Changing the Flow

Research Questions

1. **How have humans impacted Louisiana's wetlands?**
1. **What are the social and economic effects of wetland loss in Louisiana?**
3. **How are people working together to restore Louisiana's wetlands?**

What do you think your life would be like if you were growing up in Houma, a small town on Bayou Terrebonne? In many ways, your life would be much as it is now. You would do lots of the same things you do each day—eat, sleep, go to school, do homework, practice music, or play sports. But, there would be one big difference. The land around you would be changing more quickly than most of us are used to. If you lived near the coastline, you might notice that the field where you play soccer seemed to be moving nearer to the water each season. Areas you once knew as land might have even slipped under water!

In the last 80 years, residents of the Mississippi delta region of Louisiana have seen numerous changes in their landscape. Although many of these changes have allowed people to settle along the river, they have also contributed to the disappearance of the wetlands.

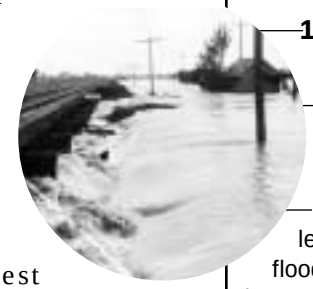
There is good news, though. More and more people are beginning to recognize the threat posed by continued wetland loss in the delta region. Two people who are working to find ways to conserve and restore the health of Louisiana's wetlands are JASON host researchers Earl Melancon and Marco Giardino. Although they are both concerned about wetland loss, they address the issue differently. Marco Giardino is a **remote-sensing scientist** who works for NASA (National Aeronautics and Space Administration). He uses **satellite imaging** to monitor wetland restoration projects and changes in the landscape. Earl Melancon is an oyster biologist at Nicholls State University in Louisiana. He has spent more than 25 years working alongside fishermen to study the effects of ecosystem changes on oysters and on commercial fisheries. Earl Melancon's research helps fishermen and project planners predict and lessen the impact of restoration projects on fisheries.

Earl Melancon and JASON student host Ike Akagha conduct oyster research.

1 How have humans impacted Louisiana's wetlands?

The Mississippi delta region is approximately 7,000 years old, and it has changed considerably over time, as you might expect. During most of these 7,000 years, however, humans had little impact on the river system.

The first people to come to the area that is now New Orleans were Native Americans, who arrived around 500 B.C. These people and their descendants had little impact on the river system for the next 2,200 years. All that changed in 1718, when French colonists established a permanent settlement in New Orleans. These colonists and other settlers who followed them quickly discovered the rich soil, which had been deposited along the river by years of periodic flooding. Taking advantage of this soil and other natural resources, the settlers built farms and homes, and the growth and spread of the region's population began. Today, more than 950,000 people live in the two largest parishes (counties) that make up the New Orleans metropolitan area. Many more live along the southern part of the river.



New Orleans's location on the river, a major artery of transportation, made it one of the busiest and most important trade centers in North America. But the geography and river that enabled New Orleans to grow also threatened it. The river flooded every few years, ruining crops, damaging homes, and causing loss of life. Over the years, as the population grew, the need for flood control, natural resource harvesting, and transportation brought about many changes to the Mississippi River delta region.

To protect against the floods, people built **levees**, raised banks of earth, along the river and around the entire city of New Orleans. In addition to building levees, engineers **dredged**, or dug out, channels in the river and through the wetlands of the delta region. The channels protected the region from floods by allowing water to flow between existing levees. They also provided transportation up the river and through the surrounding wetlands.

Over the years, higher and higher levees were built, and more channels were dredged. When oil and natural gas started to be removed from the delta region in the early 1900s, a vast network of pipelines

Humans in the Delta: A Time Line

1717 Europeans first settle New Orleans

1718 New Orleans experiences major flooding

1727 First levee to completely surround New Orleans is completed. It measures about 1 m (3 ft) in height and about 1.6 km (1 mi) in perimeter

1727–1800+ Settlers receive land if they promise to build levees on it for more flood protection

1829 U.S. Army Corps of Engineers begins work on development and maintenance of navigation channels

1849 and 1850 Major floods occur

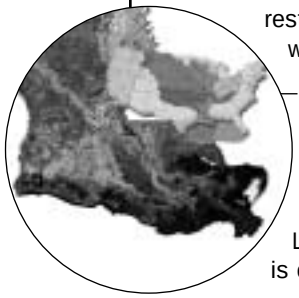
1927 Most disastrous flood in the history of New Orleans occurs

1928 Flood Control Act is legislated to provide effective flood control to Mississippi's lower valley region

1937 First gated spillway between two levees provides double protection to inhabitants

1956 Designed to improve oyster harvests, the Bayou Lamoque diversion project opens

1990 The Coastal Wetlands Planning, Protection, and Restoration Act, commonly known as the "Breaux Act," is enacted to focus on protecting and restoring Louisiana's wetlands



1998 Coast 2050, a long-term project to perform a coast-wide plan of strategies to restore and protect Louisiana's wetlands, is created

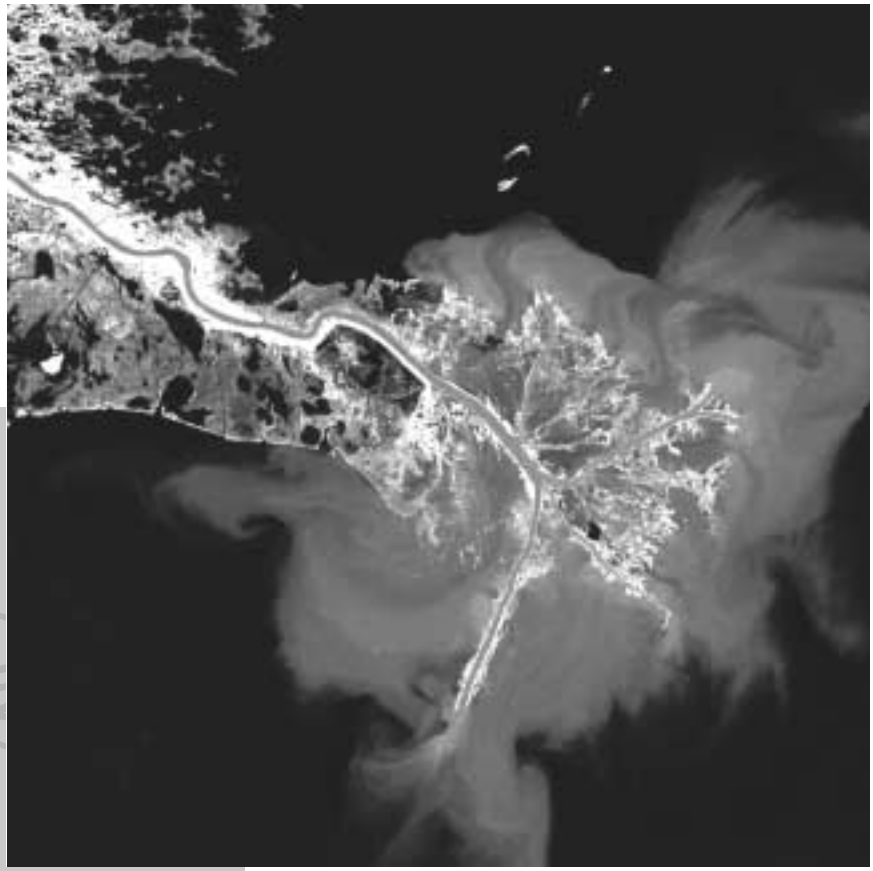
was built to carry the products through the wetlands. In building and maintaining these pipelines, companies dredged thousands of kilometers (miles) of channels.

In 1927, a huge flood, causing over $400 million in damage and the loss of many lives, hit New Orleans and the entire lower Mississippi River valley. To provide immediate flood relief, a levee downstream from New Orleans was **breached**, or broken through. This helped save New Orleans, but it flooded the community of Caernarvon, Louisiana. In response to that flood, the U.S. Army Corps of Engineers widened the channel of the river above the city and raised surrounding levees. **Spillways**, or passages for overflow, were built to allow excess water to flow off in a controlled fashion.

Today, the massive levee system along the lower Mississippi prevents the river from distributing sediment in the delta's wetlands. Why is this so? With levees, the river cannot overflow its banks. The river water and the sediment

Did You Know...

With levees keeping water in and out of the city of New Orleans, sudden runoff from the Superdome's enormous roof could flood nearby parts of the city. To prevent such flooding, builders designed the walls of the dome to absorb rainfall and release it slowly over time.



A NASA Landsat image shows a plume of sediment pouring from the mouth of the Mississippi River into the Gulf of Mexico.

carried by it flow directly to the Gulf of Mexico, where the sediment falls into the deep ocean. At the same time, the ocean is attacking the wetlands from the south. Disappearing barrier islands allow waves and currents from the Gulf of Mexico to reach the wetlands themselves. Salt water wears away the soil. Outgoing tides that used to deposit sediment on the marshes now flow through the channels, carrying sediment to the gulf. These events speed up erosion in the wetlands.

The energy sediment and water have as they pour into marshes determines how far the sediment travels before settling. Raise your energy level and determine how this process works by rolling on to the Hypothesis-based Learning Activity, Let the River Run! on page 82.

ADD TO YOUR Journal

Think about a place that you've heard about or lived in that has experienced a flood. In your JASON Journal, describe how the water caused problems for you and the community. Also describe what it might be like to live in an area where flooding is a constant threat.

2 What are the social and economic effects of wetland loss in Louisiana?

Human changes to the Mississippi River system, combined with existing natural forces, are causing the rapid disappearance of Louisiana's wetlands. With the wetlands will go many native plants and animals that call this region home. What will these changes mean for the people living in Louisiana?

Louisiana is hurricane country, and hurricanes move water. High winds and low pressure drive powerful waves, called storm surges, inland from the Gulf of Mexico. These massive walls of water, which can reach a height of 5.5 m (18 ft), carry enormous destructive force. In the past, this force has been absorbed first by the barrier islands and then by the marshes of the wetlands themselves. But as the barrier islands break down and the wetlands disappear, open water moves closer to towns and cities, including New Orleans, the "city in a bowl." The levees surrounding New Orleans are only 6 m (20 ft) high on average, although some are as high as 11 m (35 ft). As the wetlands disappear, pumps designed to handle only rainfall are all that protect New Orleans from a powerful storm surge. Such a surge could kill thousands of inhabitants and cause billions of dollars in damage to the city.

For people who live in and make their living from the wetlands, the danger caused by their loss is less dramatic but just as disturbing. As the wetlands disappear, jobs and traditional ways of life gradually disappear. For more than 200 years,

Coastal Louisiana has been hit by a number of powerful hurricanes in the past 100 years. To find out more about these giant tropical storms, visit **NOAA's** National Hurricane Center by going to *www.jason.org*, logging onto Team JASON Online, and clicking on **Resources.** Not sure if you are registered on Team JASON Online? Check with your teacher.

Did You Know...

The Mississippi River waterway system spans 23,200 km (14,500 mi). It is traveled mainly by barges that transport cargoes such as oil, natural gas, steel, grain, and other farm and manufactured goods. In addition to river barges, New Orleans ports see the passage of 6,000 ocean vessels and 700,000 cruise passengers annually.

FACT OR Fallacy?

Land loss in an area causes an immediate reduction in fishery productivity.

Fallacy: Many fishermen have reported more catches as wetlands begin to disappear. As the vegetation goes underwater and decays, it initially releases more nutrients into the local food web.

bayou families have lived on harvests of fish, waterfowl, and other seemingly sustainable resources found in this rich ecosystem. They have passed skills, traditions, and knowledge from generation to generation. But if **estuarine** habitats, which are habitats found where rivers meet the sea, disappear, nets will come up empty, and traditions will be lost.

While the impact of wetland loss on individuals is hard to measure, the impact on the state and national economy can be predicted. The wetlands of Louisiana's delta region produce a good portion of this country's supply of fish, shellfish, oil, and natural gas. New Orleans hosts millions of tourists each year, and the surrounding ports are the busiest in the world. Through these ports, millions of tons of goods are shipped to and from countries worldwide and throughout the United States.

Economic Value of Louisiana Wetlands and Adjacent Gulf

Oil and Natural Gas Production	$1 billion/year
Recreational Fishing	$944 million/year
Commercial Fishing	$343 million/year
Eco-tourism	$220 million/year
Alligator Harvest	$25 million/year
Fur Harvest	$1 million/year
Waterborne Commerce	500 million tons/year

Louisiana Department of Natural Resources, August 2003

STOP & EXPLORE

For years, Earl Melancon has worked with oystermen and others in the estuary to understand how wetland loss and restoration projects affect them. Become one of these stakeholders and express your opinions in Activity 3.1, Weighing the Stakes, on page 84.

3 How are people working together to restore Louisiana's wetlands?

Scientists now understand how and why Louisiana's wetlands are disappearing and what needs to be done to restore them. Finding ways to allow the Mississippi River to replenish wetland areas with new sediment, however, is tricky. Restoration efforts will affect the many people who live and

work along the river. The concerns of these **stakeholders**—people affected by wetland loss and the proposed restoration solutions—must be taken into consideration.

In 1990, the U.S. Congress passed the Coastal Wetlands Planning, Protection, and Restoration Act, or Breaux Act. This act led to the creation of Coast 2050 in 1998. The project is a partnership between federal and state authorities to prevent the predicted catastrophic loss of the coastal wetlands and to restore a healthy, balanced ecosystem. Coast 2050 has built a team of diverse stakeholders and experts to address the problem. Together, members of Coast 2050 are studying and implementing projects that range from small to huge, from low cost to expensive, and from short term to long term.

Small, local projects help to slow down the erosion of existing wetlands. Students, for example, grow marsh plant seedlings and then plant them along pipeline channels to help prevent erosion. Communities collect discarded Christmas trees and dump them in rows in the water to form sediment traps. **Artificial reefs** are being created along barrier islands to help prevent the erosion of the islands. They also provide a surface for young oysters to attach themselves.

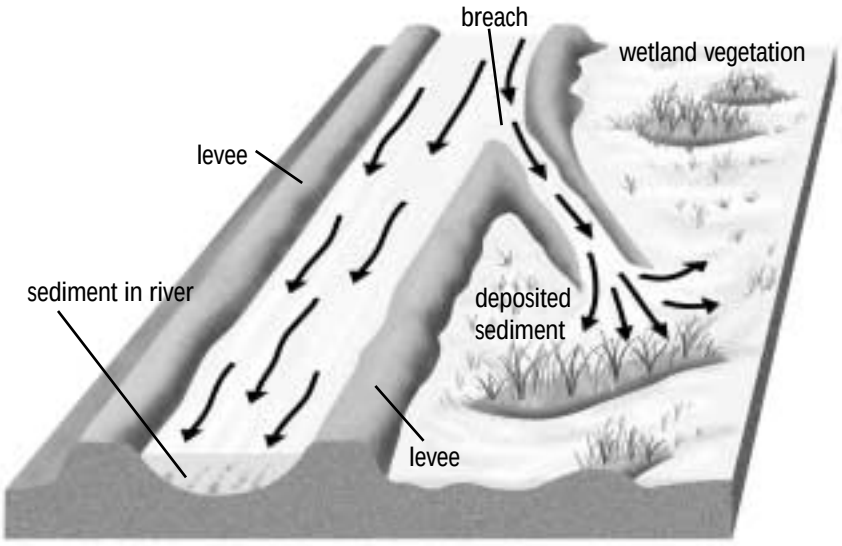
A sediment barrier created from old Christmas trees.

Medium to large projects seek to reverse erosion by bringing sediment into the wetlands to form new land. There are two types of projects that import sediment from the Mississippi River into the wetlands: **freshwater reintroduction,** or diversion, projects and **sediment reintroduction projects.**

LINK TO... What can the people of New Orleans do to survive a deadly hurricane? Explore "Hurricane 2050! The Struggle to Save New Orleans" by going to *www.jason.org*, logging onto Team JASON Online, and clicking on **Digital Labs**.

Did You Know...

Land use in two countries impacts Louisiana's wetlands! Human efforts to reduce erosion along the entire length of the Mississippi River, including parts of Canada and the United States, have reduced the amount of sediment carried downstream to the wetlands at the river's mouth.



A breach allows freshwater to flow into surrounding wetlands.

ADD TO YOUR Journal

School students are trying to do their part to help slow wetland loss. In your JASON Journal, describe things that you and your family could do to help protect the environment in which you live. How might one person or a small group of people make a difference?

Freshwater reintroduction, or diversion, projects

For freshwater reintroduction, or diversion, projects, engineers create a breach in the river's levee. The river water, carrying a small sediment load, flows through the breach, down a channel, and into the wetlands.

One successful but controversial example of a freshwater reintroduction is the Caernarvon Freshwater Diversion Project, which was constructed in 1991. As a follow-up to this project, Marco Giardino and others involved in Coast 2050 use digital satellite images to monitor land gain and loss. As of 2004, there has been a land gain of about 2 percent. There have also been some interesting lessons to be learned.

The introduction of freshwater and its sediment in Caernarvon changed oyster habitats and oyster fisheries. More freshwater made the wetlands less salty, and this caused oyster populations to shift to areas that were saltier. As a result, oystermen who leased rights to fish in specific areas lost money when oysters could no longer survive in their areas. Because the effects of freshwater reintroduction, or diversion, were not considered early on, a long legal battle between the oystermen and the state took place.

More recently, the team from Coast 2050 built the Davis Pond Freshwater Diversion. Thanks to the research of Earl Melancon and lessons the team learned from Caernarvon, the team reached a compromise with local fishermen about the location of the reintroduction and changes to oyster leases.

Sediment reintroduction projects

Unlike freshwater reintroduction, or diversion, projects, sediment reintroduction projects are designed to transport

Did You Know...

Nearly all the dead in the city of New Orleans are buried in tombs above ground. Water frequently seeps into underground graves.

The dotted lines show the proposed location of the Third Delta Conveyance Channel.

enough sediment into the wetlands to prevent the additional loss of land in the system. One proposed project, the Third Delta Conveyance Channel, would be the biggest reintroduction project ever planned and one of the world's largest engineering projects. The sediment reintroduction channel would carry as much as 5,600 m^3 of water and sediment per second (200,000 ft^3/s) for a distance of more than 50 km (30 mi).

Pipeline slurry projects are a second type of sediment reintroduction. Pipeline slurry projects use new or existing pipelines to move sediment that has built up at the bottom of the river. With a movable pipeline, sediment can be pumped directly to the areas where it is most needed.

The projects described here are all part of the Coast 2050 plan to preserve and restore the remaining wetlands in southern Louisiana. Marco Giardino uses satellite images to monitor the success of various types of projects.

LINK TO... Marco Giardino isn't the only NASA scientist photographing the Mississippi River delta! **NASA** satellites have taken many beautiful pictures of the area. To see some of them, go to *www.jason.org*, log onto Team JASON Online, and click on **Resources.** Not sure if you are registered on Team JASON Online? Check with your teacher.

STOP & EXPLORE **Marco Giardino is the ultimate long-distance photographer. Working at NASA, he collects satellite pictures of areas the Coast 2050 team is trying to restore. Help prepare a digital image of the Caernarvon Freshwater Diversion Project by simulating the process in Activity 3.2, How Satellites Take Pictures, on page 90.**

Fieldwork in Your Neighborhood

The land around you may not be disappearing in the same way Louisiana's wetlands are, but the water flow in your area has been changed by people in the last 100 years. Plan the future of a local water control project. Turn to the Fieldwork Activity, To Dam or Not to Dam? on page 95.