THE FORCES ARE WITH US:
Natural Forces Affecting The Basin
Chapter 8

Essential Questions:

What are the natural forces that affect the Lake Pontchartrain Basin?

Does my Mardi Gras souvenir cup cause global climate change?

Does my Mardi Gras souvenir cup cause sea-level rise?

Can my city survive a direct hit from a major hurricane?
THE FORCES ARE WITH US:
Natural Forces Affecting the Lake Pontchartrain Basin

OBJECTIVE:

• Understand the direct and implied relationships among global climate change, storm events, subsidence, and erosion.

• Understand the potential impact of global climate change and related issues on the Lake Pontchartrain Basin.

MULTIPLE INTELLIGENCES LEARNING ACTIVITIES:

Verbal/ Linguistic: Develop a student newspaper on factors affecting the Lake Pontchartrain Basin.

Logical/ Mathematical: Plot hurricane data sets on a tracking map.


Bodily/ Kinesthetic & Musical Rhythmic: Develop a multimedia project to foster environmental appreciation or depict environmental degradation.

Interpersonal: Write C-Mail messages and responses to classmates.

Intrapersonal: Write a reaction paper about hurricane impact on coastal parishes of the Basin. Associate feelings with facts regarding factors that affect the Lake Pontchartrain Basin.

Naturalist: Conduct an experiment to measure how water level affects the growth of wetland plants.

Humanity and the natural world are interconnected in the Lake Pontchartrain Basin, as everywhere on the planet. Precipitation, temperature, and sea level have always influenced where people live, grow food, and do business. We influence the natural world by the things we do or do not do in the local environment. In this section, we will focus on certain factors affecting the Lake Pontchartrain Basin, including: global climate change or global warming, sea-level rise, hurricanes, subsidence and erosion.

NATURAL FORCES AFFECTING LAKE PONTCHARTRAIN:

- Erosion
- Global Climate Change
- Severe Storms/ Hurricanes
- Subsidence
The earth’s atmosphere is a thin blanket of gases which serves many important functions. It protects the planet from harsh ultraviolet (UV) rays from the sun, and it warms the Earth’s surface and modifies our climate. This naturally occurring phenomenon is called the **greenhouse effect**.

Earth’s atmosphere is made up of about 78% nitrogen, 21% oxygen, and about 1% of trace gases that absorb infrared radiation. These trace gases, which trap heat to warm the earth, are known as the **greenhouse gases**. The two most important ones in producing the insulating effect of Earth’s atmosphere are carbon dioxide (CO₂) and water vapor (H₂O), but others include methane (CH₄), chlorofluorocarbons (CFC’s), nitrous oxide (N₂O), and ozone (O₃). The following chart lists the major greenhouse gases and their sources.
<table>
<thead>
<tr>
<th>GREENHOUSE GASES</th>
<th>NATURAL SOURCES</th>
<th>HUMANMADE SOURCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide CO₂</td>
<td>• respiration of animals and plants</td>
<td>• burning of fossil fuels</td>
</tr>
<tr>
<td></td>
<td>• volcanic eruptions</td>
<td>• clearing land for agriculture</td>
</tr>
<tr>
<td></td>
<td>• decay of organisms</td>
<td>• cement manufacturing</td>
</tr>
<tr>
<td>Methane CH₄</td>
<td>• livestock</td>
<td>• landfills</td>
</tr>
<tr>
<td></td>
<td>• wetlands</td>
<td>• coal mines</td>
</tr>
<tr>
<td></td>
<td>• termites</td>
<td>• rice paddies</td>
</tr>
<tr>
<td>Chlorofluorocarbons CFC’s</td>
<td>• none</td>
<td>• natural gas leaks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• burning of biomass</td>
</tr>
<tr>
<td>Nitrous Oxide N₂O</td>
<td>• soil microbes’ digestion</td>
<td>• refrigerators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• auto air conditioners</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• solvents</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• insulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• aerosols</td>
</tr>
<tr>
<td>Ozone O₃</td>
<td>• lightning</td>
<td>• burning coal and wood</td>
</tr>
<tr>
<td></td>
<td>• pine trees</td>
<td>• chemical fertilizers</td>
</tr>
<tr>
<td>Water Vapor H₂O</td>
<td>• evaporation</td>
<td>• photochemical reaction between nitrogen oxides and organic</td>
</tr>
<tr>
<td></td>
<td>• transpiration</td>
<td>compounds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• will increase as evaporative effect rises proportionally to increasing amounts of other greenhouse gases</td>
</tr>
</tbody>
</table>
To help you understand more about this complex topic, review this chart of greenhouse gases from a historical perspective:

<table>
<thead>
<tr>
<th>Atmospheric Greenhouse Gas</th>
<th>Range from Dawn of Humans to 1750 A.D.</th>
<th>Concentration in 1990 A.D.</th>
<th>Annual Rate of Increase and Pre-Industrial Levels (PL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon dioxide (CO₂)</td>
<td>180-295 parts per million</td>
<td>353 parts per million</td>
<td>annual growth: 25% PL: 0.5%</td>
</tr>
<tr>
<td>Methane (CH₄)</td>
<td>0.3-0.8 parts per million</td>
<td>1.72 parts per million</td>
<td>annual growth: 115% PL: 0.5-1.0%</td>
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<tr>
<td>Nitrous Oxide (N₂O)</td>
<td>275-295 parts per billion</td>
<td>310 parts per billion</td>
<td>annual growth: 9% PL: 0.25%</td>
</tr>
<tr>
<td>CFC-11</td>
<td>Not invented yet</td>
<td>280 parts per trillion</td>
<td>PL: 4.0%</td>
</tr>
<tr>
<td>CFC-12</td>
<td>Not invented yet</td>
<td>484 parts per trillion</td>
<td>PL: 4.0%</td>
</tr>
</tbody>
</table>

During those same time periods, the human population of the planet increased from 760 million people in 1750 to 5.3 billion people by 1990.

How do you think this affected the amounts of greenhouse gases?

What other sources of greenhouse gases can be associated with increasing human population growth? Refer to Page 199 for help.

The amount of carbon dioxide in the atmosphere has been increasing rapidly, as has methane, which traps heat 20-30 times more efficiently than carbon dioxide. One CFC molecule traps 20,000 times the heat of one carbon dioxide molecule.

There is much concern about the negative effects on our climate which can be produced by these atmospheric changes. The increase in the amount of heat trapped by the greenhouse effect due to higher greenhouse gas concentrations will make the earth's climate warmer than it would otherwise be. This is called global warming.
There is some uncertainty and disagreement in the scientific community about the likelihood of global warming, even though scientific predictions of global temperature increase have remained quite consistent for almost 100 years now. It is estimated that the temperature increase resulting from a doubling of CO₂ concentrations over pre-industrial levels would occur in the range of 3-8 degrees Fahrenheit (1.5-4.5 degrees Celsius). Scientists believe that this could occur by the middle of the 21st century—or sooner, if CO₂ levels more than double. As long as amounts of greenhouse gases continue to escalate, the earth’s average global temperatures are expected to increase. As average temperature climbs, so will the likelihood of unusual or disturbed weather patterns around the globe—including the Lake Pontchartrain Basin! Severe storms may increase in frequency and intensity, including tropical storms and hurricanes. Droughts may be commonplace in some areas, resulting in habitat loss, water shortages, and more forest fires. But weather patterns are not the only things that will be affected.

A number of studies indicate that the sea has been rising 1-2 millimeters each year for the last century. This is not all due to global warming, though, because the land itself rises and subsides over time due to natural processes. But if atmospheric CO₂ concentrations double, the Intergovernmental Panel on Climate Change (IPCC) estimates that planetary warming could cause global sea level to rise from 3-11 inches (8-29 centimeters) to 39 inches (1 meter) in the next 50 to 100 years. This action, which would result from water’s tendency to expand when heated as well as from melting of glacial ice and polar ice caps, would send hundreds of meters of seawater encroaching over gently sloping coastal land. This would permanently flood hundreds of square miles of low-lying coastal areas along the Gulf. For those of us who live in the Lake Pontchartrain Basin, it means that barrier islands, tourist beaches, fishing centers, cultural and historical sites, business and industry, groundwater supplies, wildlife habitat, and residential areas would be severely impacted. Coastal wetland habitats might be lost or greatly reduced. We could probably prevent these negative effects from happening, but it would cost over $50 billion for bulkheads and levees to hold back the sea.
WHAT HAPPENS WHEN SEA LEVEL RISES OR FALLS?
A Topographic Model

The current concerns with global warming have made us wonder what will happen if there are changes in water levels of Lake Pontchartrain and the Gulf of Mexico. This activity is meant to increase our awareness of the effects of changing water levels on a coastal landscape.

Objectives:
- Construct a model of a contour map
- Use a contour map model to study changes in water levels and land elevations
- Understand the impact of sea-level rise on the Lake Pontchartrain Basin

Materials: per group
- Clear plastic shoebox
- Metric ruler
- Brown and green clay
- Transparency marker or grease pencil
- Acetate transparency sheet
- Water

Procedure:
1. Use the clay to form a coastal landscape in the bottom of the shoebox. Don’t forget to leave room for water representing the Gulf of Mexico!

2. Using the metric ruler, mark one-centimeter increments starting from the bottom to the top on the outside of the shoebox.

3. With the marker or grease pencil, record the level of the coast/clay, according to the marks on the side.
   
   **How many centimeters does your clay coastline rise from the bottom of the shoebox?**

4. Slowly pour water into the container and on to the clay coastline until it becomes level with the first centimeter mark from the bottom of the shoebox.
   
   **How much of the clay coastline is covered with water?**
5. Continue adding water to the next centimeter mark.

6. Place the clear transparency sheet over the top of the shoebox. Have members of your group hold the sheet as flat as possible. Look straight down into the shoebox. With the marker or grease pencil, draw a line where the water meets the clay as you look straight down upon the coastline.

7. Continue steps 5 and 6 until you have several lines on your transparency, marking each line with the corresponding centimeter mark on the side of the shoebox. The lines formed are called contour lines, and they are used on topographic maps to indicate elevation of land and water.

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Once your map is completed, answer the following questions:

1. **How can contour maps be used to determine impact of sea-level rise on a coastline?**

2. **If the water level decreased one centimeter in elevation on your model, how much more land would be exposed? How can you determine this by using your math skills?** Explain your answer.

3. **What are problems associated with sea-level rise in the Lake Pontchartrain Basin? What can we do about it?**
WHAT IS THAT SINKING FEELING?
or ARE WE SLIP-SLIDIN’ AWAY?

**Subsidence and Erosion in the Lake Pontchartrain Basin**

Mississippi River sediment has formed most of Louisiana’s coastal wetlands over the past 5,000 years or more. This happened when river water regularly deposited sediments over land areas during the river’s annual floods, accumulating thick layers of sand, mud, and silt. Over time, a series of overlapping deltas formed, eventually building a wide deltaic plain that forms Louisiana’s coast. Lake Pontchartrain was formed when Mississippi River deltaic deposits partially closed it off from the Gulf of Mexico. All the land in the Lake Pontchartrain Basin to the south and west of Lake Pontchartrain consists of Mississippi River sediments deposited over time.

Fresh sediment is needed to nourish the wetland vegetation and to insure the buildup of land. This was never a problem, because periodic flooding of the Mississippi River spread millions of tons of sediment across coastal marshes every year. This natural process of sedimentation might have continued indefinitely if it were not for human intervention.

The annual flooding caused problems for people who had settled along the river and its distributaries. This resulted in building levees, a system of flood control to help keep the Mississippi River, as well as rivers and bayous throughout the Lake Pontchartrain Basin, confined to narrow channels. While the levee system prevents damage to people and property, including loss of lives, it also prevents river water from flowing through the wetlands. The sediment that once nourished coastal marshes now flows directly into the Gulf of Mexico, where it sinks out of sight off the continental shelf.

Without the annual deposition of sediment from the Mississippi, most of Louisiana’s coastal marshes are sinking, too. This is called subsidence, and it is a serious problem in the Lake Pontchartrain Basin. However, levees are not the only factor affecting sedimentation. The Mississippi River itself carries less sediment than it did many years ago, and much of its remaining sediment never reaches south Louisiana. Dams have been constructed on every major tributary of the Mississippi River, trapping sediment so it can’t bring new life to coastal marshes. In addition, better farming practices in the Midwestern states prevent erosion of sediment from farmland, so less finds its way into the river.

Subsidence is a serious factor affecting the Lake Pontchartrain Basin, but coupled with sea-level rise, it contributes to another problem — erosion. Even before levees lined the banks of the Mississippi River and its tributaries, Louisiana’s coastal wetlands were being affected by the digging of ditches and canals through the marsh. First dug by trappers, hunters, and farmers for navigational purposes, larger canals were made by cypress loggers to remove big trees from our once-extensive forested wetlands. Scars from these operations are still visible in the LaBranche Wetlands and in the Manchac Wildlife Management Area near Turtle Cove. The majority of canals in coastal marshes, though, were dug by the oil industry for pipelines and access to drilling sites.
How do canals contribute to subsidence and erosion in the marsh? Spoil banks formed from the dredged material add weight to the spongy marsh soil, causing it to compact and subside. As it sinks, “ponding” or the formation of large areas of open water in the marsh occurs. Over time the canals widen, and more wetlands are converted to open water. These factors change the hydrology or water flow in the wetlands, preventing much-needed sedimentation and allowing salt water to intrude farther and farther inland. Freshwater marsh vegetation cannot tolerate these environmental changes and, as it dies, the soil weakens and is subject to erosion by tidal action and severe storms. Shoreline erosion in some areas is greater than 100 feet per year.

In the Lake Pontchartrain Basin, the most dramatic effect of saltwater intrusion can be witnessed at the navigational ship channel known as the Mississippi River Gulf Outlet (MRGO). Cutting through both fresh and brackish coastal marshes of lower St. Bernard Parish, as well as areas of forested wetlands, the MRGO has contributed in a major way to existing subsidence and erosion problems. Ponding has left a swath of damage threatening St. Bernard and Orleans Parishes that will take many more years to repair the damage than it did to create it.

As sea-level rise exacerbates problems associated with subsidence and erosion, areas of the Basin especially affected by those factors are the barrier islands, such as the Chandeleur Islands. Formed by the same coastal processes that build wetlands, these fragile fringes are slowly disappearing. While serving to protect the coast from severe storms and hurricanes, barrier islands bear the brunt of such storms. Barrier islands also provide important habitat for marine life. Yet, they are deteriorating faster than natural processes can rebuild them. Sea-level rise is slowly flooding the islands, sedimentation remains low, and recent storms have contributed severe erosional damage. Without our barrier islands, the factors associated with global climate change will wreak even more havoc on the fragile coastal marshes.

Human intervention has unintentionally created these problems, and it will require human intervention to do something about them. Several projects already at work are in the experimental stages, and it will be interesting to follow their progress as we hope for positive results in rebuilding wetlands in the Lake Pontchartrain Basin. Mitigation projects have filled in existing pipeline canals and areas of open water in the LaBranche wetlands. Rock dikes near Martello Castle in Lake Borgne and between Lakes Maurepas and Pontchartrain are helping to prevent further erosion. Every year thousands of Christmas trees are placed in the marshes of Orleans, St. Bernard, Jefferson, St. Tammany and St. Charles Parishes, where they serve to slow down erosion from wave action and trap sediment.

Proposed river diversion projects are being suggested to rebuild our wetlands. These are ambitious projects, costing many millions of taxpayer dollars. Will they be worth the cost? Can we afford to do it? Will they work? Scientists are in heated debate about these projects, as more solutions to our wetland loss problem are being sought.

You can find more information on global climate change and how it affects coastal wetlands in these excellent resources:

1. Project TELLUS Teaching Modules for Global Change Issues (Lyle Soniat, Ph.D., Sea Grant Education Office, LSU, Baton Rouge, LA 70803)

2. Global Environmental Education Resource Guide (Sharon Walker, Ph.D., Gulf Coast Research Laboratory, P.O. Box 7000, Ocean Springs, MS 39566-7000)
ACTIVITY: Thinking at Right Angles

Issues associated with global climate change are complex. People often have conflicting views and feelings about problems related to these factors. In this activity, list some of the facts you know about global climate change in Section A and your feelings and associations about global climate change in Section B.

TOPIC: Global Climate Change

FACTS

A. ____________________________

_________________________________

_________________________________

_________________________________

_________________________________

_________________________________

_________________________________


FEELINGS

Is it just mee?!!!
Or is it getting
Kinda’ HOT!!!!

B. ____________________________

_________________________________

_________________________________

_________________________________

_________________________________

_________________________________

_________________________________
Spider maps are used to graphically link a central topic or concept with its major points. Details about each point are added to complete the links.

Some of the major factors affecting the Lake Pontchartrain Basin are hurricanes, global climate change, subsidence, and erosion. After completing the activities in this section, you should be able to complete the spider map below:

Factors Affecting Lake Pontchartrain Basin:
- Hurricanes
- Global climate change
- Subsidence
- Erosion
Those of us who live in the Lake Pontchartrain Basin are always wary of tropical storms or hurricanes that enter the Gulf of Mexico. These severe weather patterns are usually the result of meteorologic activity in the south Atlantic Ocean or in the Caribbean Sea from May through November. Hurricanes are born and grow in the steamy tropics. The connection is energy transfer and the role of water in that process. The sun and the ocean are the furnace for the formation of a hurricane. Toward the end of the summer, the accumulated solar warmth in ocean waters may raise the sea surface temperature to as much as 26.5 degrees Celsius.

Convert 26.5 degrees Celsius to ______________degrees Fahrenheit.
(HINT: multiply by 9; divide by 5; add 32)

In the tropical Atlantic, this heating of the ocean's surface can result in the formation of a weak low pressure system with scattered, thin clouds. If the low pressure system is pushed toward the west by the trade winds, it may gain strength with increasing winds and thickening clouds. In this manner, the low pressure system may advance to a tropical depression, then to a tropical storm, and finally to hurricane strength.

About one of every eight tropical depressions becomes a tropical storm, and the chance of a selected tropical storm becoming a hurricane is only about 60%.

Water provides the transportation for a hurricane's energy, similar to the way it may move heat from the furnace to a radiator in your school's heating system. The solar energy in the ocean causes water to evaporate from the surface, bringing heat with it. The water vapor condenses, forming hurricane clouds, and the latent heat is released into the air. This is the power that drives the hurricane. As the warm, moist air from the sea surface cools and the water vapor condenses, huge cumulonimbus clouds form. Precipitation forms in these clouds, and rain falls back to the sea surface in a continuous process. The amount of rain that falls gives us an idea of the strength of the storm. A well-developed hurricane can deliver 24 cm (about 10 inches) of rain per day!
**HURRICANE DEFINITIONS**

**Tropical Disturbance:**
Poorly organized counterclockwise circulation.

**Tropical Depression:**
Organized counterclockwise circulation, winds up to 39 mph.

**Tropical Storm:**
Well-organized counterclockwise circulation, winds 39-73 mph.

**Tropical Storm Watch:**
The possibility of winds 39-73 mph within 48 hours.

**Tropical Storm Warning:**
The likelihood of winds 39-73 mph within 24 hours.

**Hurricanes:**
Winds 74 mph or more. Heavy rains and storm surge.

**Hurricane Watch:**
The possibility of hurricane force winds in excess of 74 mph within 48 hours.

**Hurricane Warning:**
The likelihood of hurricane force winds within 24 hours.

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**SAFFIR/SIMPSON HURRICANE SCALE RANGES**

<table>
<thead>
<tr>
<th>Scale # (Category)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winds (mph)</td>
<td>74-95</td>
<td>96-110</td>
<td>111-130</td>
<td>131-155</td>
<td>156 or greater</td>
</tr>
<tr>
<td>Storm Surge (Feet)</td>
<td>4-5</td>
<td>6-8</td>
<td>9-12</td>
<td>13-18</td>
<td>18 or greater</td>
</tr>
<tr>
<td>Damage (Impact)</td>
<td>minimal</td>
<td>moderate</td>
<td>extensive</td>
<td>extreme</td>
<td>catastrophic</td>
</tr>
</tbody>
</table>

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**Objectives:**

- Focus on the impact of hurricanes on the natural and cultural environments of the Lake Pontchartrain Basin.
- Plot data of major hurricanes that have affected the Lake Pontchartrain Basin on a hurricane tracking map.
- Predict the effects of a major hurricane on the Lake Pontchartrain Basin.
- Understand the relationships among healthy wetlands, coastal erosion, and hurricane impact on the Lake Pontchartrain Basin.

**Materials:**

- Hurricane Data Sets, (Page 208)
- Student Activity Sheet, (Page 209)
- Hurricane Tracking Map (or photocopy), (Page 210)
- Construction paper
- Colored pencils
Getting Ready:

1. Discuss hurricane formation prior to this in a unit on meteorology.

2. Make copies of student activity sheet (Page 209) and hurricane tracking map (Page 210, or have students obtain one from local sources.)


Procedure:

1. On a hurricane tracking map, using a different color for each hurricane, plot the path of each storm data set provided.

2. Glue or tape student tracking maps on construction paper. Display in the classroom, hallway, cafeteria, or library.


HURRICANE DATA SETS

**HURRICANE BETSY DATA TABLE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Position Latitude</th>
<th>Position Longitude</th>
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<tbody>
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<td>2</td>
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<td>11</td>
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**HURRICANE CAMILLE DATA TABLE**

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<td>21</td>
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**HURRICANE ANDREW DATA TABLE**

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</tr>
<tr>
<td>26</td>
<td>29.5N</td>
<td>76W</td>
</tr>
</tbody>
</table>
Based on your knowledge of hurricane activity and the hurricane data you have plotted, answer the following questions:

1. When is hurricane season? _________________________________________________________
   Why? ____________________________________________________________________________

2. Where do hurricanes usually form? ________________________________________________
   __________________________________________________________________________________

3. What provides the power or energy of a hurricane? _________________________________
   __________________________________________________________________________________

4. What is a storm surge? __________________________________________________________
   __________________________________________________________________________________

5. What causes many hurricane-related deaths? ______________________________________
   __________________________________________________________________________________

6. What effects do major hurricanes have on the Lake Pontchartrain Basin? __________
   __________________________________________________________________________________
   __________________________________________________________________________________

7. How do healthy wetlands serve as a barrier to storms/hurricanes? _________________
   __________________________________________________________________________________
   __________________________________________________________________________________
   __________________________________________________________________________________

8. The coastal areas of St. Bernard and Plaquemines Parishes are very fragile due to extensive erosion in recent years. Refer to a map of that area. Write a one-page reaction paper predicting the effects of a major hurricane on the coastal parishes of the Basin.
EXTENSIONS/ PORTFOLIO:

1) Ask your students to be investigative reporters for a newspaper. Have them interview relatives, friends or neighbors who have experienced major storms while living in the Lake Pontchartrain Basin. Questions should include the “who, what, when, where, and why” of the issue.

2) Have the reporters present their findings about the impact of severe storms in creative ways: writing a feature article about an individual’s experience, drawing an editorial cartoon, or writing a newspaper story about a particular hurricane.

3) Publish the students’ work in a student newspaper about factors that affect the Lake Pontchartrain Basin—or send the article to the Lake Pontchartrain Basin Foundation for possible publication in its newsletter.

4) Develop a hurricane that starts in either the Atlantic or the Caribbean and enters the Gulf of Mexico. Name your hurricane, and carefully plot its course on your tracking map. Construct a data table and list the following data for your hurricane: map coordinates (latitude and longitude), dates and times, wind speed, states and cities that are affected.
**ACTIVITY: Subsidence/ Erosion: What Can We Do?**

As you’ve learned, subsidence and erosion are serious problems in the Lake Pontchartrain Basin. It is taking concerted effort on the part of a number of governmental agencies and citizens groups to combat these forces. Complete the following problem/solution outlines on these issues. The first one has been started for you!

<table>
<thead>
<tr>
<th>PROBLEM:</th>
<th>ATTEMPTED SOLUTIONS</th>
<th>RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What:</strong> Land subsidence</td>
<td>1. Add “fill” to landscape</td>
<td>1. Temporary; fill washes away easily</td>
</tr>
<tr>
<td><strong>Why:</strong> levees, compaction of sediments, extraction of groundwater and minerals, urbanization, wetland drainage and development</td>
<td>2. Cut “crevasses” in levee</td>
<td>2. Sediment accumulates; builds land</td>
</tr>
<tr>
<td></td>
<td>3. Plant vegetation</td>
<td>3. Holds sediment in place</td>
</tr>
<tr>
<td></td>
<td>4. Keep more “green space”</td>
<td>4. Allows water to infiltrate ground</td>
</tr>
<tr>
<td></td>
<td>5.</td>
<td>5.</td>
</tr>
</tbody>
</table>

**END RESULT**

| ![Image](213) | LPBF/UNO | 213 |
PROBLEM:

What: Erosion

Why:

levees, compaction of sediments, extraction of groundwater and minerals, urbanization, wetland drainage and development

ATTEMPTED SOLUTIONS

1. 
2. 
3. 
4. 
5. 

RESULTS

1. 
2. 
3. 
4. 
5. 

END RESULT
ACTIVITY: “C-Mail”

Classmate Mail

Journals are frequently used for students to practice reflective writing, but the entries are usually only seen by the student writer and his/her teacher. In this activity we will try another form of reflective writing, in which students communicate their thoughts or feelings about a topic of relevance to them in the form of a note or letter to a classmate. Let’s call it “C-Mail”.

Materials:

- Box with lid, covered and decorated
- Writing paper
- Pencil or pen
- Crayons or colored markers

Procedure:

1. Have students design a form that can be used for C-Mail. Print enough copies to have plenty on hand for all students!
2. Each student writes and receives C-Mail messages on thoughts or feelings associated with the issues they’ve studied concerning the Lake Pontchartrain Basin.
3. Fold each note and write the name of the recipient on the outside before placing it in the box.
4. Designate a certain time of the day for reading and writing C-Mail.
5. Remind students that they are not to send personal messages about anything other than the designated topic(s).

SUGGESTED “STARTER STATEMENTS” FOR STUDENTS:

- One thing I learned is......
- One question I have is......
- I would like to ........
- This connects with what we learned about......
- The best part is......
- I (am, am not) prepared for a major hurricane, because.....
- Auto emissions are largely responsible for increasing amounts of CO₂ in the atmosphere. I can help reduce those numbers by......

What other starter statements can you add?
**ACTIVITY: The Pontchartrain Picayune:**
Producing Your Own Newspaper

One interesting way to educate others about factors affecting the Lake Pontchartrain Basin is to produce a student newspaper. This can be a big job, but it can also be a lot of fun for your class if everyone works hard.

At a newspaper, the work is divided by department, so you and your classmates will work in teams representing each different division. Here are the major departments in any newspaper. Feel free to add any others that you might need.

<table>
<thead>
<tr>
<th>Newspaper Department</th>
<th>Responsibilities and Duties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publisher</td>
<td>Head of the newspaper staff; assign newspaper jobs to various teams and individuals</td>
</tr>
<tr>
<td>News Department</td>
<td>Led by the Editor-in-Chief; write and illustrate all articles and features; take photos</td>
</tr>
<tr>
<td>Business/Advertising Department</td>
<td>Raise money to publish the newspaper; sell newspapers; sell advertising space</td>
</tr>
<tr>
<td>Design Department</td>
<td>Put stories, art and photos into proper form for printing; print the paper</td>
</tr>
</tbody>
</table>

**READY?**

Check the diagram below and start thinking about which part of the newspaper is right for you.
Let’s think about those jobs and generate ideas for The Pontchartrain Picayune. Refer to other activities you’ve done in this unit and write about the people and events that are important in the Lake Pontchartrain Basin.

SUGGESTED NEWS DEPARTMENT ASSIGNMENTS:

NEWS: Write articles on wetland loss, endangered species, pollution, or natural resources in the Basin. Keep abreast of the news for current events occurring in the Basin that you can feature in your paper.

FEATURES: Write an article on “The Big One,” telling what would happen if a Category 5 hurricane hit New Orleans. Interview an older relative or friend about erosion problems they’ve seen in the Basin. Write a story on Julia Sims, the nature and wildlife photographer from Ponchatoula, along with a photo essay on wetland plants and animals. Give recipes for your favorite seafood dishes. Write an article on a field trip to your favorite place in the Basin.

EDITORIAL: Write your opinion about the importance of hurricane preparedness, recycling used motor oil, or carpooling. Draw an editorial cartoon about pollution or erosion in the Basin. Solicit letters to the editor on various topics of interest in the Basin.

SPORTS: Cover the first annual “Cliff Glockner Fishing Rodeo,” honoring the legendary fisherman from Bayou Lacombe. Write an article about deer management in the Basin. Write an article about the history of trapping nutria, mink, and muskrat. Cover a sportsmans’ show and report on the latest in fishing lures. Give dates and times for the Hunter Education Workshops sponsored by LA Wildlife & Fisheries.

ENTERTAINMENT: Draw a comic strip featuring “Snapley,” a Lake Pontchartrain crab. Design a maze based on a map of the Lake Pontchartrain Basin. Develop a crossword puzzle or a word search puzzle with the vocabulary words for this unit. Write a review for the fictional movie, “Hurricane!” (Did you see “Twister!”?)

WEATHER: Design a weather report for the Basin. Include a map, high and low temperatures, rainfall, three-day forecast, ozone index, tide chart, and any other information we might need to know.

HEADLINES: A good headline will draw readers to your article. It should be short and interesting, meant to catch the reader’s eye.

PHOTOGRAPHY AND ART: Take photographs, or clip some from magazines, that will highlight your articles and make them more interesting. Draw clear illustrations, graphs, or charts that can help your readers understand the subject more easily. Remember to include captions for your pictures!
IT TAKES MONEY TO PUBLISH A NEWSPAPER:

Suggestions for the Business/Advertising Department

 Decide on a "price" for each issue of *The Pontchartrain Picayune*.

 What is your plan for marketing the newspaper?

 Who is your intended audience?

 Who will sell or distribute the newspapers?

 You can raise money for your newspaper by selling advertising space. Make a decision about the type of ads you want to feature in *The Pontchartrain Picayune*. Do you want to accept any advertising, or will you accept only advertising for environmentally-friendly products and services?

 Here are some ideas for ads that you can develop: a store that sells fishing/hunting accessories; a shoestore with a sale on hiking boots; jackets, tennis shoes, and backpacks made of recycled plastic; canoeing lessons; wetland tours to Bayou LaBranche, Bayou Sauvage, and Turtle Cove.

 Can you think of others? Look at advertising circulars from a local paper for more ideas. Make your ads interesting. Use lettering (fonts) of different types and sizes. Keep the text simple. Add artwork or photographs for visual interest and to help “sell” the product.

 GETTING THE PAPER READY TO PRINT:

Suggestions for the Design Department

 After the stories, artwork, and advertising are ready, the Design Department has the job of putting *The Pontchartrain Picayune* together. What does that job entail?

 A computer can be a big help, but it’s not a necessity for assembling a great newspaper. Experiment with different types and sizes of fonts for variety as well as a look you like.

 How large is your newspaper? Will readers have a hard time finding certain features of interest to them? You might want to develop an index to direct readers to the page number of their favorite section.

 Look at several different newspapers for ideas on layout. This is the arrangement you use for fitting all the pieces of *The Pontchartrain Picayune* on paper. Cut out each headline, story, drawing, photo, and ad. Place them on paper to fit. Empty spaces? What will you do? Draw pictures or ads for those spots.

 How will *The Pontchartrain Picayune* be printed? Be sure that all your arrangements are in order. You will need access to a copy machine and enough paper to print the necessary number of copies.
PRESS TIME!!

Finishing Touches by the Editorial Staff

Be sure to proofread each article several times before The Pontchartrain Picayune goes to press.

Do a final check on all headlines and photo captions for accuracy.

Check to see that the circulation staff is ready to distribute the paper.
MULTIMEDIA PRESENTATION

**Objective:**
Develop a 5-10 minute multimedia presentation which evokes feelings of environmental appreciation or depicts environmental degradation in the Lake Pontchartrain Basin.

**Procedure:**
1. Use photographic slides, computer-generated slides, video, or pictures that portray your topic.
2. Select music or poetry that fits your theme.
3. Correlate video and audio components into a presentation.
4. Present your project to the class on the date assigned.

**Grading:**
- The multimedia project is worth ____ points.
- Projects will be scored by peer assessment, using the rubric provided.

**MULTIMEDIA PROJECT ASSESSMENT RUBRIC**

<table>
<thead>
<tr>
<th>V I S U A L</th>
<th>5 (Outstanding)</th>
<th>4 (Very good)</th>
<th>3 (Average)</th>
<th>2 (Fair)</th>
<th>1 (Poor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding pictures; excellent quantity &amp; variety</td>
<td>Clear, good pictures; good quantity &amp; variety</td>
<td>Decent pictures; adequate quantity &amp; variety</td>
<td>Mediocre pictures; barely enough quantity; little variety</td>
<td>Poor quality pictures; inadequate quantity; poor variety</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A U D I O</th>
<th>5 (Outstanding)</th>
<th>4 (Very good)</th>
<th>3 (Average)</th>
<th>2 (Fair)</th>
<th>1 (Poor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfectly fits topic; emotionally moving; perfect timing</td>
<td>Relates well to topic; very strong message; good timing</td>
<td>Fair amount of relevance; moderately strong message; okay timing</td>
<td>Barely matches topic; weak message; poor timing</td>
<td>Inappropriate match for pictures; message lacking; no timing</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>O B J E C T I V E</th>
<th>5 (Outstanding)</th>
<th>4 (Very good)</th>
<th>3 (Average)</th>
<th>2 (Fair)</th>
<th>1 (Poor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very specific to topic; evidence of hard work; makes you want to go out &amp; save the planet; holds audience rapt</td>
<td>Fits topic well; very good work; inspiring; interested audience</td>
<td>Doesn’t make a strong case; average effort; audience attention wanders</td>
<td>Boring; not enough time spent; little emotional response; does not keep audience attention</td>
<td>Evokes no emotional response; inappropriate; no evidence of overall effort</td>
<td></td>
</tr>
</tbody>
</table>

Commendations/Recommendations: ________________________________

________________________________________________________________________________________
A small increase in sea level has a major effect on the low-lying wetlands of the coastal areas of Louisiana, including the Lake Pontchartrain Basin. When sea-level rise is measured together with the natural process of subsidence, or sinking of the land that occurs in these areas, a rate of relative sea-level rise is obtained. Relative sea-level rise is of great concern for the wetlands of the Lake Pontchartrain Basin because it adds to the problems of wetland loss and saltwater intrusion. As the land becomes lower relative to the sea level, salty water floods areas that were once more freshwater environments, killing the vegetation and leading to erosion of wetlands.

**Objectives:**

Students will:

1. investigate the effect of water-logging on the growth of wetland plants;
2. measure the growth rate of wetland plants over time; and
3. make observations and inferences about the response of wetland plants to increased water levels.

**Teaching Materials:**

Per group or class:

- Ten plant pots — uniform size, proportional to the size of the plants
- Ten wetland plants obtained from a nursery, not the wetlands
- Potting soil
- Large, shallow trays on which to place the pots
- Water
- Ruler
- Handout: “Help! I’m Up to My Hips in Water!” (Page 225)
Getting Ready:

1. Before proceeding with this activity, be sure that you have enough time to collect the data on plant growth (at least eight weeks).

2. Research wetland plants with your students, becoming familiar with the common species.

3. Obtain enough wetland plants for each group of students to have a sample of ten. Examples of suitable wetland species include: bald cypress (Taxodium distichum) seedlings; marsh hay grass (Spartina patens); any species of rush (Juncus); any species of sedge (Carex, Scirpus or Cyperus); bulltongue (Sagittaria).

4. Obtain enough plant pots and soil to carry out the experiment. Choose smaller plants to make the experiment manageable.

Procedure:

This experiment may work best outside if you have a secure place at your school.

1. Set up the wetland plants in pots, arranging them in a convenient pattern for watering.

2. Carefully water each pot to the levels according to the handout: “Help! I’m Up to My Hips in Water!”

3. Maintain the water levels in the pots by watering as needed.

4. Measure the growth of the plants once a week; choose a day and time and always measure at the same time each week.

5. Make and record observations about the appearance of the wetland plants in each pot at each watering time.

6. At the end of the eight-week period of the measurement, calculate the growth rate of each plant and plot this value on the graph for each water level.

7. Draw conclusions about the effect of water levels on the plant growth.

8. How do your results relate to sea-level rise in the natural wetlands?

Extensions:

1. Include a non-wetland species of plant in the experiment to make a comparison between plant types.

2. Repeat the experiment, but keep the water level constant and vary the salinity. Use water of 0, 2, 5, 10, 15 and 20 parts per thousand (ppt) of salt. (One teaspoon in one liter of water makes approximately 1 ppt solution).

3. Draw conclusions about the effect of saltwater intrusion on the wetland plants used in the experiment.

4. Research further the natural habitat of the plants you used in your experiment. Do they naturally occur in the marsh or swamp? Do they live in fresh water, intermediate or brackish marsh?
Assessment Procedure:

Assess the students on their ability to maintain their experiment over time, keep accurate records, and to reach reasonable conclusions based on their observations and measurements. Assess their ability to translate the raw data on the chart into graph form.

<table>
<thead>
<tr>
<th>Value Points</th>
<th>Student’s experiment was:</th>
<th>Student’s conclusion was:</th>
<th>Translation of raw data into graph form:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Partially complete; there were incomplete records.</td>
<td>Not present.</td>
<td>There were many errors, causing the graph to be inaccurate.</td>
</tr>
<tr>
<td>2</td>
<td>More than half complete; at least half of the records were kept.</td>
<td>Partially formed.</td>
<td>Most data was correctly transferred, but graph contained many errors.</td>
</tr>
<tr>
<td>3</td>
<td>Complete; records were kept for all 8 weeks.</td>
<td>Complete, but did not match results well.</td>
<td>Data was transferred from chart to graph accurately. Graph was missing some labels.</td>
</tr>
<tr>
<td>4</td>
<td>Completed; good records were kept for all 8 weeks.</td>
<td>Complete and matched results well.</td>
<td>Data transferred accurately and graph complete. Graph’s appearance was adequate.</td>
</tr>
<tr>
<td>5</td>
<td>Very thoroughly completed; excellent records were kept throughout.</td>
<td>Well written and showed excellent understanding of observations and results.</td>
<td>All data was accurately transferred. Graph was complete and visually pleasing.</td>
</tr>
</tbody>
</table>

Maximum points: 15
**Handout:**
Help! I’m Up to My Hips in Water

Data Table

<table>
<thead>
<tr>
<th>Plant No.</th>
<th>Water Level (cm)</th>
<th>Growth of Plants (mm/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>Week 1 Week 2 Week 3 Week 4 Week 5 Week 6 Week 7 Week 8</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

**Graph of Growth Rate of Plants Versus Water Level**