

# Keeping Our Heads Above Water

## —Success of Restoration Projects

### Learning Objectives

- Analyze maps and graphed data showing a barrier island before and after restoration and before and after Hurricanes Katrina and Rita.
- Evaluate the success of the restoration project using the data and by collecting online information.
- Predict the future changes in land area in the barrier islands.

### Materials List

- Computer with internet access
- Activity Sheets 1, 2, and 3 (one per student or student group)
- Copy of BTNEP resources Posters of *The Barrier Islands of the Barataria-Terrebonne Estuary*

### Focus/Overview:

In this lesson, students will use maps and graphed data created by coastal scientists, as well as online information on coastal restoration projects, to analyze changes in land area that have taken place on Louisiana's barrier islands. They will use critical thinking skills to evaluate a restoration project on a barrier island in terms of costs and benefits. They will make predictions about future land area changes on the barrier islands.

### Background:

The Isles Dernieres barrier Islands (made up of Raccoon, Whiskey Trinity, and East Islands), have been eroding for many years and in 1989, scientists made the following prediction: "The Isles Dernieres now lie several miles seaward of the retreating mainland, and at current rates, they will be destroyed by 2007" (McBride and others, 1989, in Louisiana Barrier Island Erosion Study: Atlas of Shoreline Changes). Although it may seem that they were mistaken, the islands are above water today because projects were designed and implemented that increased their width and height by pumping sediment onto them. Figure 1 on Activity Sheet 2 illustrates an example of one of these projects. In all, Raccoon, Whiskey, Trinity, and East Islands in the Isles Dernieres chain and Timbalier and West Timbalier Islands have all been restored in this way. These projects have proved successful in helping to maintain the barrier islands in the face of numerous storms. In this activity we will take a close look at these projects and analyze their costs and benefits to decide just how successful they really are.

## Preparation

- Make enough copies of Activity Sheets 1, 2 and 3 for the students to work individually or in small groups.

# Science

## Procedure—Analyze, Assess, Predict

## Using Figure 1

### *With Teacher's Guide to Activity Sheets*

1. Study Figure 1 on Activity Sheet 2. It is a map of Trinity Island before and after restoration done by CWPPRA, the Coastal Wetlands Planning, Protection and Restoration Act. List three differences you observe between the first and second map.

Answers will vary but may include: canals are filling in, there is more bare land, island is wider on the east.

2. Go to the website <http://www.lacoast.gov> and click on the “projects” tab at the top of the page. An interactive map will come up. You can mouse over this map to find any project (in this case *TE 24 on Trinity Island off the coast of Terrebonne Parish.*) An active link will appear and you can navigate to the project Fact Sheet. An alternate way to navigate to a project is to use the alphabetic list of all the projects in the state, via the link found below the map. In order to use the list to find the barrier Islands in the Barataria Terrebonne estuary, search for projects in Terrebonne Parish (beginning with “TE”) and then scroll down to Isles Dernieres Restoration Trinity Island (TE-24) and click on that project.

Find TE-24 General Project Fact Sheet and open it up. (Or print the fact sheets supplied at the end of this lesson.) Use this source of information to find the answers to the following questions:

- a. In what year was the project completed? **1999**
- b. What was the size of the project area in acres? **776 acres**  
How many acres of land were created by the project (not the same number)? **500 acres**  
How many acres are projected to remain after 20 years? **109 acres**
- c. Why will the area decrease over 20 years? **Answers will vary but may include causes for erosion or land loss such as hurricanes, wave action, winter storms, or human degradation.**
- d. How much did the project cost? **\$10.7 million** How much per acre is this (cost of project divided by the number of acres created)? **For 500 acres the cost is \$21,400 per acre but for 109 acres the cost is \$98,165 per acre.** How was this project funded? **Through federal and state funds in a project called the Coastal Wetlands Planning Protection and Restoration Act.**
- e. What is the main benefit of the project? **Creation of a new marsh platform that will protect the island and the land behind it.**

## Procedure—Analyze, Assess, Predict

## Using Figure 2

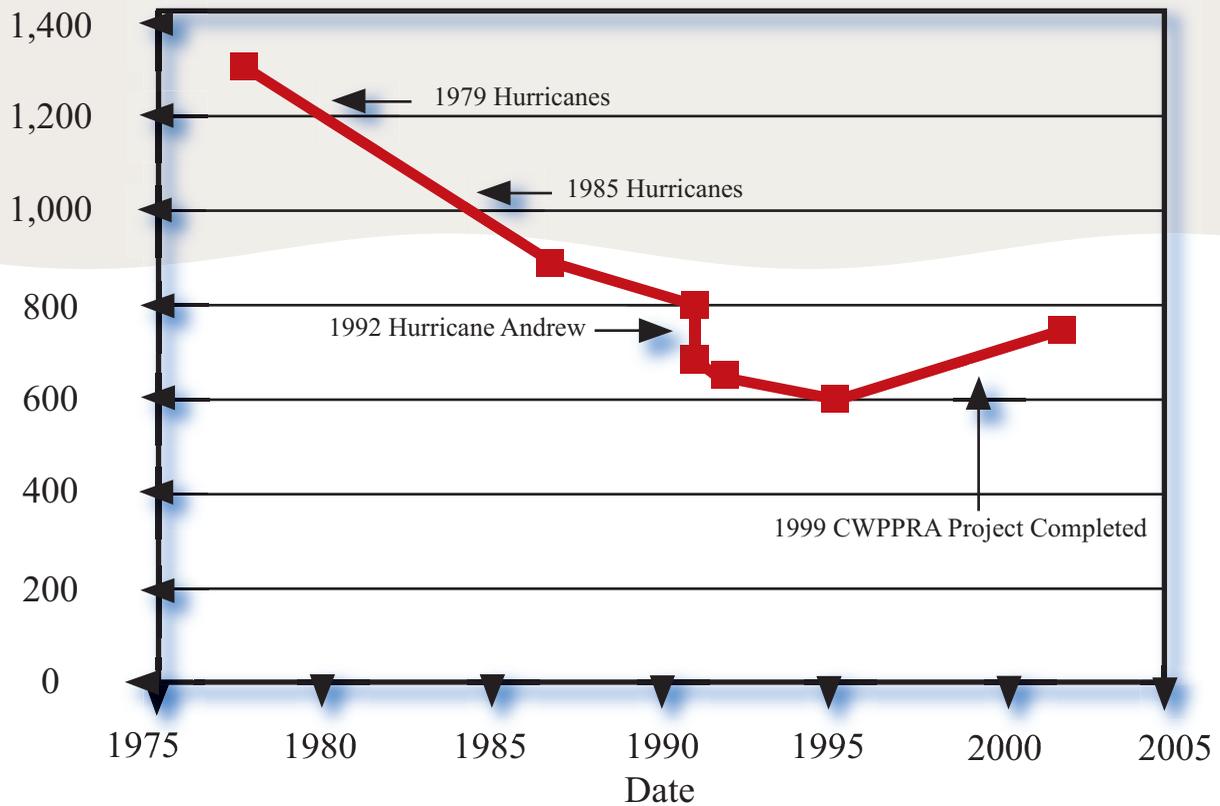
3. Use Figure 2 to answer the following questions about the effects of the 2005 hurricanes on Trinity Island
- What was the main impact of the hurricanes to Trinity and East Islands?  
**It removed sediment from the island.**  
Which of the two islands lost more land area? **East Island**
  - Before August/ September 2005, Trinity and East Islands were separate.  
What caused them to join? **Hurricanes moved the sediment.**
  - Based on the information available, do you think the restoration projects on Trinity and East Islands helped to prevent erosion during hurricanes Katrina and Rita?  
**Answers will vary.**

## Procedure—Analyze, Assess, Predict

## Using Figure 3

4. Use Figure 3 to answer these questions about Trinity Island's change over time.
- What was the land area of Trinity Island in 1978? **1,300 acres**
  - What was the land area after Hurricane Andrew in 1992? **680 acres**
  - What was the land area in 2002? **750 acres**
  - Calculate the change in area between 1978 and 1992 and between 1992 and 2002.  
**1978 to 1992 1,300 acres - 680 acres = 620 acres lost**  
**1992 to 2002 620 acres to an increase of 750 acres = 70 acres gained**
  - Do these figures indicate that the restoration project helped to increase the land area of the islands? **yes**
  - Draw a line on the graph to predict the land area change caused by Hurricanes Katrina and Rita (use Figure 2 to help you predict). **Slightly down**
  - Based on the information in the graph, write a prediction for the land area change for Trinity Island for the time period 2002 – 2020. What known and unknown factors must be taken into account to make such a prediction?  
**Land will probably be lost due to hurricanes and winter storms.**
  - What do you think your children will learn about Louisiana's barrier islands when they are your age? **Answers will vary.**
5. Based on your answers above and the knowledge you have about the values of barrier islands to Louisiana's coastal residents, complete the cost/ benefit table for TE 24 (Figure 4). Remember that some of the costs and benefits may not be obviously stated on the fact sheet. Write your thoughts about the cost versus the benefits of this project. Do you think it is worth the cost to the taxpayers? Be prepared to defend your decision.

**Figure 3:** Graph of land area change over time for Trinity Island



**Figure 4:** Cost-Benefit Chart

Costs	Benefits
10.7 million dollars	New land was created
Using sand from the shoals— Decreases the sediment budget	New wildlife habitat was created
Cost of plants, sand fences, etc.	New recreational areas were created
Dredging can have harmful effects on the environment	Protection from storms and surges in hurricanes

**Conclusions about the project**

Answers will vary

# Keeping Our Heads Above Water

## Success of Restoration Projects

**Student Name:** \_\_\_\_\_

### Using figure 1:

1. Study Figure 1 on Activity Sheet 2. It is a map of Trinity Island before and after restoration done by CWPPRA, the Coastal Wetlands Planning, Protection and Restoration Act. List three differences you observe between the first and second map. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
2. Go to the website <http://www.lacoast.gov> and click on the “projects” tab at the top of the page. An interactive map will come up. You can mouse over this map to find any project (in this case TE 24 on Trinity Island off the coast of Terrebonne Parish.) An active link will appear and you can navigate to the project Fact Sheet. An alternate way to navigate to a project is to use the alphabetic list of all the projects in the state, via the link found below the map. In order to use the list to find the barrier Islands in the Barataria Terrebonne estuary, search for projects in Terrebonne Parish (beginning with “TE”) and then scroll down to Isles Dernieres Restoration Trinity Island (TE-24) and click on that project. Find TE-24 General Project Fact Sheet and open it up. Use this source of information to find the answers to the following questions:
  - a. In what year was the project completed? \_\_\_\_\_
  - b. What was the size of the project area in acres? \_\_\_\_\_  
How many acres of land were created by the project (not the same number)? \_\_\_\_\_  
How many acres are projected to remain after 20 years? \_\_\_\_\_
  - c. Why will the area decrease over 20 years? \_\_\_\_\_

# Keeping Our Heads Above Water

## Success of Restoration Projects

- d. How much did the project cost? \_\_\_\_\_  
How much per acre is this (cost of project divided by the number of acres created)? \_\_\_\_\_  
How was this project funded? \_\_\_\_\_  
\_\_\_\_\_
- e. What is the main benefit of the project? \_\_\_\_\_  
\_\_\_\_\_

### Using figure 2:

3. Use Figure 2 to answer the following questions about the effects of the 2005 hurricanes on Trinity Island.
- a. What was the main impact of the hurricanes to Trinity and East Islands? \_\_\_\_\_  
\_\_\_\_\_
- Which of the two islands lost more land area? \_\_\_\_\_
- b. Before August/ September 2005, Trinity and East Islands were separate.  
What caused them to join? \_\_\_\_\_
- c. Based on the information available, do you think the restoration projects on Trinity and East Island helped to prevent erosion during hurricanes Katrina and Rita? \_\_\_\_\_
- d. Do you think the restoration project was successful in its goal to prevent the disappearance of the islands? \_\_\_\_\_

### Using figure 3:

4. Use Figure 3 to answer these questions about Trinity Island's change over time.

# Keeping Our Heads Above Water

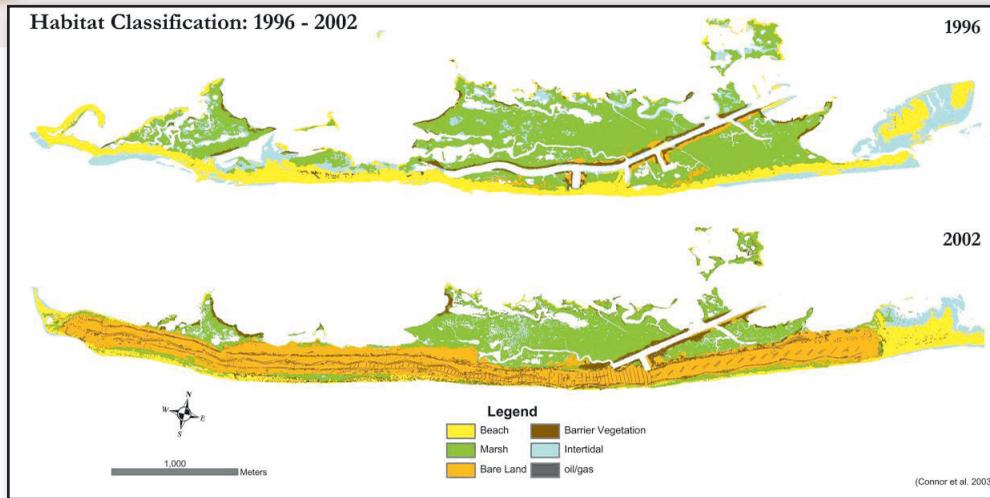
## Success of Restoration Projects

- a. What was the land area of Trinity Island in 1978? \_\_\_\_\_
- b. What was the land area after Hurricane Andrew in 1992? \_\_\_\_\_
- c. What was the land area in 2002? \_\_\_\_\_
- d. Calculate the change in area between 1978 and 1992 and between 1992 and 2002.  
1978 to 1992 \_\_\_\_\_  
1992 to 2002 \_\_\_\_\_
- e. Do these figures indicate that the restoration project helped to increase the land area of the islands? \_\_\_\_\_
- f. Draw a line on the graph to predict the land area change caused by Hurricanes Katrina and Rita (use Figure 2 to help you predict). \_\_\_\_\_
- g. Based on the information in the graph, write a prediction for the land area change for Trinity Island for the time period 2002 – 2020. What known and unknown factors must be taken into account to make such a prediction? \_\_\_\_\_  
\_\_\_\_\_
- h. What do you think your children will learn about Louisiana's barrier islands when they are your age? \_\_\_\_\_  
\_\_\_\_\_
5. Based on your answers above and the knowledge you have about the values of barrier islands to Louisiana's coastal residents, complete the cost/ benefit table for TE 24 (Figure 4). Remember that some of the costs and benefits may not be obviously stated on the fact sheet. Write your thoughts about the cost versus the benefits of this project. Do you think it is worth the cost to the taxpayers? Be prepared to defend your decision.

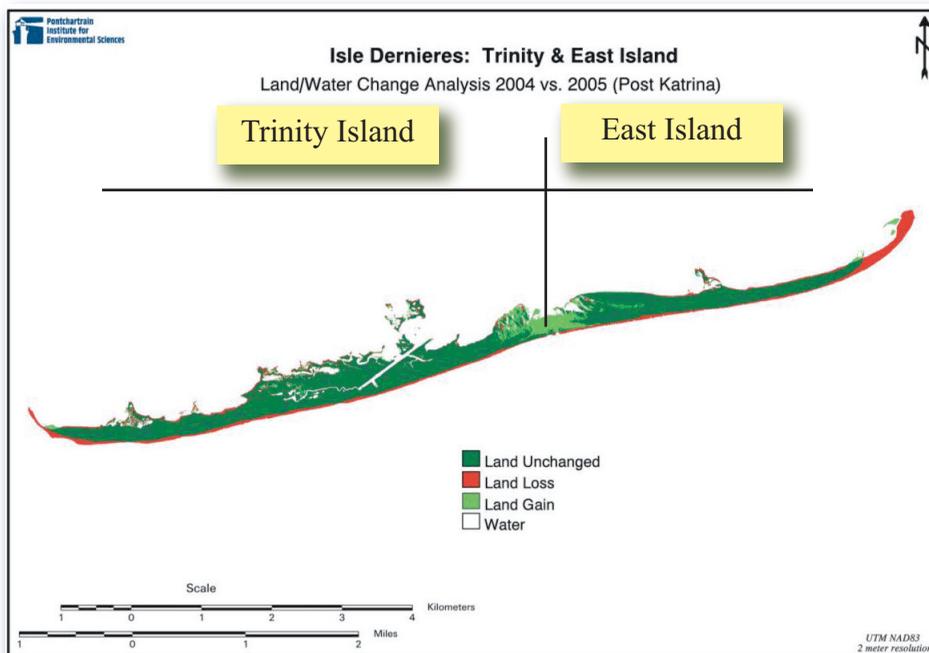
# Keeping Our Heads Above Water

## Change Over Time for Trinity and East Islands

Student Name: \_\_\_\_\_



**Figure 1:** Habitat classification maps showing Trinity Island before and after the restoration project was completed. The “bare land” area on the bottom section of the map is the sediment that was pumped onto the island. done by CWPPRA, the Coastal Wetlands Planing, Protection and Restoration Act.

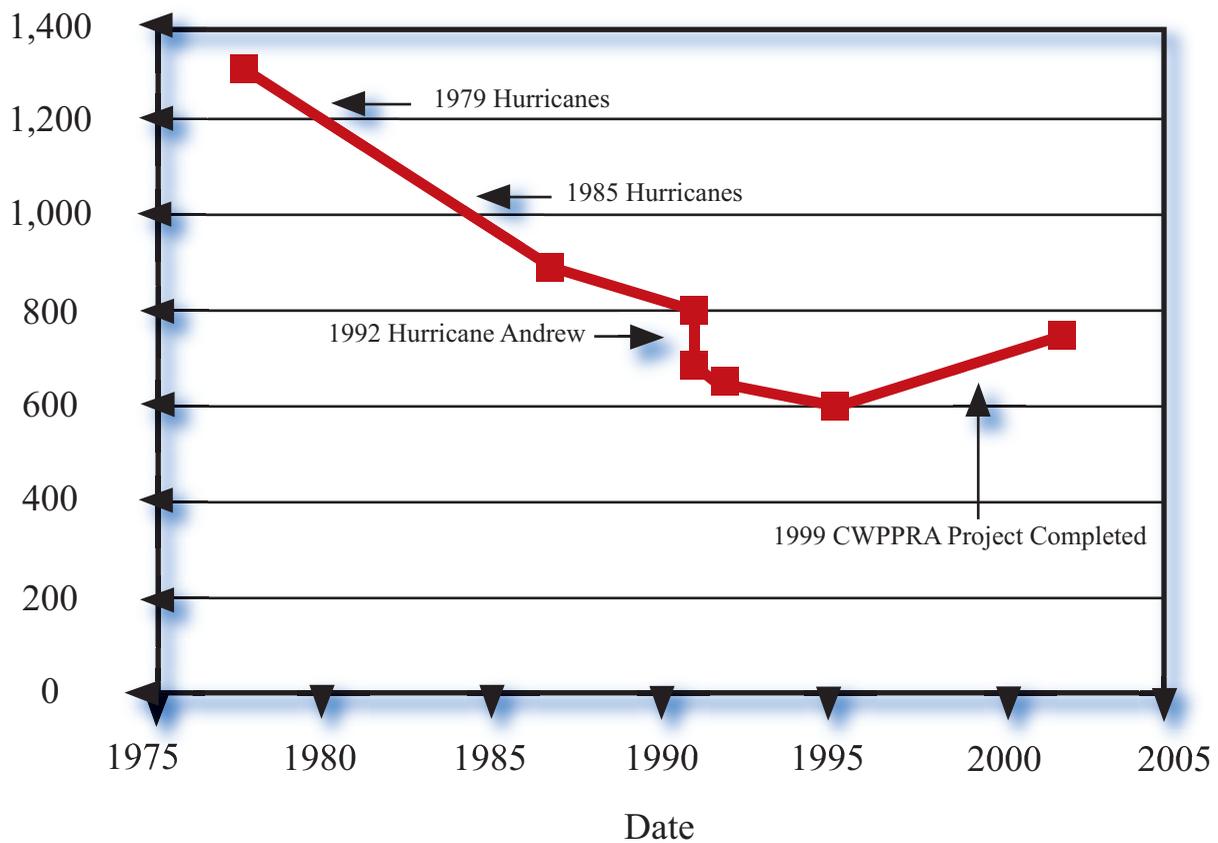


**Figure 2:** Land loss map showing Trinity and East Islands, now joined together by sediment deposition after hurricanes Katrina and Rita. The red area is the sediment lost due to the storm surges. The lighter green areas represent sediment deposition due to the storms.

# Keeping Our Heads Above Water

## Change Over Time for Trinity and East Islands

**Figure 3:** Graph of land area change over time for Trinity Island



# Keeping Our Heads Above Water

## Costs and Benefits of Restoration Projects

Student Name: \_\_\_\_\_

Figure 4: **Cost-Benefit Chart**

Costs	Benefits

**Conclusions about the project**



October 2002  
Cost figures as of: January 2012

## Isles Dernieres Restoration Trinity Island (TE-24)

This pdf can be found online at <http://lacoast.gov/new/Projects/Info.aspx?num=TE-24>

### Project Status

**Approved Date:** 1992      **Project Area:** 776 acres  
**Approved Funds:** \$10.7 M      **Total Est. Cost:** \$10.7 M  
**Net Benefit After 20 Years:** 109 acres  
**Status:** Completed June 1999  
**Project Type:** Barrier Island Restoration  
**PPL #:** 2

### Location

Trinity Island, which is one of five islands that make up the Isle Dernieres barrier island chain, is located approximately 13 miles south of Cocodrie, Louisiana, in Terrebonne Parish. It is bordered to the north by Lake Pelto and Terrebonne Bay, to the west by Whiskey Pass, to the south by the Gulf of Mexico, and to the east by New Cut and East Island.

### Problems

The Isles Dernieres chain of barrier islands in Louisiana is experiencing land loss and fragmentation as a result of both natural processes and human activities. Trinity Island was expected to be lost by the year 2007 if no restoration was completed. The entire Isles Dernieres chain was projected to be lost by the year 2010 without restoration.

Louisiana's barrier islands buffer coastal areas from the storm surges that accompany hurricanes and tropical storms. They also protect interior fringe wetlands along the bay's shoreline from waves coming from the open Gulf of Mexico. Trinity Island serves as a nursery area for waterfowl and migratory species.

### Restoration Strategy

The project required restoration of approximately 7.5 miles of both Trinity and East islands. It involved the construction of temporary perimeter containment dikes behind considerable stretches of the islands.

Sediment was suction-dredged from previously defined borrow areas of Lake Pelto and used to hydraulically fill the areas within the retaining dunes and dike structures.

An elevated marsh platform sloping from the dunes to the back bay dikes was created. The dunes and filled marsh were also planted with various species of vegetation.



Trinity Island sand fence and vegetative plantings.

### Progress to Date

Construction of this Isles Dernieres project is complete. The dredging and shaping was completed in October 1998 and the vegetative planting was completed in June 1999.

Approximately 500 acres of island were created. The "net benefit after 20 years" figure listed above is the amount projected to remain of the created acreage at the end of the 20-year life of the project. Not included in the benefited acreage figure are benefits to the inland marsh because of reduced wave energy due to barrier island restoration.

Dune elevation, along with sand fencing and vegetation, is enhancing the barrier island's capabilities to buffer storm surges to fringe marshes and coastal towns. The temporary containment dikes have degraded because of natural processes. Intertidal areas have developed naturally.

This project is on Priority Project List 2.

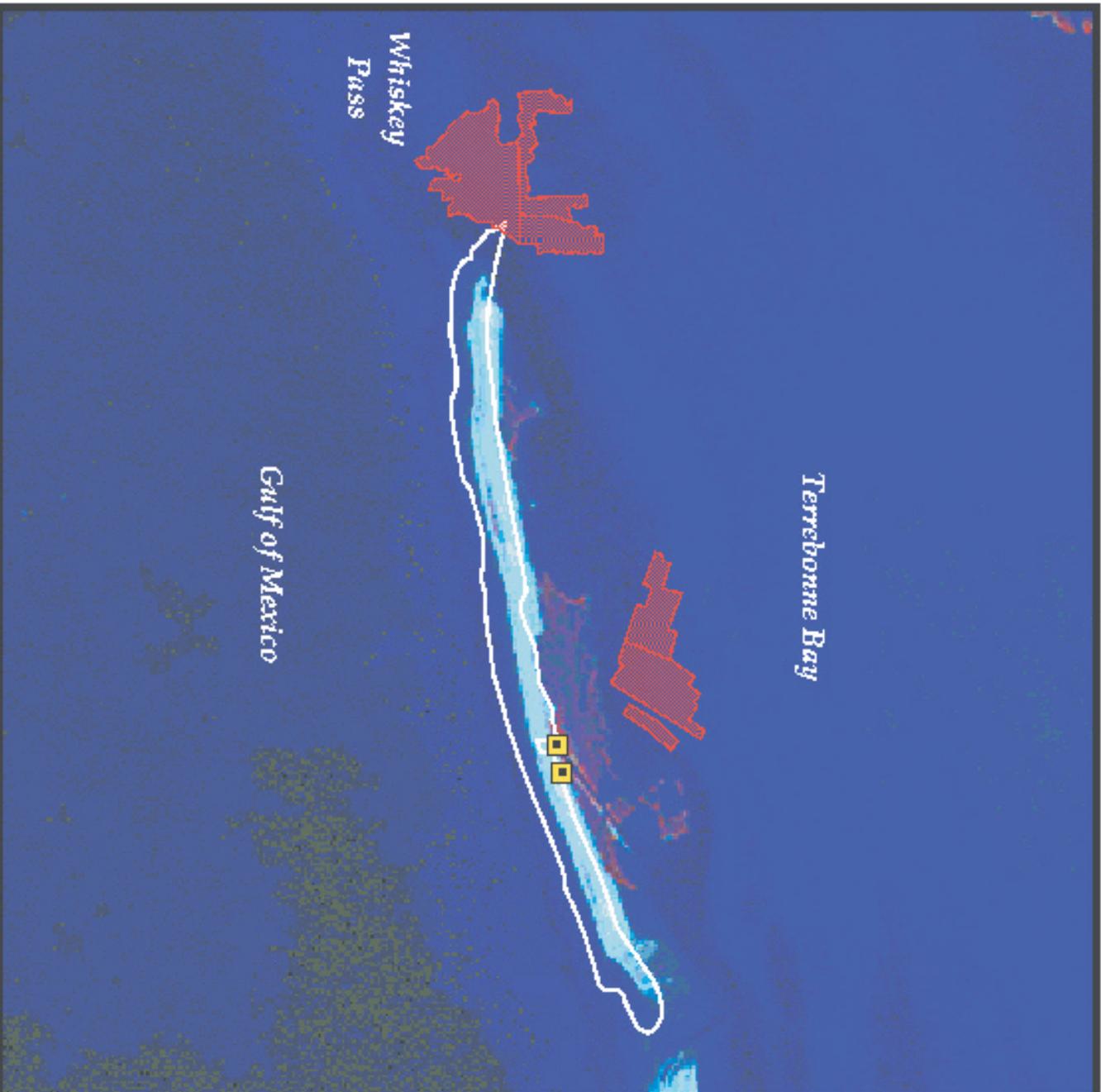
For more project information, please contact:



**Federal Sponsor:**  
U.S. Environmental Protection Agency  
Dallas, TX  
(214) 685-7255



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

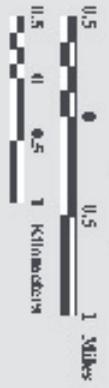


**Isles Dernieres  
Restoration  
Trinity Island  
(IE-24)**

	Plugs
	Borrow Site
	Project Boundary

**Includes:**  
 Marsh Creation Area  
 Seeding Area  
 Vegetative Plantings  
 Sediment Fences

**USGS**  
 science for a changing world



Map Prepared By:  
 T.S. Frazier, et al. of the French  
 U.S. Geological Survey  
 National Wetlands Research Center  
 Coastal Restoration Task Station

Jackpot and logo: J. Lemaitre, Adapted: satellite imagery 2000  
 Map Date: August 21, 2002  
 Map ID: 2002-1-202  
 Data: unclassified, Aug-1-01, 2002

## Extension Activity

1. Visit a barrier Island restoration project that involves pumping sediment onto the island.
2. Invite a speaker from the CWPPRA program to the class to provide in-depth information about the projects.
3. Assign a research project to groups of students that increases the amount of information gathered from the CWPPRA and other websites.
4. Arrange for your students to attend an event such as Ocean Commotion or Louisiana Earth Day's Wetland Tent and assign information gathering tasks involving interviewing experts and gathering a variety of data from exhibits.

## Resources

**William, S. J., Penland, S., Sallenger, A. H., (Eds). 1992. Louisiana Barrier Island Erosion Study: Atlas of shoreline Changes in Louisiana from 1853 to 1989. USGS.**  
<http://marine.usgs.gov/fact-sheets/Barrier/barrier.html>  
[www.lacoast.gov](http://www.lacoast.gov)

**The Coastal Wetlands Planning, Protection and Restoration Act Web Resources**  
[www.LACoast.gov](http://www.LACoast.gov) (The link to the fact sheet is  
<http://lacoast.gov/new/Projects/Info.aspx?num=TE-24>)

**The Barataria-Terrebonne National Estuary Program**  
[www.BTNEP.org](http://www.BTNEP.org)

**The U.S. Geological Survey National Wetlands Research Center**  
[www.nwrc.usgs.gov/](http://www.nwrc.usgs.gov/)

**Land Area Change in Coastal Louisiana from 1932 to 2010** (June 2011) The analyses of landscape change presented in this report use historical surveys, aerial data, and satellite data to track landscape changes. Summary data are presented for 1932–2010; trend data are presented for 1985–2010.

<http://pubs.usgs.gov/sim/3164/>

# follow up

## Assessments

## Rubric:

Objectives	Criteria				
Points	1	2	3	4	Points
Students will analyze maps and graphed data showing a barrier island before and after restoration and before and after Hurricanes Katrina and Rita.	Student answered at least 50% of questions accurately for maps and graphed data.	Student answered more than 70% of questions accurately for maps and graphed data and made plausible inferences and predictions	Student answered at least 90% of the questions accurately for maps and graphed data, made plausible inferences and predictions and demonstrated an overall understanding of the meaning of the data for coastal restoration.	Student answered 100% of the questions accurately for maps and graphed data, made insightful inferences and predictions and showed deep understanding of the meaning of the data for coastal restoration.	
Students will evaluate the success of the restoration project using the data and by collecting online information.	The student gathered some data and was able use the information to list at least 1 cost and 1 benefit for the project.	The student gathered adequate information from data presented and on-line sources to list at least 2 costs and 2 benefits for the project.	The student gathered adequate information from data presented and on-line sources to list at least 3 costs and 3 benefits, including "hidden" costs and benefits and wrote thoughtful conclusions about the project's overall value and success.	The student gathered plenty of information from data presented and on-line sources to list at least 4 costs and 4 benefits, including "hidden" costs and benefits and wrote and defended insightful conclusions about the project's overall value and success.	
Students will predict the future changes in land area in the barrier islands.	Student used data presented to write at least one plausible prediction about the future of Louisiana's barrier islands.	The student used data presented and gathered from an on-line source to make more than one plausible prediction about the future of Louisiana's barrier islands.	The student used data presented and on-line source to make and defend at least insightful predictions about the future of Louisiana's barrier islands.	The student used data presented and gathered from an on-line source to make and defend at least 3 insightful predictions about the future of Louisiana's barrier islands.	
<b>Total Points</b>					
<b>Teacher's Comments</b>					

# follow up

## GLE's

### **Ecological Systems and Interactions**

Describe the abiotic and biotic factors that distinguish Earth's major ecological systems (SE-H-A1)

### **Resources and Resource Management**

Identify the factors that affect sustainable development (SEH- B6)

### **Personal Choices and Responsible Actions**

Analyze the effect of common social, economic, technological, and political considerations on environmental policy (SE-H-C3)

Analyze the risk-benefit ratio for selected environmental situations (SE-H-C4)

Describe the relationship between public support and the enforcement of environmental policies (SE-H-C5)

### **Environmental Awareness and Protection**

Describe how accountability toward the environment affects sustainability (SE-H-D5)

## Lesson Source

