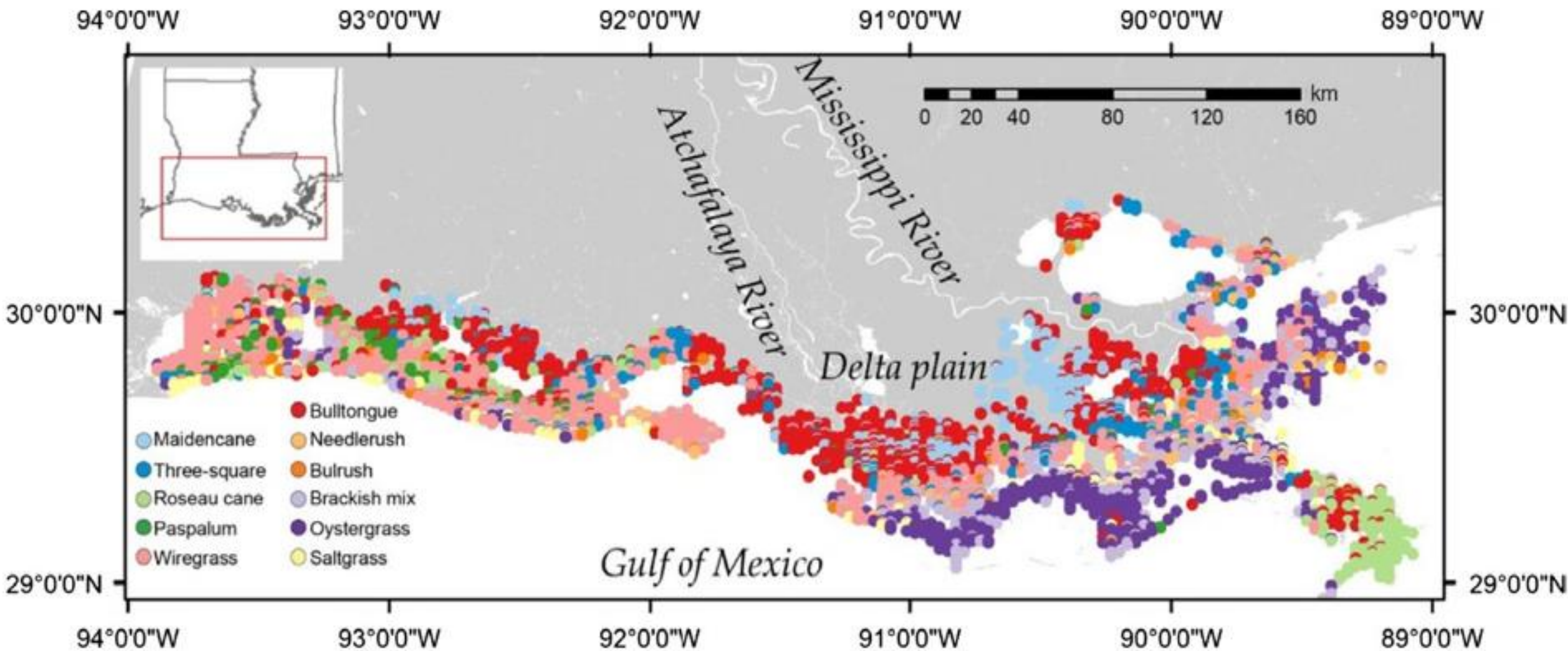
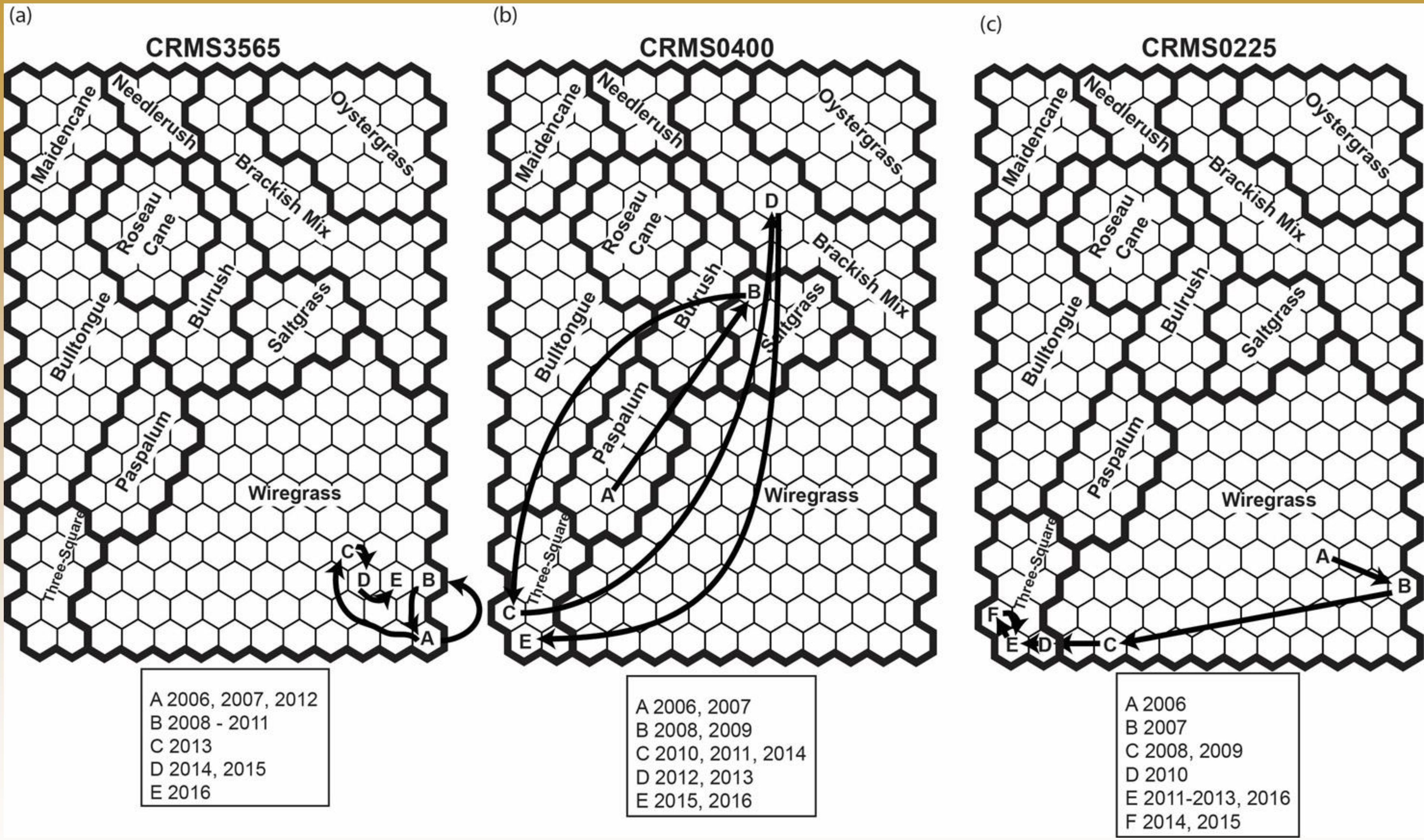


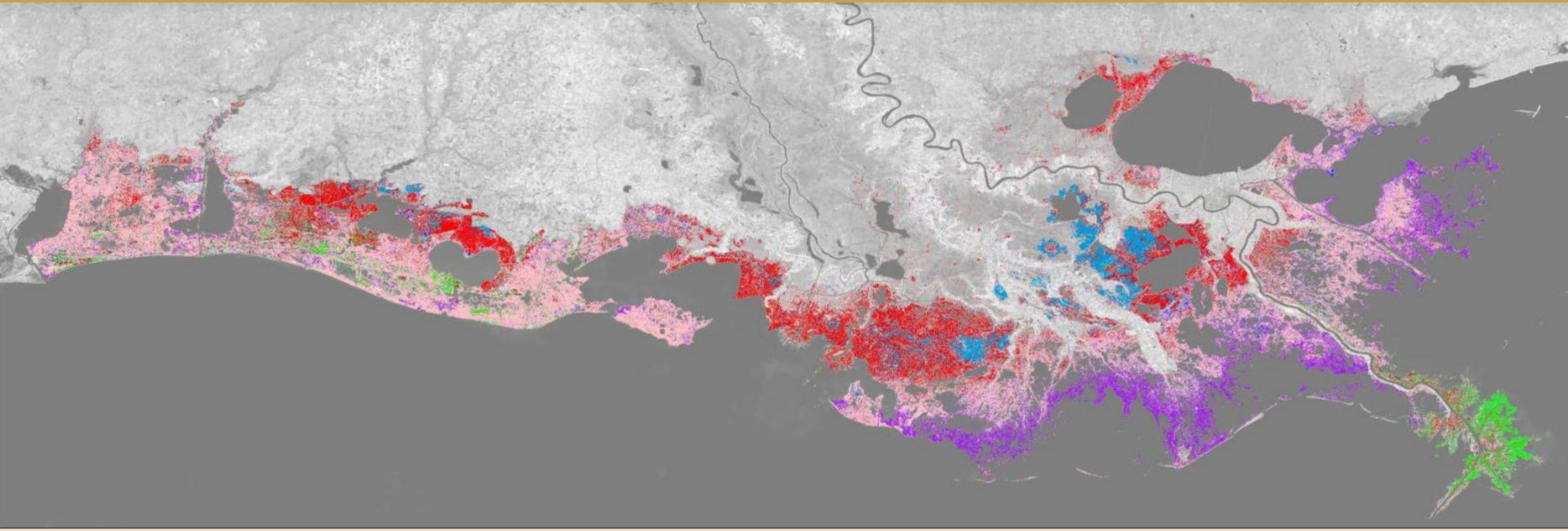
FIGURE 7 Self-organizing map classification of species cover data from 2013 helicopter-based vegetation surveys conducted at 4,215 locations across coastal Louisiana (Sasser et al., 2014)

Visualize Temporal Trends



- CRMS3565 temporally stable community composition vs CRMS0400
- CRMS0225 (2008-2009) indication that a community shift is under way but not yet crossed a distinct boundary.

Integration with Remote Sensing
Manuscript in development



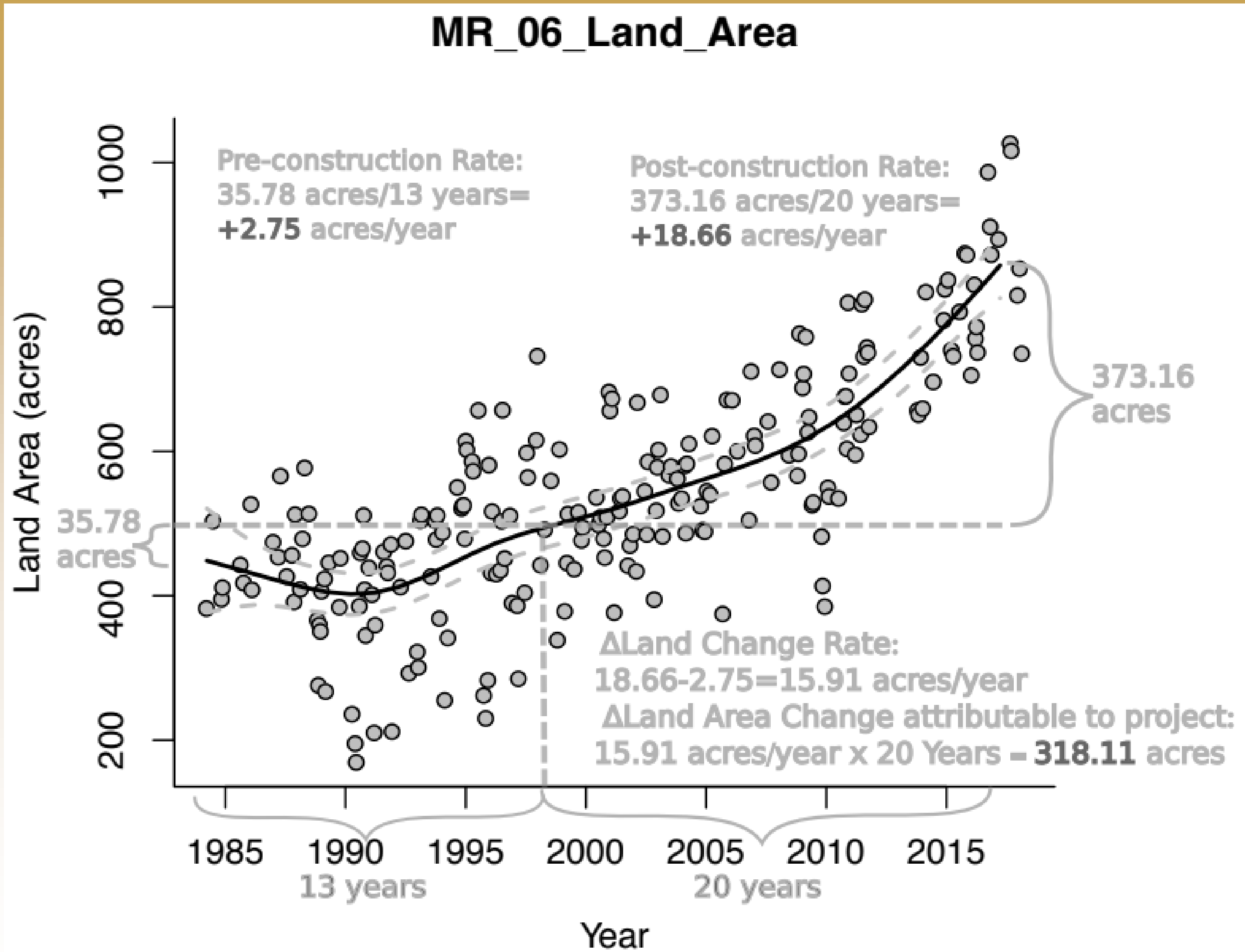
- Classified samples (n ≈ 4000) from helicopter surveys
- Used a portion of the classified samples as training data for supervised classification of multispectral satellite imagery (Sentinal)
- Preliminary analysis suggest classification by remote sensing may obtain correct classification rates approaching 80%
- Technique should allow for annual mapping at 10m resolution

Paper in development
Couvillion et al.

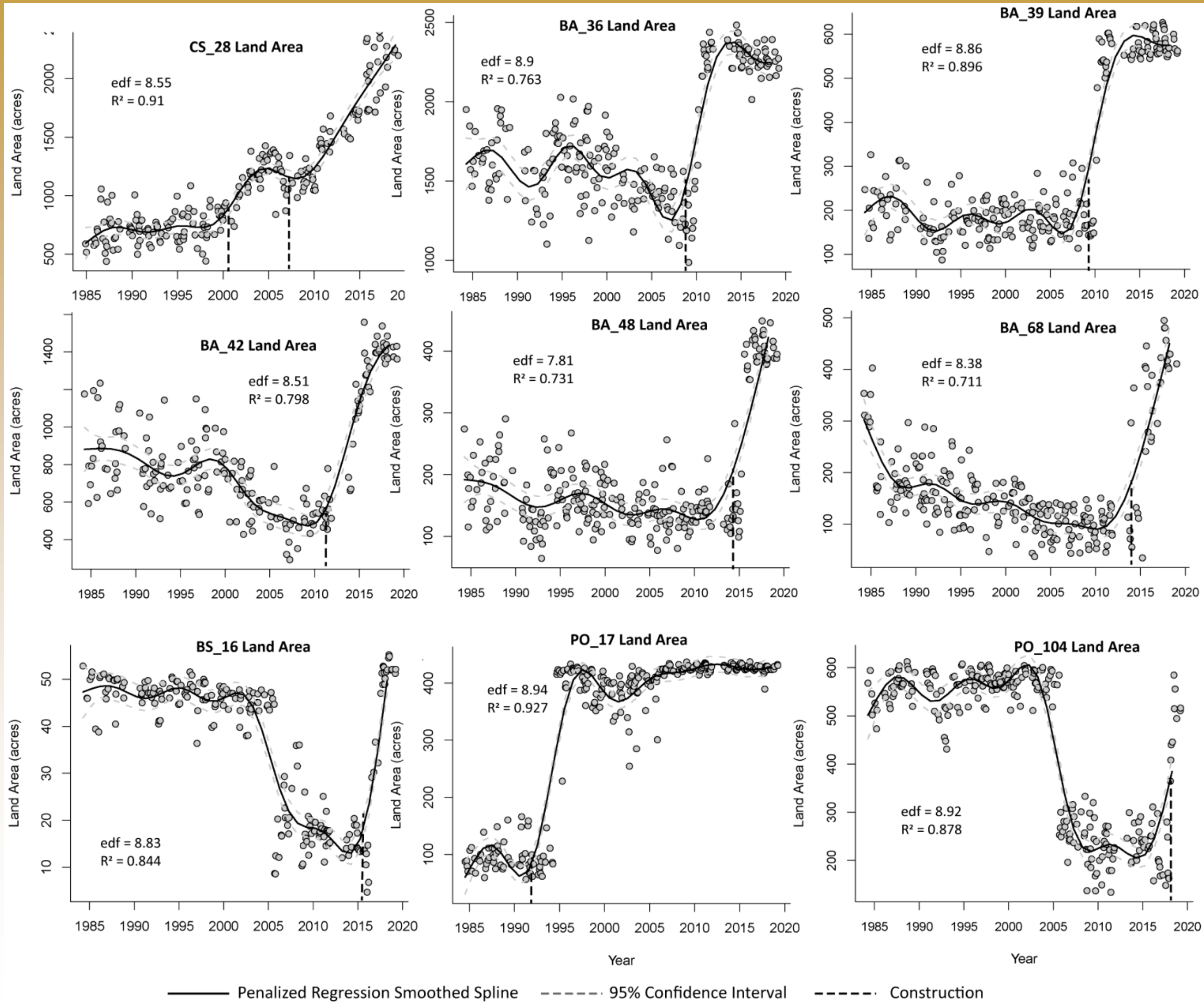
Assessing the Efficacy of Coastal Wetland Planning, Protection and Restoration Act (CWPPRA) Restoration Projects Intended to Create or Sustain Land

- 1984-2018 satellite imagery to assess the land building & land sustaining effects of constructed CWPPRA projects
- ~ 200 observations per project (cloud free dates)
- Fractional estimates of land, water, and aquatic vegetation for each pixel
- Adjusted for expected effects of intra-annual water level variation on land area
- Compared pre- and post-construction land area estimates and change rates
- Results summarized by project and project type
- Original project boundaries created some analysis issues (ex., too big or too small)
- Will not assess Hydrologic Restorations
    - unless primarily intended to build/sustain land (ex. Crevasse management)

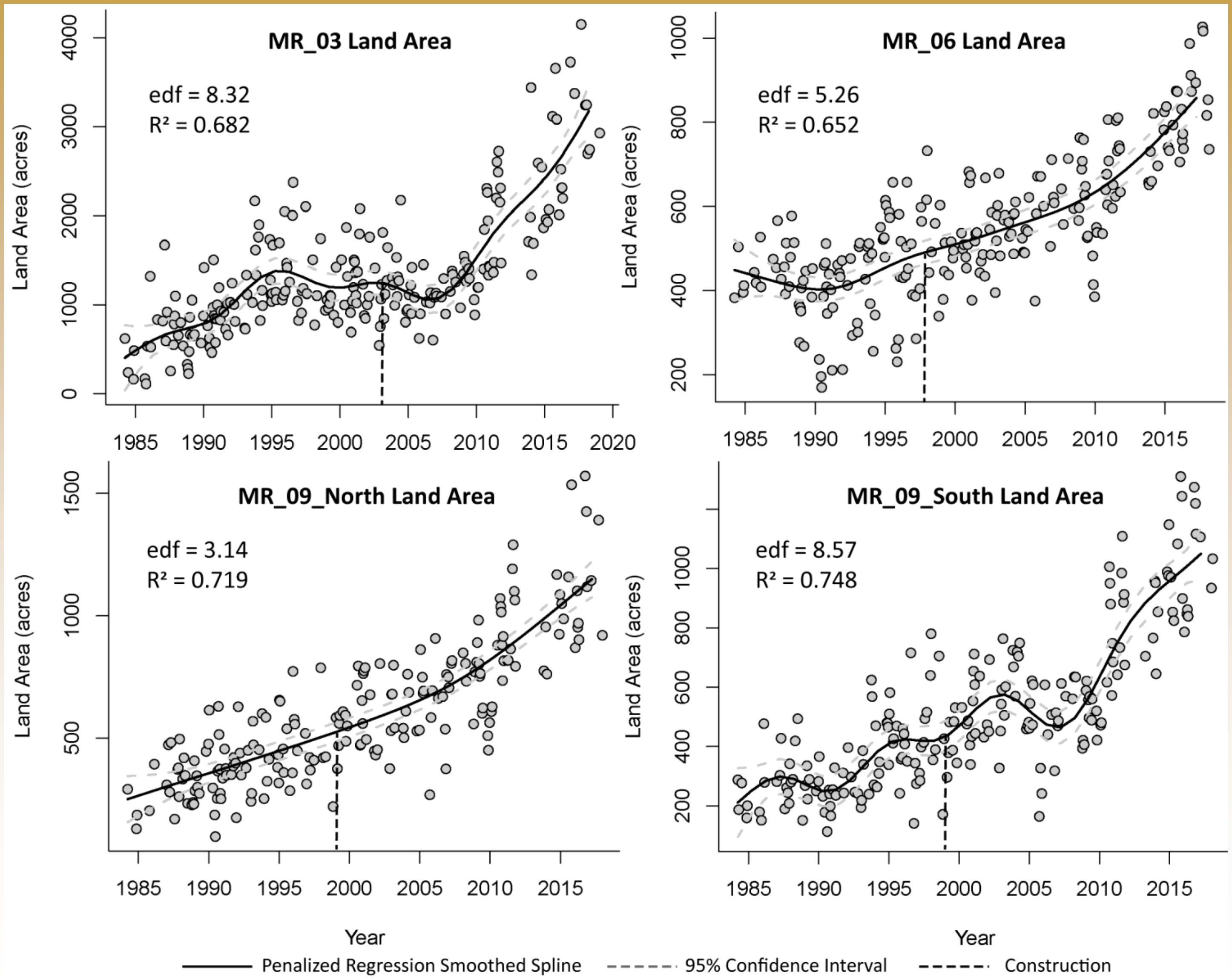
Paper in development
Couvillion et al.
Example



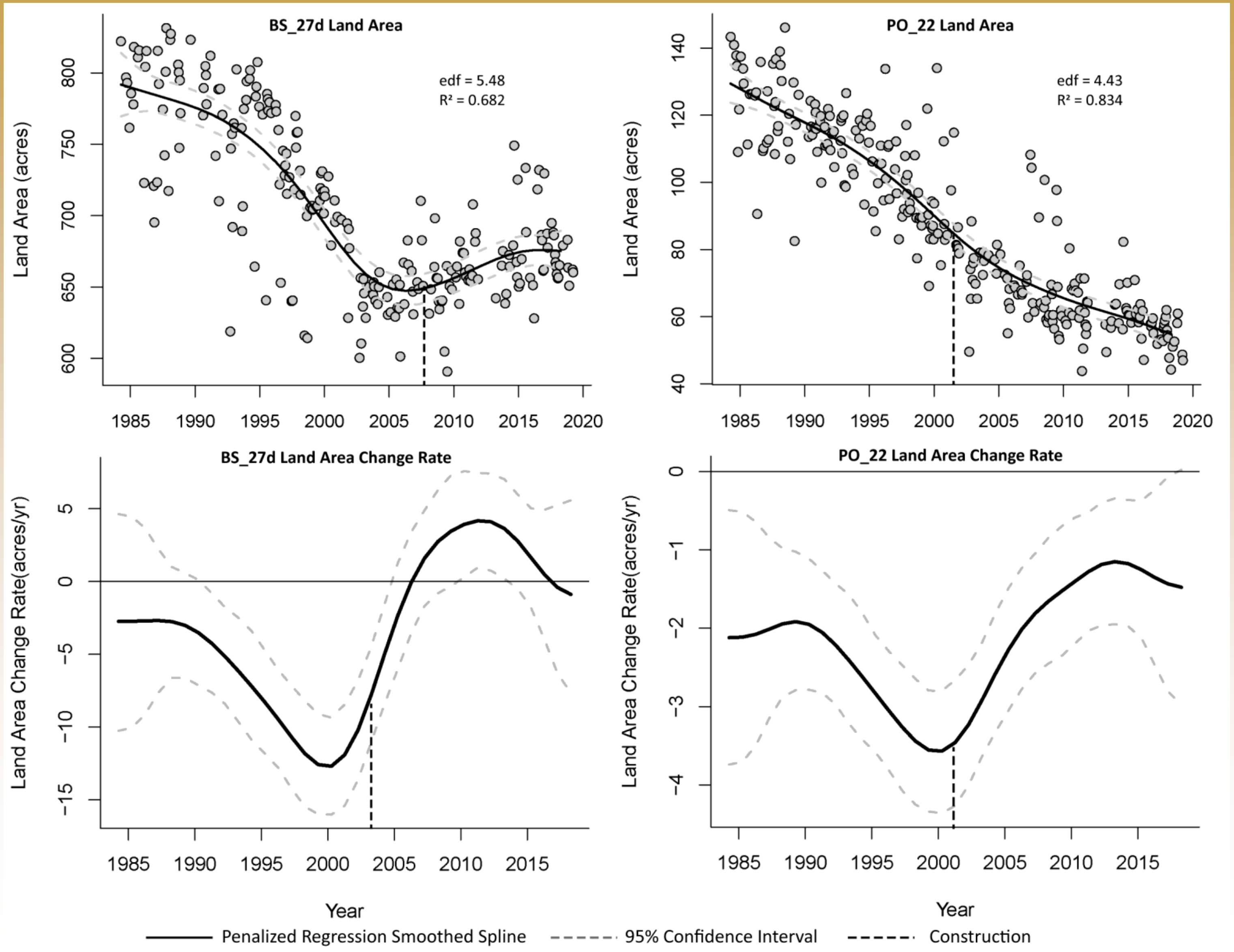
Paper in development
Couvillion et al.
Marsh Creation



Paper in development
Couvillion et al.
Crevasse Management



Paper in development
Couvillion et al.
Shoreline Protection



Paper in development
Couvillion et al.

- Expected manuscript submission this summer
- Each project output will be presented in tabular form
- Figures for each project will be available in science base
- This effort highlights the importance of drawing boundaries that reflect project influences
- Redrew boundaries where it was appropriate or used revised project boundaries
  - ex., barrier island rollback
- Potential future opportunity to refine WVA benefit calculations

CRMS Programmatic Funding

- Full annual budget approved through FY20
- $10M annual approval starting in FY21
- Projected annual deficit $1M - $3.6M in subsequent 5 years
- Plan to submit proposal to NRDA LA-TIG for funds from the Monitoring and Adaptive Management budget
- Implemented cost cutting measures and are exploring others

Cost Cutting Mechanisms
Floating Marsh Redesign

- Redesigning M01 set up for floating marshes
  - Reduce size, clogging, impact on vegetation and mat buoyancy
- Removed sondes at floating sites in Feb 2019
- Experimenting with new design and cheaper equipment starting summer 2019 at 4 sites
- Anticipate redeployment throughout network late 2019

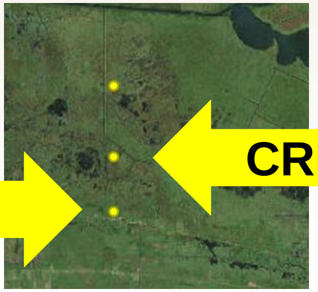
Original Design

Re-designed

Cost Cutting Mechanisms
Use of surrogate sondes

- Analyzed 9 yrs of water data--daily mean salinity and water level
- 21 station pairs provided statistically equivalent data
- Considered whether removing of 1 station in each pair would impact ability to assess existing or future restoration areas.

- Reduced selection to 10 pairs for further consideration
- Compared tidal amplitudes within 10 pairs, no real differences (<1/4 inch)
- Calculated percent time flooded at proposed eliminated station using “real” station data and surrogate station data
- If mean annual percent time flooded error was ≥ 5% between real and surrogate data, the station was not consideration for removal



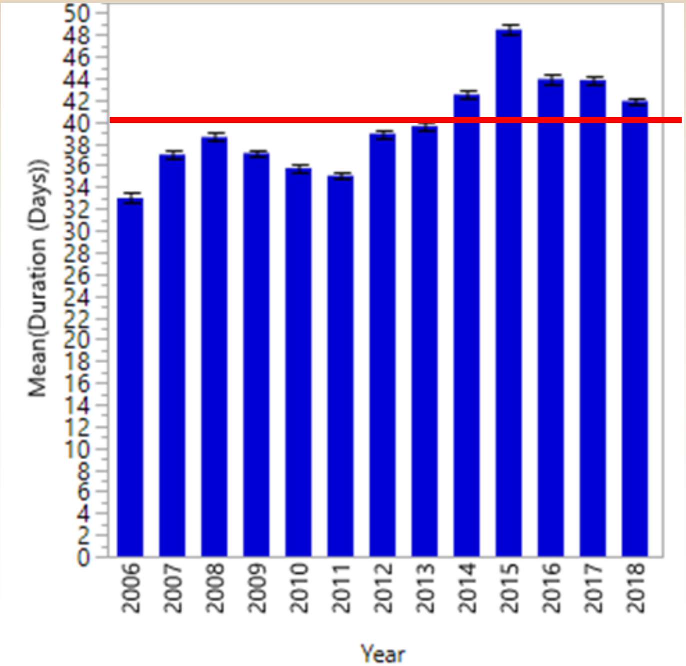
Cost Cutting Mechanisms
Use of surrogate sondes

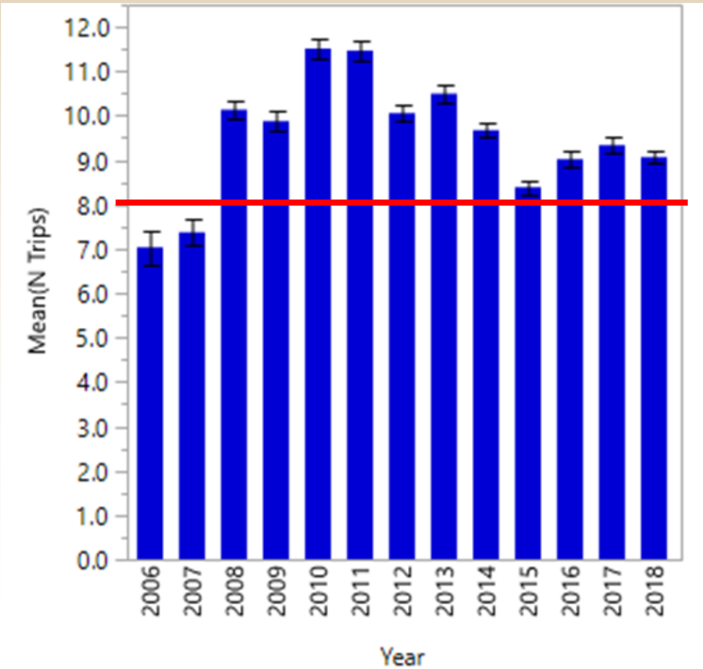
- Recommend eliminating 7 stations effective October 1, 2019
- Standard language will be added to the CIMS database, CRMS charting, & mapping viewer to notify users of the change
- CRMS0000-**H0X** will indicate a sonde that has been eliminated where surrogate data is being served in the database for the eliminated station's temperature, salinity, and water level.
- Site-specific flooding will be calculated for the -H0X station using the observed marsh elevation at the CRMS site.

Basin	Station_ID for elimination 10/1/2019	Station_ID of surrogate 10/1/2019
BA	CRMS0176-H01	CRMS0174-H01
BA	CRMS0253-H01	CRMS0220-H01
TE	CRMS2881-H01	CRMS0411-H01
ME	CRMS1409-H01	CRMS0553-H01
ME	CRMS1446-H01	CRMS0590-H01
CS	CRMS2154-H01	CRMS0661-H01
CS	CRMS2156-H01	CRMS0669-H01

Cost Cutting Mechanisms
Adjust Hydro Servicing Schedules

- Reducing the frequency of servicing could reduce costs
  - reduce field labor
  - equipment rental (boats)
  - decrease number of records processed
- Need to balance reducing cost and data quality
- Current CRMS contract states sondes must be serviced every 60 days (approximately 6 times per year) - averaging ~ 40 day deployments
- Average has been >8 visits per year (~3500 trips per year)



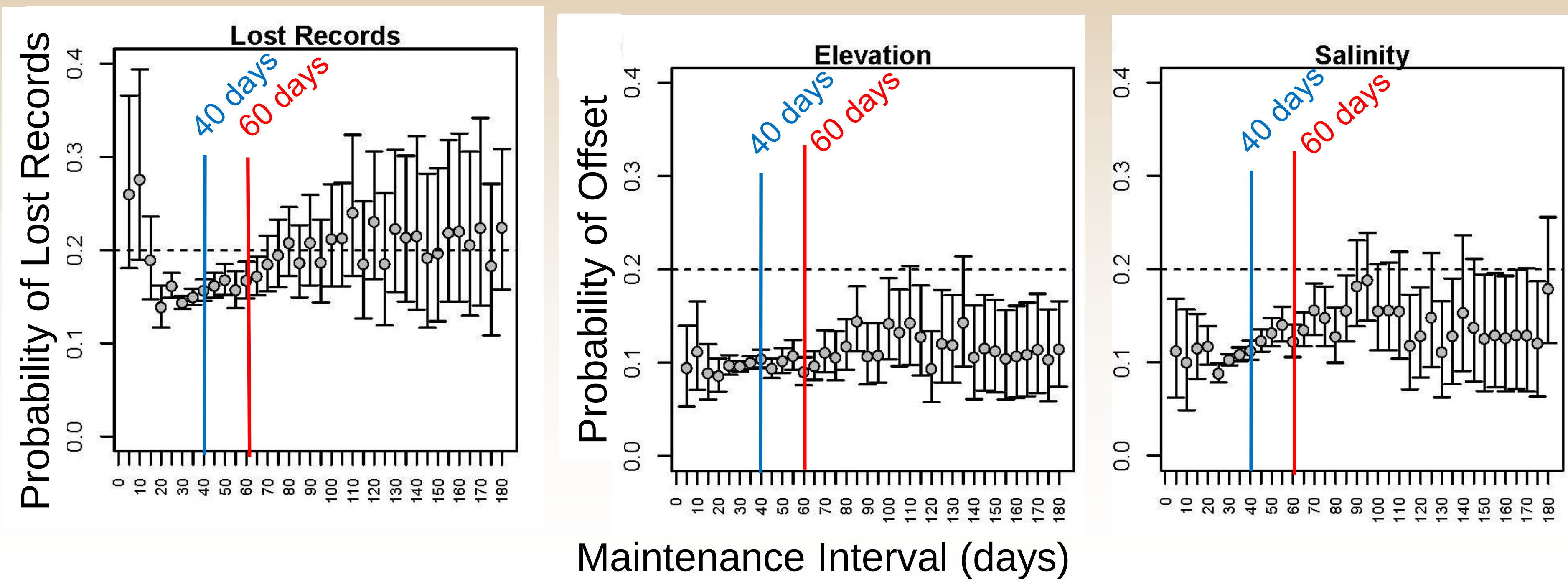


Cost Cutting Mechanisms
Adjust Hydro Servicing Schedules

Draft results, manuscript in prep

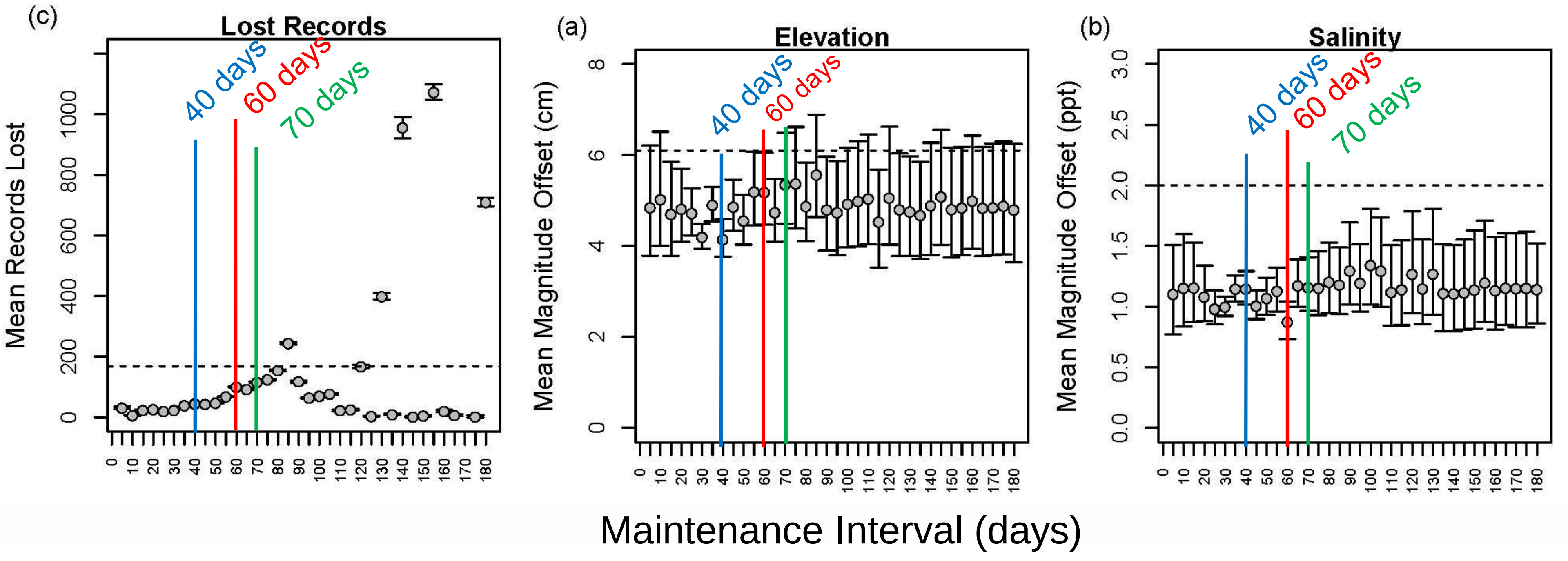
- Analyzed 12 years of hydro data to:
  1) Determine the effects of maintenance interval on probability of missing records
  2) Determine the effects of maintenance interval on probability of data adjustment
  3) Quantify the magnitude of adjustment (given that one occurred)

  Using raw sonde data and ground truth values during servicing for water elevation and salinity.

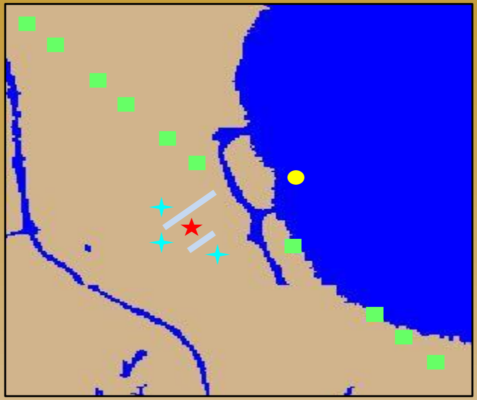


Cost Cutting Mechanisms
Adjust Hydro Servicing Schedules

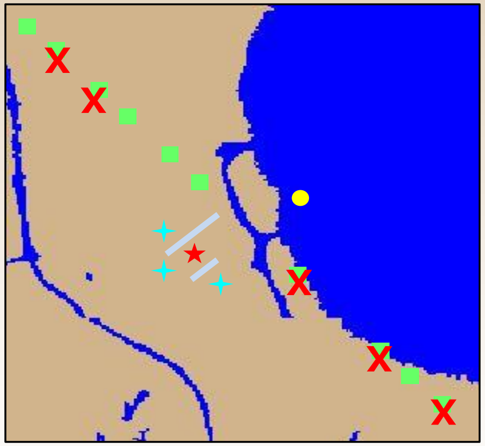
- 5 trips per year spaced evenly equals 73 days
- Analytical tools have a 70% hydro completeness threshold
  - >110 days lost is problematic
- Next CRMS contract (Jan. 2021) plan to increase the maintenance interval & set a max # of trips/site/yr



Potential Cost Cutting Mechanisms Reduce Annual Vegetation Effort



- Contractor labor costs could be reduced if less effort was required for annual vegetation sampling. Goal would be to increase number of full sites sampled per day and therefore we would have to remove 4 or 5 stations per site.



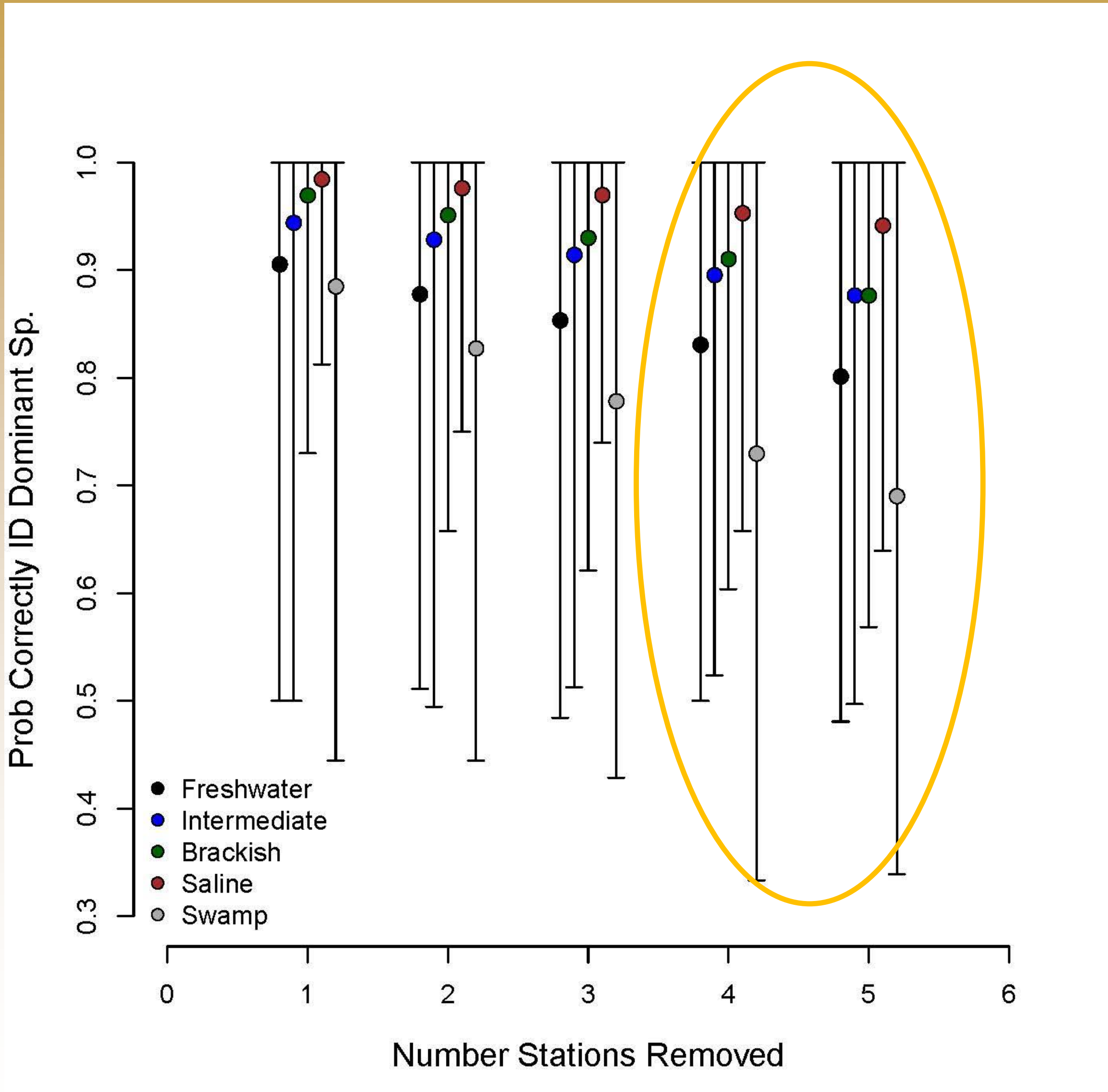
- We analyzed the effect of removing between 1 and 5 vegetation stations for several vegetation metrics.
- For each CRMS site, we calculated the metric using 10 stations and then for the subset of remaining stations (i.e., 9, 8,….5) using all combinations of station removal.

Potential Cost Cutting Mechanisms
Reduce Annual Vegetation Effort

Metrics analyzed:

- The probability that the <u>dominant</u> spp was correctly identified in the subset of stations
- Proportion of species from full sample observed
- An index of similarity (Jaccard)
- Difference in total cover
- Difference in Shannon diversity index

Potential Cost Cutting Mechanisms Reduce Annual Vegetation Effort



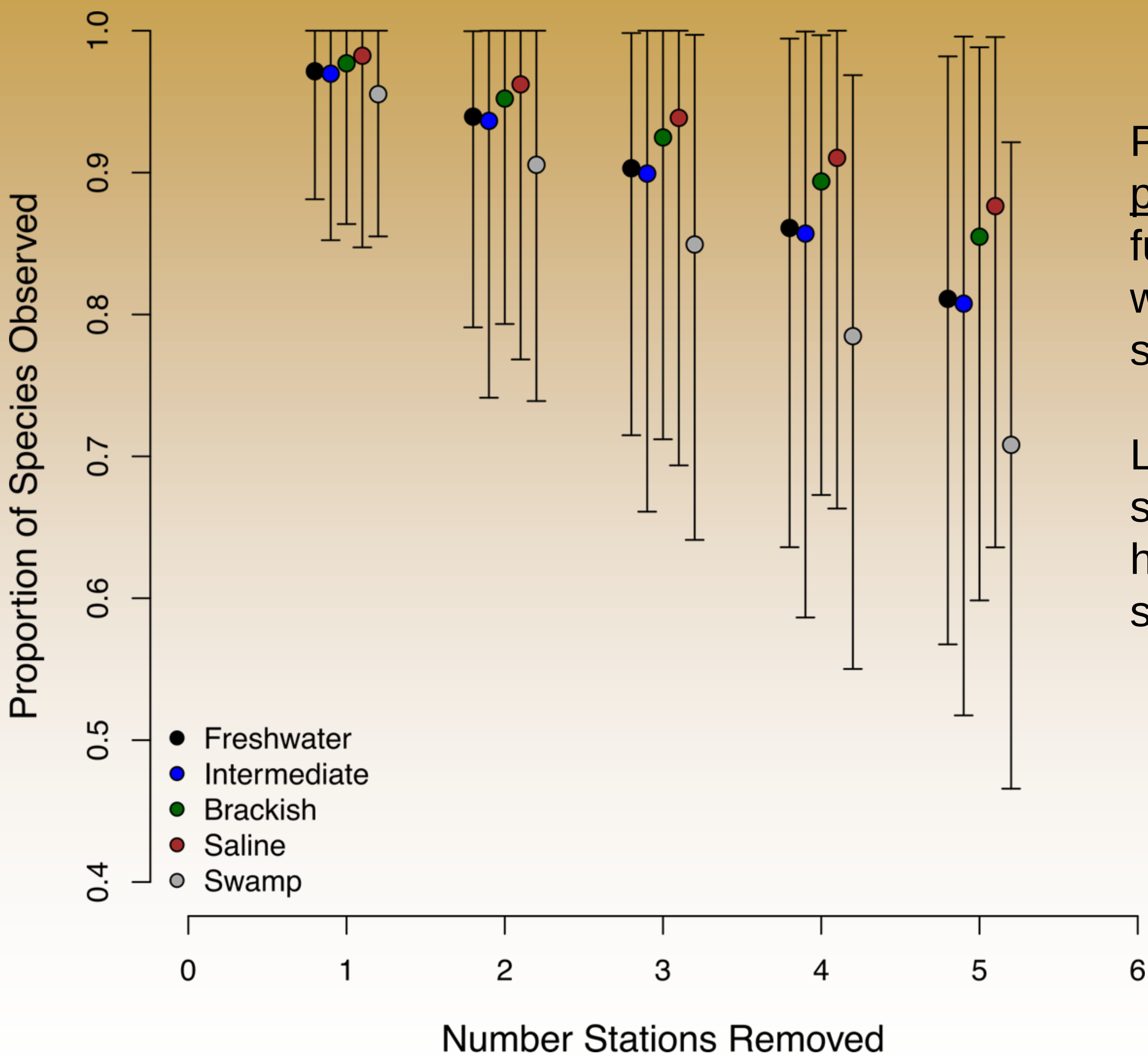
Probability that reducing allows us to correctly identify the most dominant species in the full sample.

We would be wrong on the dominant species 20%.

Correctly ID'ing dominant is important to classify wetland type.

Changes in sampling could be mistaken for actual community change.

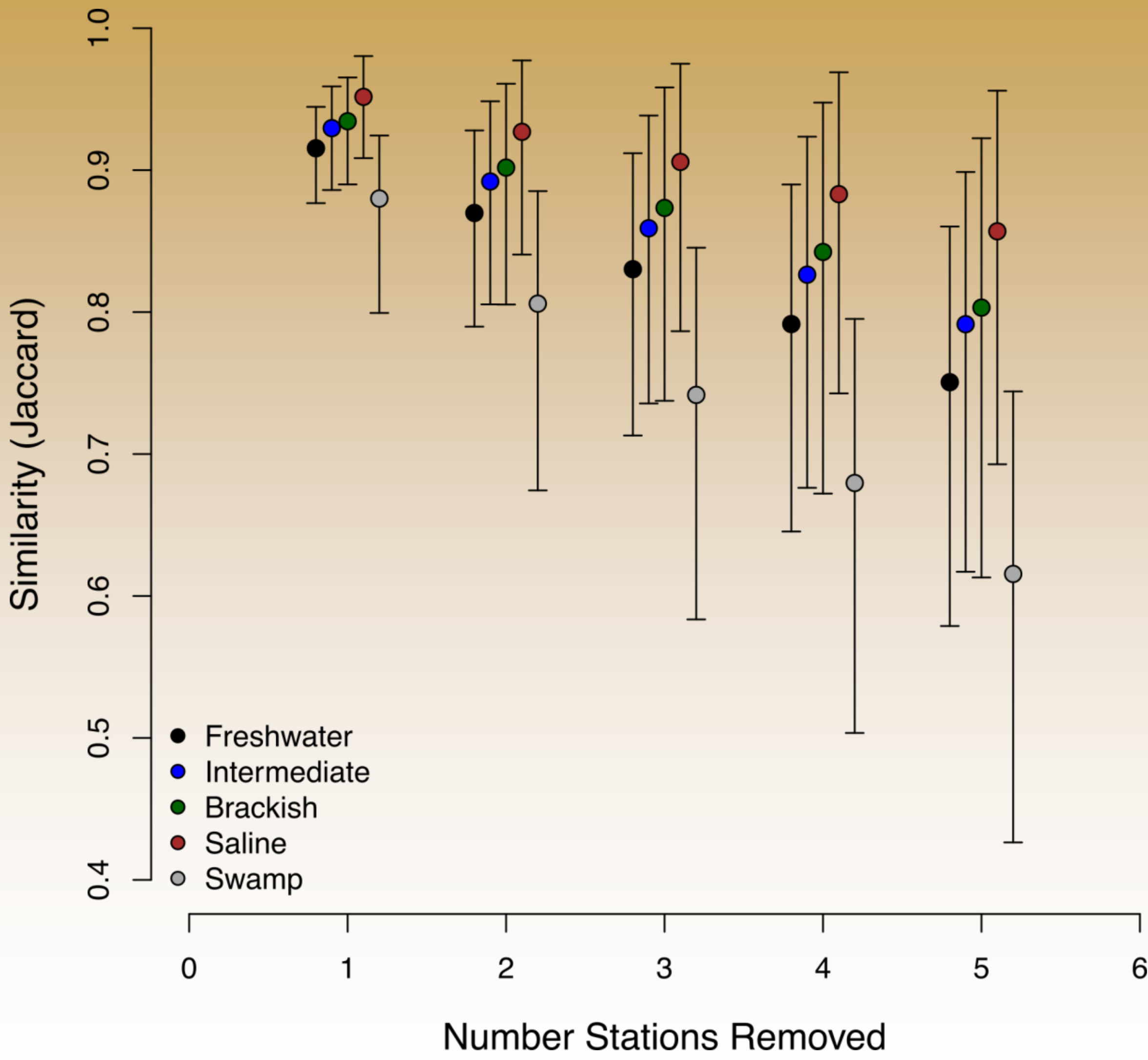
Potential Cost Cutting Mechanisms Reduce Annual Vegetation Effort



Proportion of species presence/absence in the full dataset that we observe when we leave out stations.

Likely to miss 20% of species presence which has direct implications for site classification.

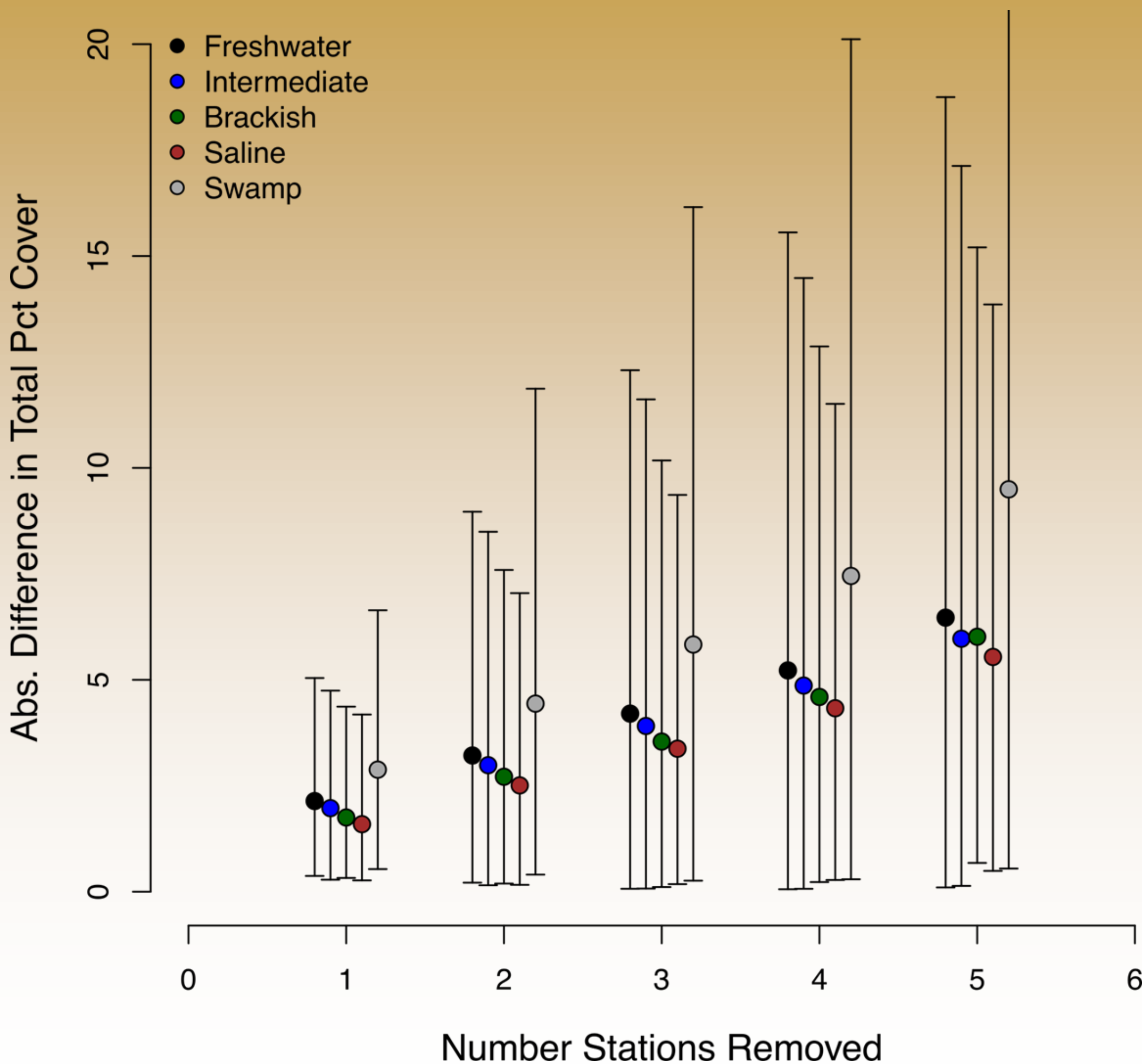
Potential Cost Cutting Mechanisms Reduce Annual Vegetation Effort



<u>Species composition</u> in the full dataset that we observe when we leave out stations.

The community we would see is 25-40% different to the one we would get with 10 plots.

Potential Cost Cutting Mechanisms Reduce Annual Vegetation Effort



Difference in total cover (regardless of species).

Total cover has been shown to the best predictor of future transition to open water.

Losing precision in the estimates will directly effect our understanding of which sites are most vulnerable.

Potential Cost Cutting Mechanisms
Reduce Annual Vegetation Effort

- **Results for some metrics are concerning**
  (i.e., Probability of correctly ID'ing dominant, similarity, & total cover)

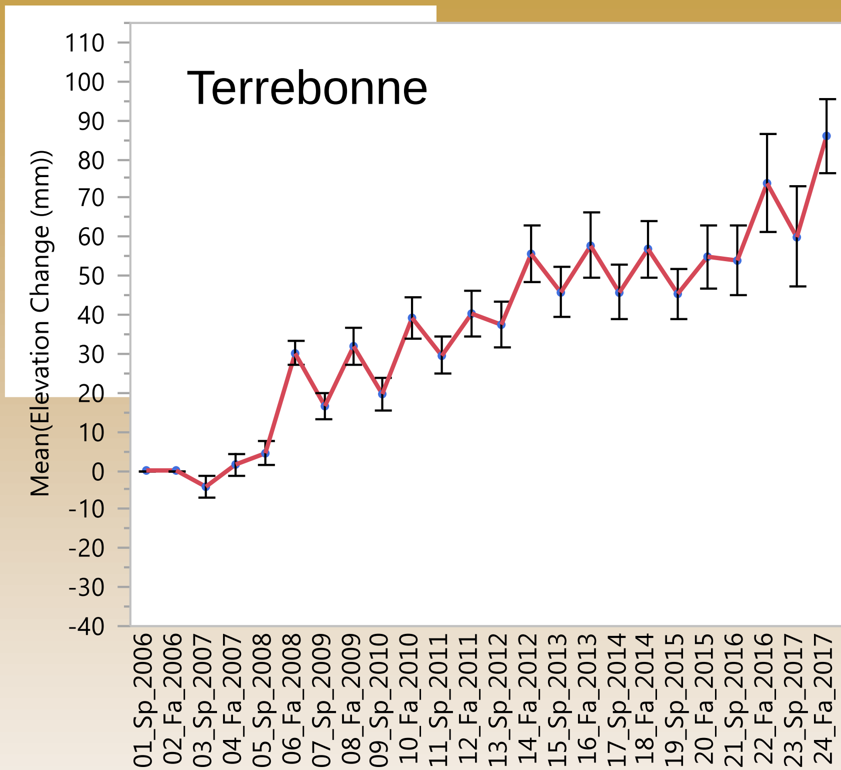
- **Major changes to vegetation sampling would influence how the data are used for interpretation and decision making**

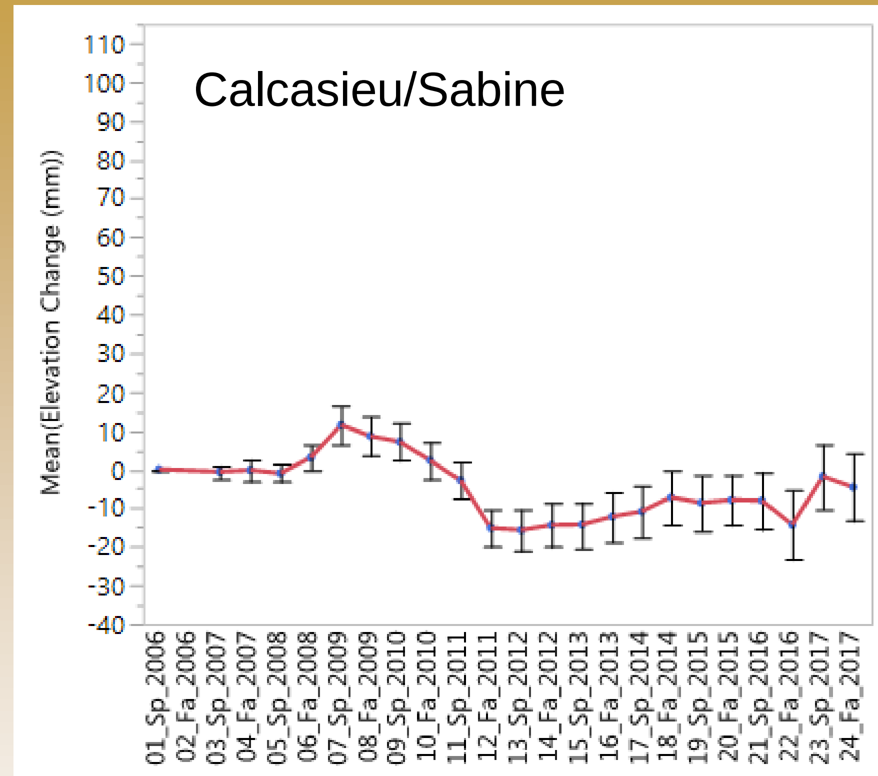
- **Need to balance potential cost reduction vs data reduction influences on ecological assessment and modeling**

Potential Cost Cutting Mechanisms
RSET Sampling Modifications

- We currently measure RSET and Accretion every spring and fall.
- We use those data to generate Elevation Change and Accretion Rates.
  - Used in SVI and determine restoration influence on the marsh surface
- We considered whether or not we get the same Elevation Change Rate if we only collected data in one of the two seasons.

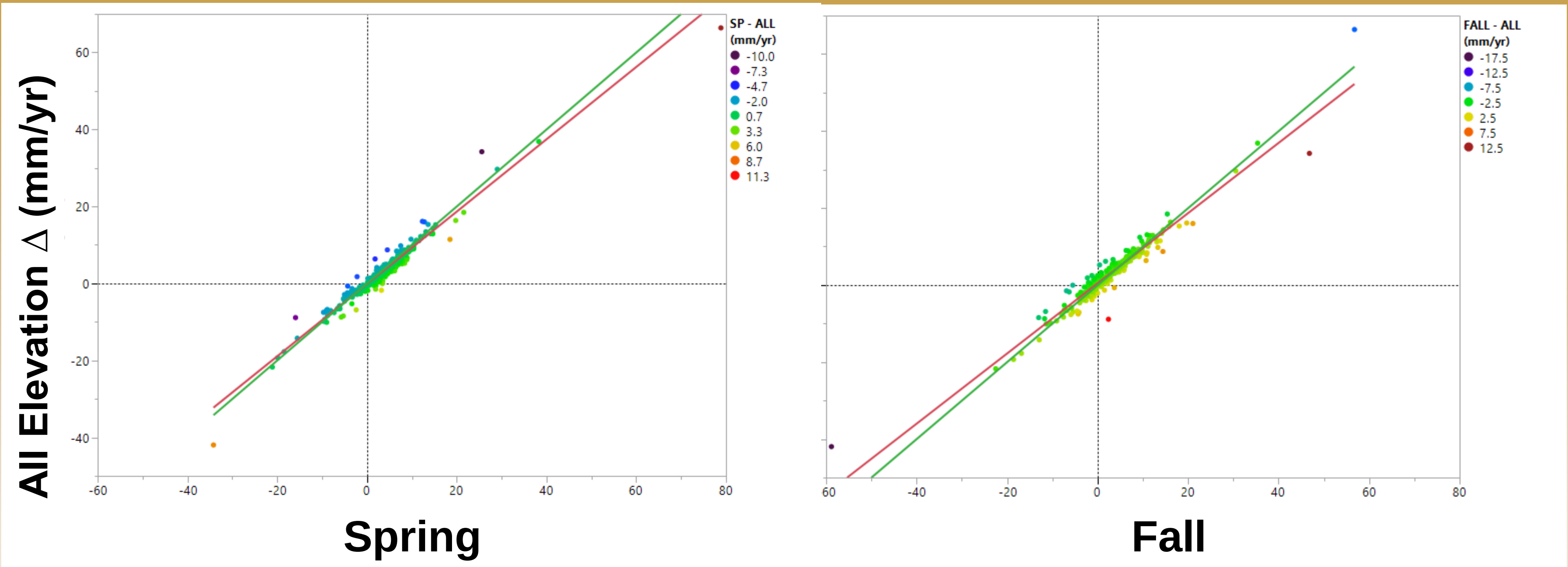
Potential Cost Cutting Mechanisms
RSET Sampling Modifications





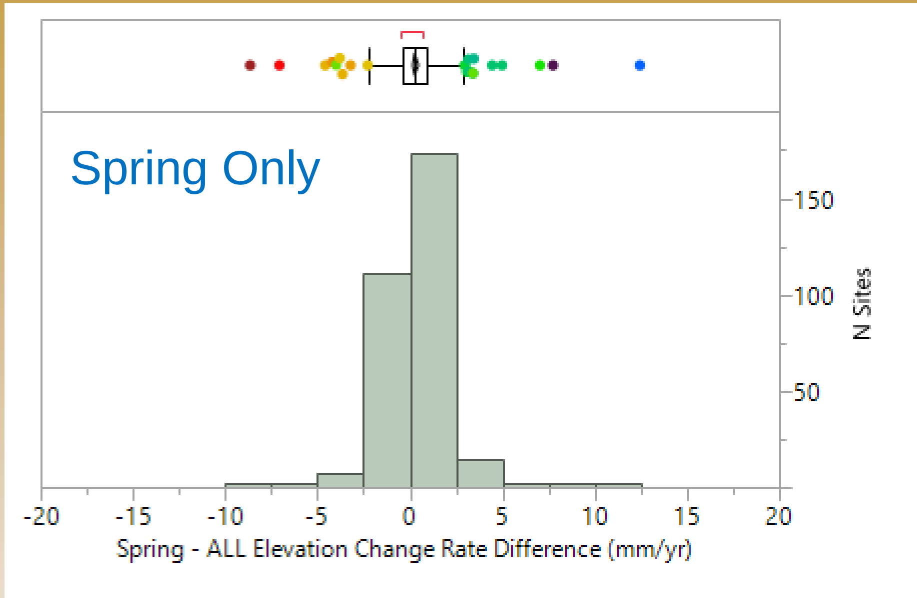
- Some basins show a clear seasonal pattern where elevations are lower in the Spring and higher in the Fall (Upper ME, TE and BA).
- The processes that drive this seasonality are not well understood.
- Measuring 1x/yr will not capture the process in the CRMS surface elevation data.

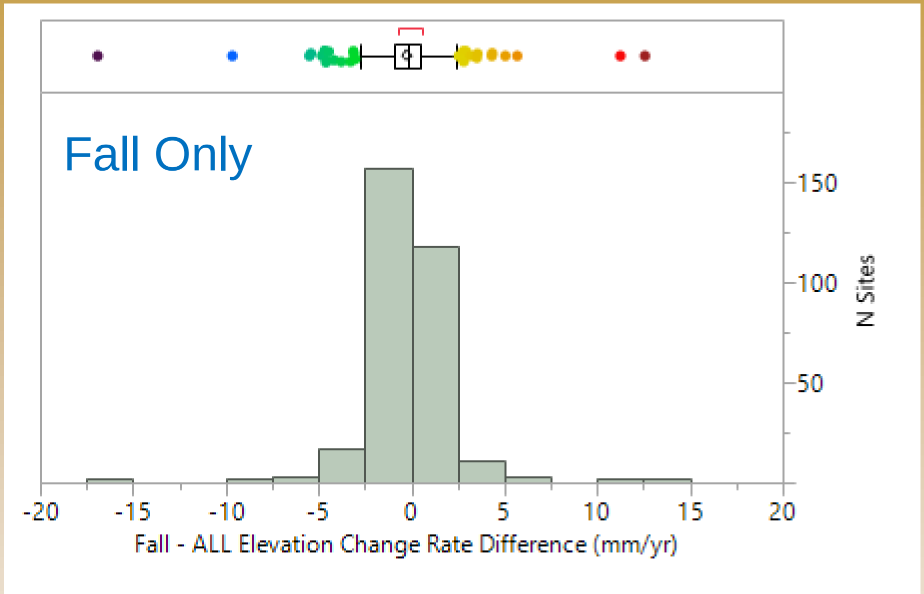
Potential Cost Cutting Mechanisms
RSET Sampling Modifications



- Sampling in spring OR fall would give the same general information about site surface elevation change.
  - Sites with high elevation gain rates still have high elevation change rates and vice versa.
  - Some sites with low elevation change rates see their sign flip (13 Spring Only; 21 Fall Only)

Potential Cost Cutting Mechanisms
RSET Sampling Modifications





- Spring Only measurements are slightly higher than current rates (mean 0.3 mm/yr) and Fall Only measurements are slightly lower than current rates (-0.2 mm/yr).
- Starting elevation in the spring is lower than starting elevation in the fall.
  - Spring Only would provide a higher elevation change rate from a lower starting point.
  - Fall Only would provide a lower elevation change rate from a higher starting point.

Potential Cost Cutting Mechanisms
RSET Sampling Modifications

- Programmatically we are using linear regression to determine elevation change rates.
- Using both spring and fall data provides the best fit.
- However, if we have to choose Spring or Fall Only sampling, then we should chose the season with the best linear regression fits.
- Spring Only has lower Std Error and smaller P-values than Fall Only.

Data Set	N Sites minimum Std Err	N Sites P value (<0.05)
BOTH	285	223
FA	4	189
SP	18	211

Potential Cost Cutting Mechanisms
RSET Sampling Modifications

- We can estimate elevation change rates with one measurement per year.
- Spring would be better than fall because it is closest to using all of the data and has the best regression fits.
- Access restrictions occur at many sites during the fall.
- We will be unaware of whether or not sites continue to show a seasonal pattern or develop a seasonal pattern.

Update Coastwide Aerial Photography

- Coastwide high resolution aerial photography was collected in fall of 2018.
- Data are currently being QA/QC’d
- August 2019, anticipated delivery to USGS
- Project specific land/water analyses have been prioritized and will start as soon as the data are available.
- 2021 and 2024 coastwide collections are last in programmatic budget with the intent of using data from a constellation of satellites thereafter

Questions??

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