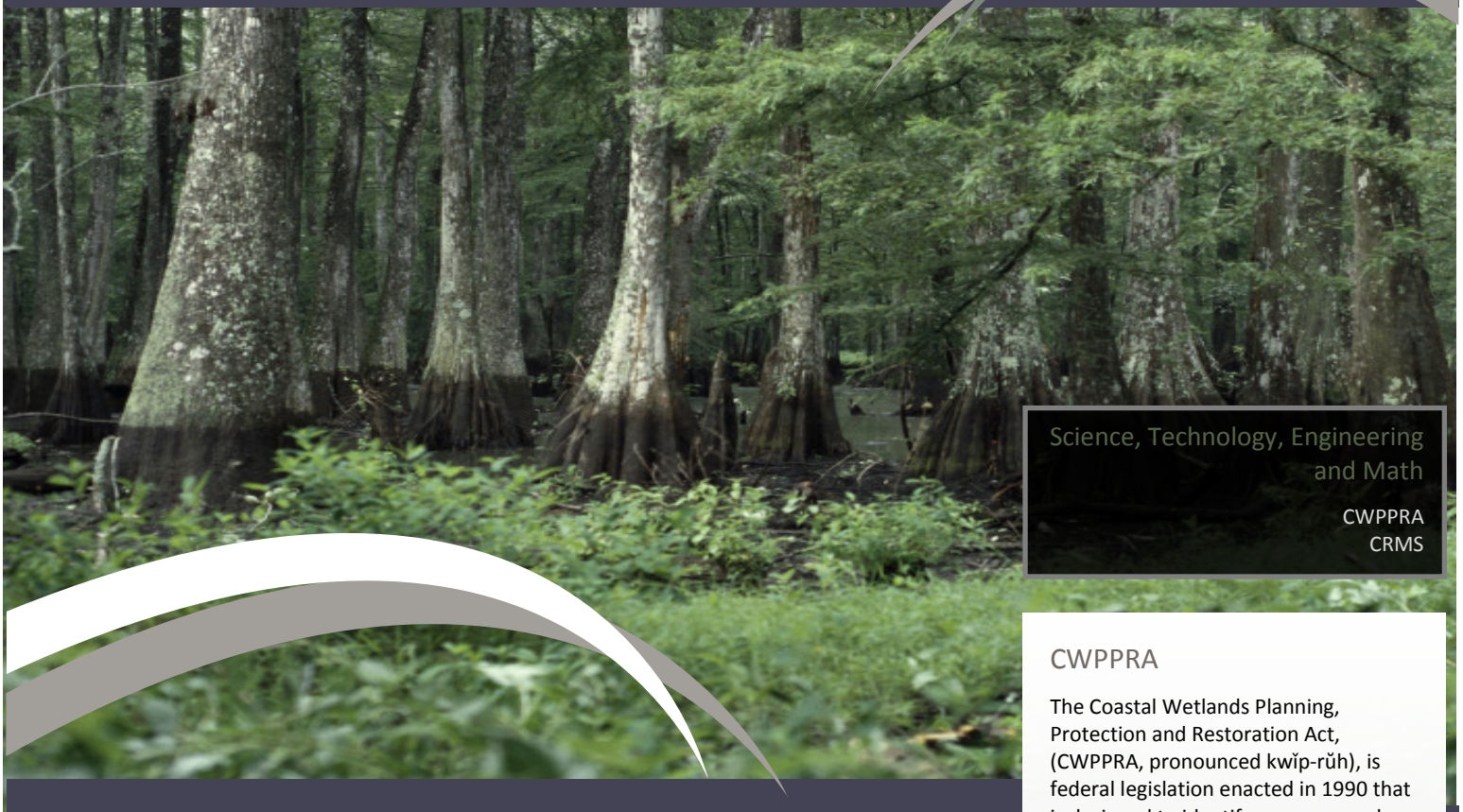
STEM, Louisiana Wetland Restoration, and Student Success

National Science Teachers Association Meeting -November 10, 2011



Science, Technology, Engineering and Math

CWPPRA
CRMS

Science, Technology, Engineering and Math -STEM

In order for the United States of America to remain economically competitive, our citizens must invest in science, technological research, engineering, and mathematics. Currently, in many school districts, there is a push to increase student participation and interest in these subjects with the purpose of creating a well-developed workforce.

Many scientific organizations have even prepared position statements that endorse "preparing students for success in the global economy." There are education blogs, coalitions, guidebooks, lesson plans, and books related to encouraging students to pursue careers in one of the aforementioned areas. While all of these are important parts of being a solution to our country's need, classroom teachers are often faced with the stark reality of preparing lessons that engage students in real life science, technology, engineering and math or "STEM."

This unit is designed to teach students about an active group of environmentalist in Louisiana and their effort to protect a dynamic, unique, wetlands ecosystem. As you uncover the projects and people who work via the Coastal Wetlands Planning, Protection and Restoration Act; the goal of this lesson is to inspire students to become engage in defending the habitat that they appreciate.

CWPPRA

The Coastal Wetlands Planning, Protection and Restoration Act, (CWPPRA, pronounced kwĭp-rŭh), is federal legislation enacted in 1990 that is designed to identify, prepare, and fund construction of coastal wetlands restoration projects. Since its inception, 149 coastal restoration or protection projects have been authorized, benefiting over 112,000 acres in Louisiana. The legislation (Public Law 101-646, Title III CWPPRA) was approved by the U.S. Congress and signed into law by former President George H. W. Bush. Learn more at *www.LaCoast.gov*

CRMS

CWPPRA's Task Force implemented the Coastwide Reference Monitoring System (CRMS) as a mechanism to monitor and evaluate the effectiveness of CWPPRA projects at the project, region, and coastwide levels. The CRMS design implements a multiple reference approach by using aspects of hydrogeomorphic functional assessments and probabilistic sampling. Learn more at *www.LaCoast.gov/crms*

Secretary of the Environmental Protection Agency (EPA), Ms. Lisa Jackson, visits CWPPRA's coastal restoration project at Bayou Dupont in Louisiana.

Students learn about various wetland plants that are used to protect and preserve Louisiana habitats.

Students study barrier island beach profiling in Grand Isle, Louisiana's only inhabited barrier island.

Instructional Information

Topic can be taught in: ***Physical Science, Earth Science, Environmental Science, Introduction to Engineering, and Mathematics***

Grade level: ***8th to 12th***

Topic of lesson: *Students will learn how Louisiana is rebuilding its vanishing coastal wetlands ecosystem. Students will learn about restoration techniques and related monitoring efforts tied to real-time online field-gathered statistics.*

Objective: *The students will be able to utilize: mathematics, organizational tools, and graphing skills to solve problems; write and defend a conclusion based on logical analysis of experimental data; cite examples of scientific advances and emerging technologies and how they affect society; analyze the conclusion from their investigation by using data to determine its validity; and use the rules of evidence to examine experimental results.*

Rationale: *This lesson was developed in order to provide students with access to actual scientific information that is currently used by scientists and engineers to create new projects and evaluate the effectiveness of current coastal restoration projects. Teachers may choose to use this lesson at the beginning of the year to introduce scientific processes or may choose to use the lesson prior to year-end testing. By looking at actual real-time data, students are more likely to engage the topic.*

Instructional Strategies: *Direct instruction, inquiry-based discussion*

Materials: *Online access for students is necessary!*

Resources: **http://LaCoast.gov**

http://LaCoast.gov/CRMS

http://LaCoast.gov/new/Pubs/videos.aspx

Computer Software Requirements: Adobe Reader, a video media player

Activities:

1. The instructor will introduce the topic of Louisiana wetland loss, coastal wetlands protection and restoration via PowerPoint presentation.

2. Students will review the "East Marsh Island Marsh Creation, TV-21" CWPPRA project. Students will watch a 6 minute video about the TV-21 restoration efforts.

3. Students will view data from the nearby CRMS site, "CRMS0523." Students will analysis real-time data from the site.

4. Students will write a short report about what they have learned.

Extensions: *There are 390 CRMS sites and 149 CWPPRA coastal restoration projects. Students can investigate other sites and projects.*

Assessment: *Assess student's understanding through use of worksheets, reports and incorporating formative assessments as students work through projects.)*

CWPPRA- Understanding the Actions

Why Protect Louisiana?

Louisiana wetlands are unique and vital ecological assets worth saving. Wetlands act as a storm buffer against hurricanes. They act as flood control devices by holding excess floodwaters during high rainfall (much like a sponge). Wetlands replenish aquifers. They purify water by filtering out pollutants and absorbing nutrients. CWPPRA funds have been instrumental in helping to restore Louisiana's vanishing wetlands. Approximately 40 percent of the coastal wetlands in the lower forty-eight states are located in Louisiana. Unfortunately, this fragile environment is disappearing at an alarming rate. Louisiana has lost up to 40 square miles of marsh per year for several decades – that accounts for 80 percent of the nation's annual coastal wetland loss.

To date, Louisiana has lost coastal land area equal to the size of the state of Delaware. This loss is at an average rate of an acre every hour. If the current rate of loss is not slowed by the year 2040, an additional 800,000 acres of wetlands will disappear, and Louisiana's shoreline will advance inland as much as 33 miles in some areas.

Wetlands also provide habitat for a variety of wildlife. Coastal Louisiana lands are the breeding grounds and nurseries for thousands of species of aquatic life, land animals, and birds of all kinds – including our national symbol, the bald eagle. This ecosystem also provides a migratory habitat for over five million waterfowl each year.

People also benefit from Louisiana's coastal lands. Louisiana is responsible for a major portion of our nation's oil and gas production, shipping commerce, fisheries industry, fur harvesting, and oyster production, accounting for over 55,000 jobs and billions of dollars in revenue. Additionally, wetlands are wonderful recreational resources and are part of Louisiana's growing ecotourism industry. To learn more about the economic value of our wetlands, read "The Cost of Doing Nothing" in WaterMarks (Summer 1999).

CWPPRA project managers, scientists, and engineers use a variety of techniques to protect, enhance, or restore wetlands. Each restoration project may use one or more techniques to repair delicate wetlands. These techniques include: shoreline protection, barrier island restoration, marsh creation, fresh water reintroductions, sediment diversions, hydrologic restoration, marsh management, sediment and nutrient trapping, terracing, outfall management and vegetative plantings.

Total Active

CWPPRA Projects: **149**

Completed CWPPRA Projects: **93**

CWPPRA Active Construction Projects: **9**

CWPPRA Projects Currently in Engineering and Design: **47**

13 of the 47 scheduled for construction in FY2012

Since 1990, the wetland area that CWPPRA has protected, created, or restored in Louisiana is 112,000 acres

(Greater than 426,000 acres have also been enhanced.)

East Island Marsh Creation (TV-21)

History: HOW MARSH WAS CREATED IN LOUISIANA

Over millennia, sand silt, and clay delivered via the muddy floodwaters of the migrating Mississippi River built the wetlands of Louisiana's coastal zone.

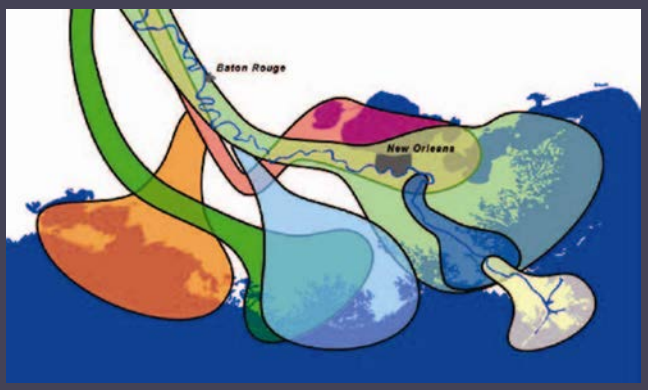


Diagram above shows the lobes of the river as they have changed over time.

Problem: HOW MARSH WAS DISTRUBED AND DESTROYED

With construction of the levees along the river to reduce flood risk to adjacent communities, the floodwaters responsible for creating the wetlands were channeled into the Gulf of Mexico. Without the annual re-nourishment from the river, wetlands have been sinking and converting to open water. Additionally, man-made canals changed the hydrology of the area.

Levees along the Mississippi River

Pipe delivering sediment

Solution: CREATIVE SOLUTIONS TO CHALLENGING PROBLEMS

To restore the sinking wetlands, marsh creation replicates the natural land building process in a controlled and much accelerated fashion. Land is built by a pipeline dredge that removes sediment from a borrow site and re-distributing the sediment to a strategic location. This new land is then vegetated and wildlife begins to return.

This is Louisiana's favorite reptile – the American Alligator (Alligator mississsippiensis). It is the largest reptile in North America.

September 2010 (rev)
Cost figures as of: October 2011

East Marsh Island Marsh Creation (TV-21)

Project Status

Approved Date: 2005 **Project Area:** 362 acres
Approved Funds: $22.6 M **Total Est. Cost:** $23.0 M
Net Benefit After 20 Years: 169 acres
Status: Construction
Project Type: Marsh Creation
PPL #: 14

Location

The project is located in the Teche/Vermilion Basin at the east end of Marsh Island Wildlife Refuge southeast of Lake Sand in Iberia Parish, Louisiana.

Problems

Substantial areas of interior emergent marsh on Marsh Island have been converted to open water, primarily because of Hurricane Lili (2002). Areas targeted under this project are those with the greatest historical land loss and within close proximity to East Cote Blanche Bay.

Restoration Strategy

This project is designed to re-create brackish marsh habitat in the open water areas of the interior marsh primarily caused by hurricane damage. Based on 2007 aerial photography analysis, approximately 197 acres of marsh will be nourished and 165 acres of open water will be restored to interior emergent marsh habitat. The loss rates for the interior ponded areas are estimated to be reduced by 50 percent. This project provides a synergistic effect with CWPPRA's Marsh Island Hydrologic Restoration (TV-14), a project constructed in December 2001.

Aerial view of the east end of Marsh Island after commencement of construction activity.

Aerial view of the east end of Marsh Island where material dredged from East Cote Blanche Bay will be deposited to fill in open ponds and nourish marsh.

Progress to Date

The Louisiana Coastal Wetlands Conservation and Restoration Task Force approved funding for engineering and design at their February 2005 meeting. The U.S. Environmental Protection Agency and the Natural Resources Conservation Service, working through the Louisiana Department of Natural Resources, completed the engineering and design of the project and construction began in March 2010.

This project is on Priority Project List 14.

For more project information, please contact:

Federal Sponsors:

U.S. Environmental Protection Agency
Dallas, Tex.
(214) 665-7459

NRCS Natural Resources Conservation Service
Alexandria, La.
(318) 473-7756

Local Sponsor:
Coastal Protection and Restoration Authority
Baton Rouge, LA
(225) 342-4736

East Marsh Island Marsh Creation (TV-21)

Marsh Creation/Nourishment *

Project Boundary

*denotes proposed features

USGS science for a changing world

0.1 0 0.1 0.2 Kilometers

0.1 0 0.1 0.2 Miles

Map Produced by:
U.S. Department of the Interior
U.S. Geological Survey
National Wetlands Research Center
Coastal Restoration Field Station
Baton Rouge, La.

Background Imagery:
2005 Digital Orthophoto Quarter Quadrangle

Map Date: June 20, 2008
Map ID: USGS-NWRC 2008-11-0289
Data accurate as of: June 11, 2008

CWPPRA Tools Used By Scientists, Engineers, Construction Staff, Members of the Public, Teachers, and Students

The **LaCoast.gov** web site contains:

- General Project Fact Sheets
- Environmental Assessments
- Ecological Reviews
- Project Manger's Technical Fact Sheets
- Maps
- Data (may include mosaics or additional engineering data)
- Wetland Value Assessments
- Monitoring Reports
- Project Schedule
- Coastwide Reference Monitoring System (CRMS) Reports
- Louisiana's Unified Coastal Community (LUCC) Calendar
- WaterMarks Magazine
- Volunteer Links
- Educator Links and Pages

Students Enjoy Using Technology for Communicating Scientific Information

Q: How do teachers engage students while safely using technology?

One of the safest ways to use technology in the classroom is to use a trusted site. Sites that end with .gov and .edu are generally secure resources. CWPPRA has a host of educational materials including fact sheets, data tables and movies to engage students. Additionally, CWPPRA has posted videos on YouTube.com and plans to start a Facebook Page.

http://lacoast.gov/new/Pubs/videos.aspx

STEM Student Achievement

October 19th, 2010

White House honors student achievement in STEM education

During first-ever White House Science Fair, President Obama also announces several new STEM education programs

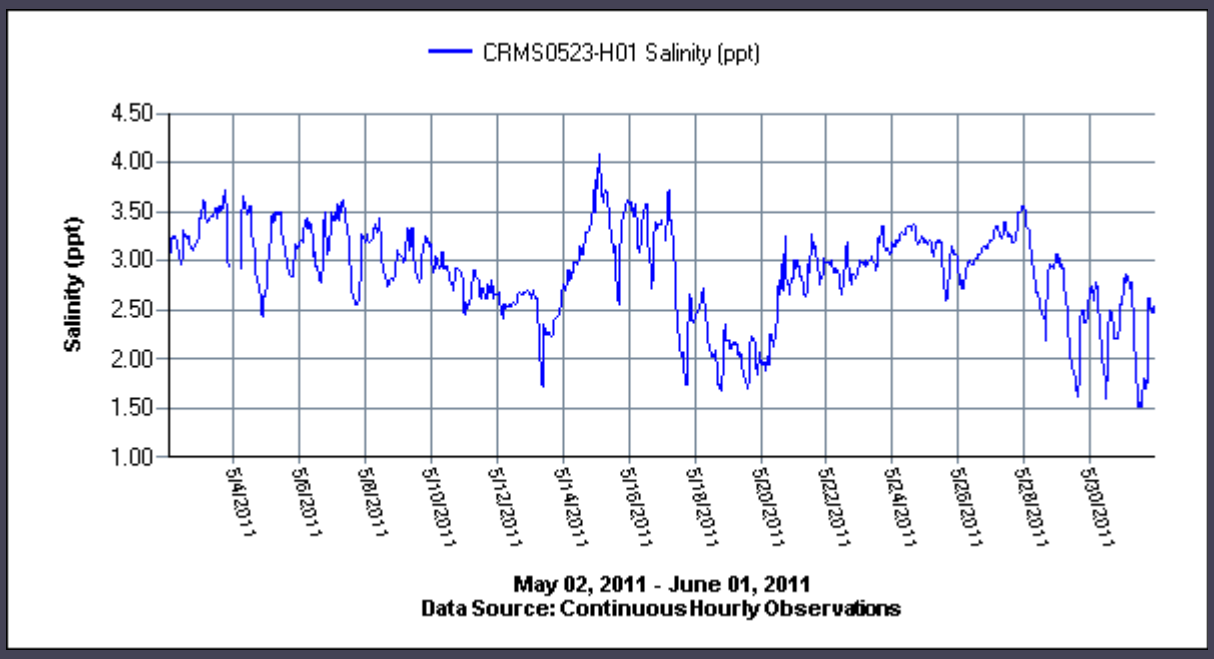
By Jenna Zwang,

… Those young people, being honored for their student achievement in the STEM disciplines, presented astoundingly impressive projects, from a sophomore girl who developed a new technique for battling cancer with light activation to a high school team from Tennessee that developed a self-contained water purification system.

"Now if that doesn't inspire you, if that doesn't make you feel good about America and the possibilities of our young people when they apply themselves to science and math, I don't know what will," Obama said. … …. ….

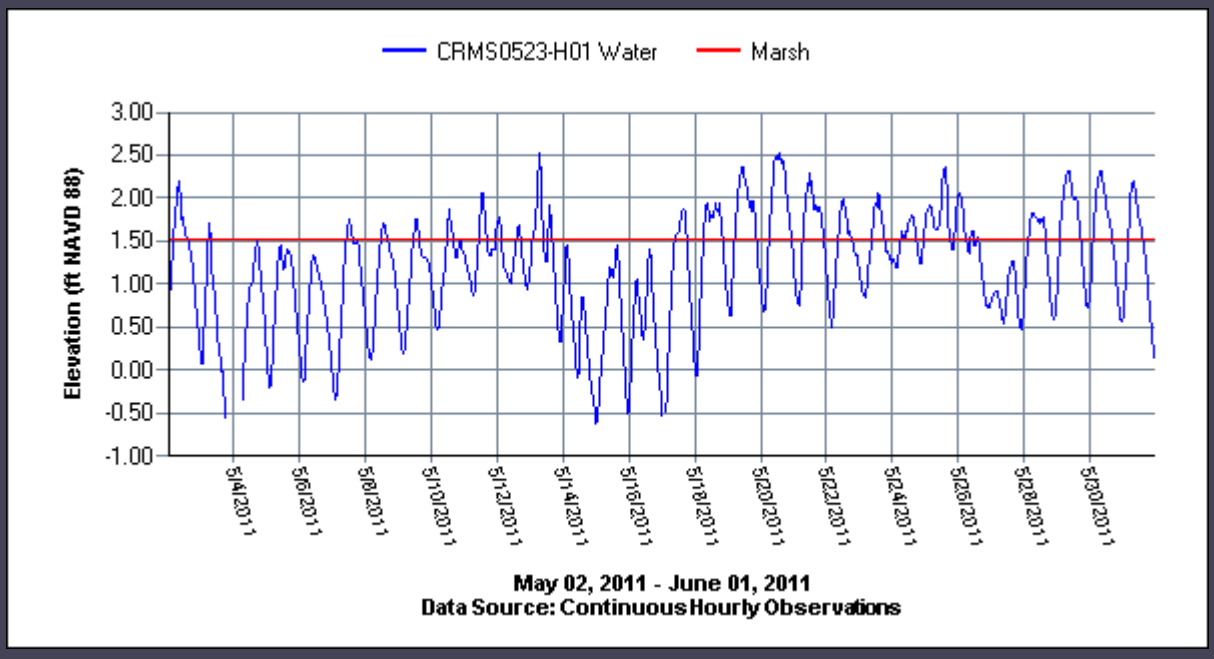
http://www.eschoolnews.com/2010/10/19/white-house-honors-student-achievement-in-stem-education/

CRMS Graphs



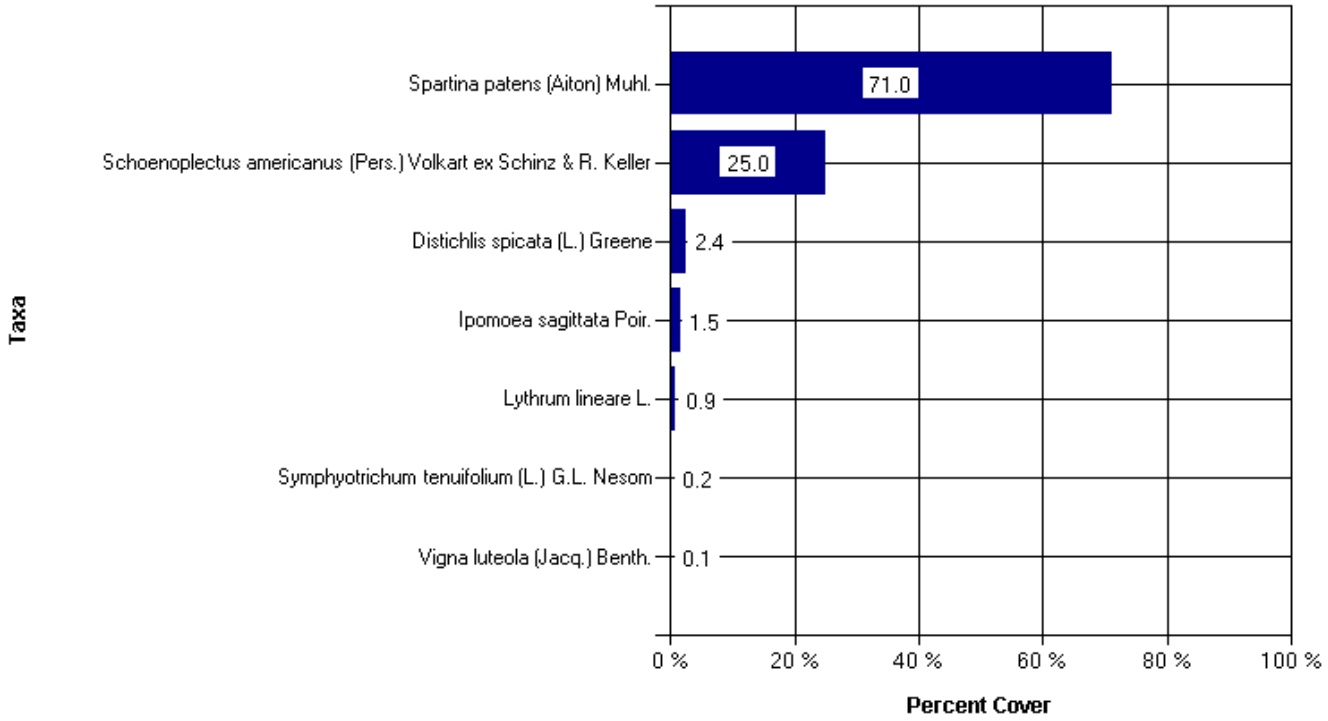
1. What could be a cause of the daily changes in salinity? Or, what influences salinity?
2. Which day during this month had the highest salinity?
3. What could be a cause for the spike in salinity?
4. What day had the lowest salinity?
5. Name three organisms that are affected by salinity?
6. What additional questions can you come up with?

CRMS Graphs

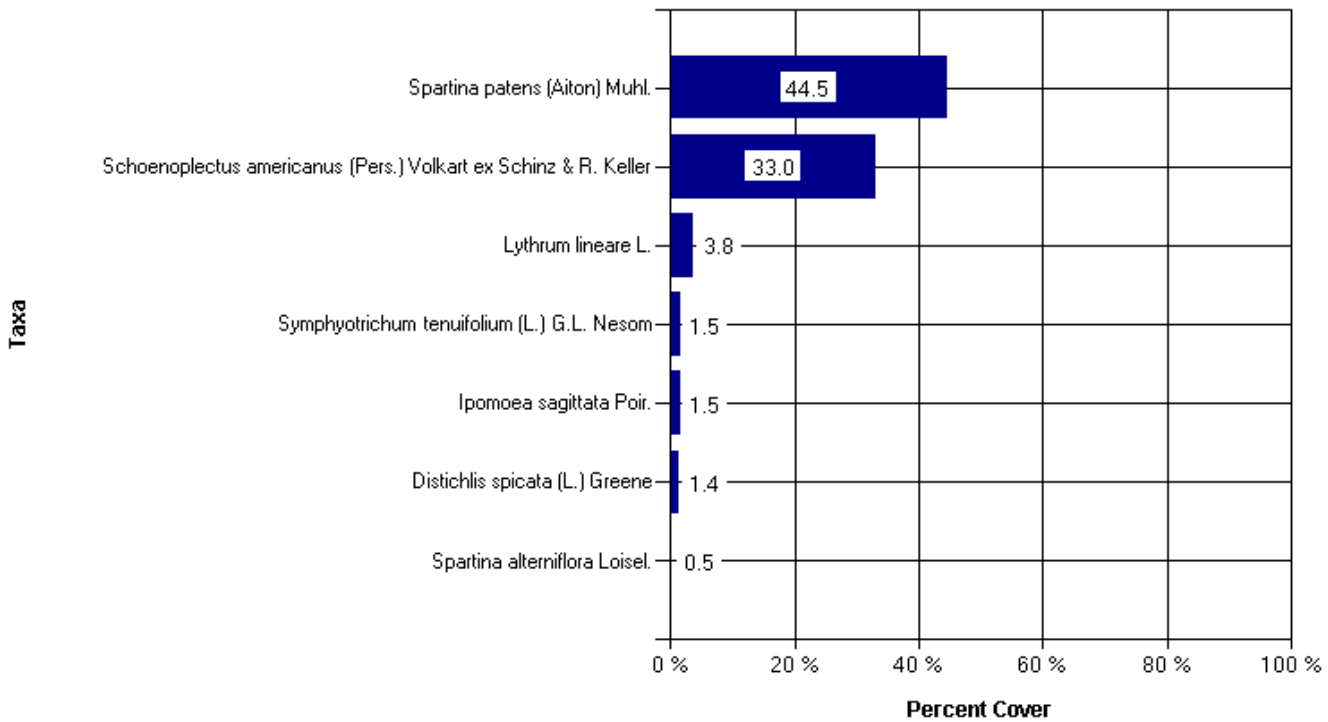


7. What does the red line represent?
8. What does the blue line represent?
9. Estimate the number of days during the month that the marsh is covered with water?
10. Estimate the high tide on May 13, 2011?
11. Estimate the low tide on May 16, 2011?
12. How much of the marsh is covered with water during the high tide on May 21, 2011?
13. What additional questions can you come up with?

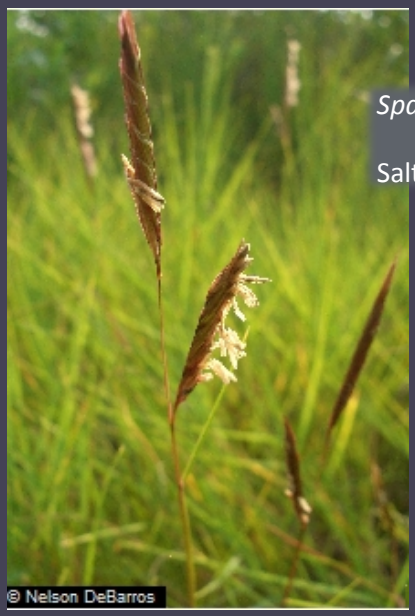
Herbaceous Marsh Vegetation Data
Site CRMS0523 - All Plots
Sample Date 08/16/2007



Herbaceous Marsh Vegetation Data
Site CRMS0523 - All Plots
Sample Date 05/26/2010



Images of Plants Found on CWPPRA Projects



Spartina patens

Salt meadow cordgrass

Ipmoea sagittata

Salt marsh morning glory

Schoenoplectus americanus

Chairman's bulrush

Lythrum lineare

Wand lythrum

Distichlis spicata

Salt grass

All plant images are from USDA Plants Website

Plants.USDA.gov

USDA United States Department of Agriculture Natural Resources Conservation Service NRCS

1. What year was the first data recorded about plants at this station?

2. What year was the last data recorded at this station?

3. Which plant is the most common in both years?

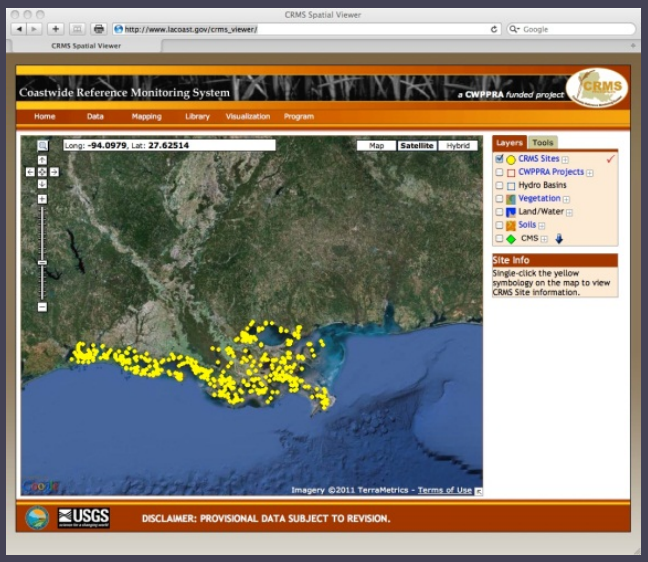
4. Give the percent cover of the Chairman's bulrush from each graph.

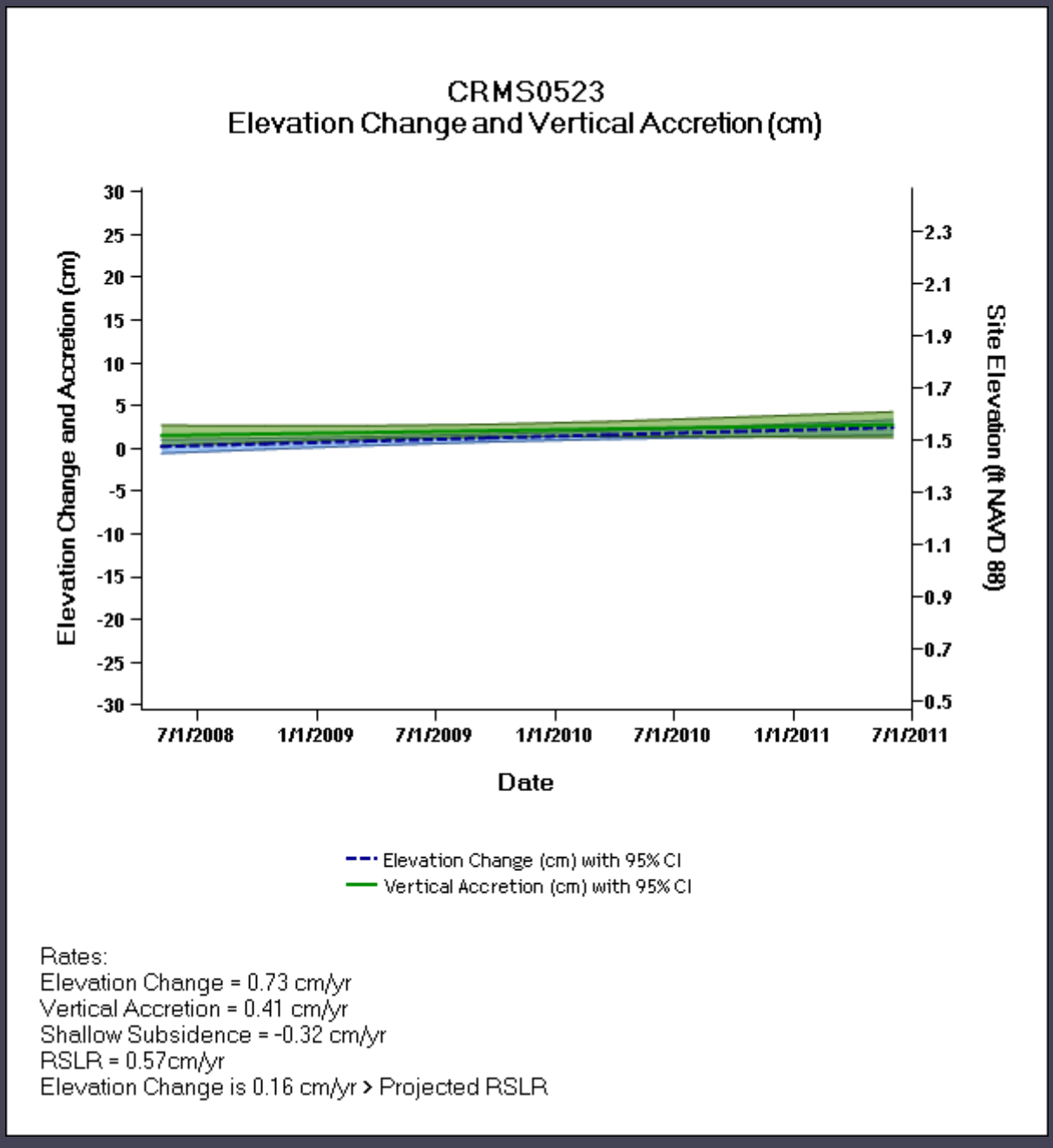
5. Why is plant diversity important in an ecosystem?

6. Which plants make up less than one percent of the population in 2007? In 2010?

7. What role do you think plants play in habitat restoration?

8. As a student, if you were going to help out with coastal restoration, which type of activity would you prefer to do and why?
    a. Grow new plants for restoration.
    b. Volunteer to help with a coastal restoration planting event.
    c. Write an article in the school newspaper to share information about restoration.
    d. Create a video to share information about coastal Louisiana.





Rates:
Elevation Change = 0.73 cm/yr
Vertical Accretion = 0.41 cm/yr
Shallow Subsidence = -0.32 cm/yr
RSLR = 0.57cm/yr
Elevation Change is 0.16 cm/yr > Projected RSLR

Professional Development

CWPPRA – Providing Louisiana with Coastal Restoration Solutions Since 1990

Abstract:

Help students become engaged!

Want your students to remember science, technology, engineering, and math (STEM) skills? Give them a chance to learn about how Louisiana is rebuilding its vanishing coastal wetlands ecosystem. In this presentation, teachers and informal educators will learn instructional techniques tied to real-time online field-gathered statistics. Also, receive a host of ***free*** materials including lesson plans, interactive CDs, books, short educational videos, and magazines related to Louisiana's coastal restoration. Bring home a taste of Louisiana's rebuilding strengths that includes actual data from the Coastal Wetlands Planning, Protection and Restoration Act's efforts.

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