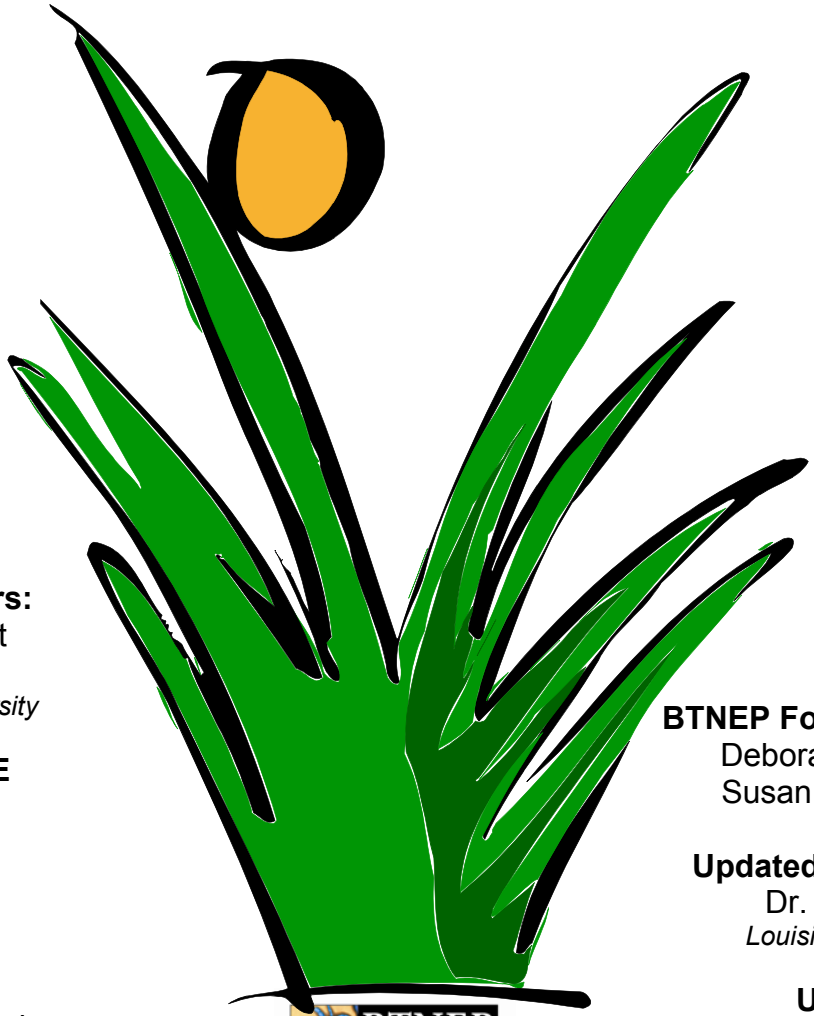
Vanishing Wetlands… Vanishing Future…

Middle School Activities and Video Guide



Project Managers:
Dr. Pat Callouet
Dr. Eric Stilling
Nicholls State University

Editor and GLE Coordinator:
Cally Chauvin

Writing Team:
Susan Proper
Louis Voiron
Deborah Allemand

BTNEP Formal Education Director:
Deborah Schultz (former)
Susan Testroet Bergeron

Updated and Formatted by:
Dr. Pam Blanchard
Louisiana State University

Updated 2004
Edited 2006

TABLE OF CONTENTS

LESSON 1 INTRODUCTION

OVERVIEW:
This lesson is designed to introduce students to some of the major concerns about the Barataria-Terrebonne wetlands. The teacher will set up an inquiry activity, followed by student exposure to new vocabulary through viewing a video clip and ending with students working cooperatively in building a model to be used during the two-week unit.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)

OBJECTIVES:
* To predict the outcome of a scientific experiment using prior knowledge.
* To identify major vocabulary associated with the Barataria-Terrebonne wetlands.
* To follow written procedures in a scientific design

STUDENT HANDOUTS:
1: Algae Bloom Data Sheet
2: Wetlands Glossary
3: Mississippi River Flow Map
4: Building a Watershed Model (supplies needed)

TEACHER GUIDE:
4: Building a Watershed Model

Activity 1 Algae Bloom (5 minutes)
Note: This is a multi-day activity that is set up on Day 1, with daily observations made on the contents of the beakers through Day 6.

Materials

bayou, river, pond or lake water (1 sample per class, i.e., gal.)	3 beakers per class
fertilizer (high in nitrogen, phosphorus, and silicates)	balance or measuring cup

1. Pass out ***Algae Bloom Data Sheet*** and have students answer the questions in Part 1 as you set up the demonstration experiment.
2. Pour the sample water into 3 beakers in relationship to the quantity needed for the fertilizer. All beakers should contain the same volume of sample water.
3. Label beaker 1 as the "control" and leave as is.
4. Add fertilizer to beaker 2 of the sample water as prescribed by the package. Label the beaker as "fertilized."
5. Add double the prescribed amount of fertilizer to beaker three and label as "excess fertilized."
6 Have students predict what will happen in each beaker compared to the others on Part II of the student handout entitled ***Algae Bloom Data Sheet***.
7. Have students record observations on a daily basis on Part III of the ***Algae Bloom Data Sheet*** and discuss the results on day 6.

LESSON 1 | INTRODUCTION (continued)

Activity 2 Video Clip (12 minutes)

1. Pass out the Wetlands Glossary handout and tell students to identify the glossary terms on their handout as they hear them referred to on the video by highlighting, circling, or underlining the terms.
2. View the Introduction of the ***Vanishing Wetlands, Vanishing Future*** video.
3. Have students look at the terms they have indicated on their glossary and make them aware that over the next two weeks they will explore these concepts and learn much about Louisiana Wetlands.

Activity 3 Building a Watershed Model (28 minutes)
**Note: This activity is designed for cooperative groups to make models to be used during the 2-week unit as applicable. Availability of supplies should be taken into consideration when planning for this activity. A lunchroom style-baking tray may be useful if a whole class model is being made.*

1. Pass out Student Handouts 3 and 4.
2. Have students read the procedures on student Handout 4 and answer any questions that students may have.
3. Monitor students as they follow the procedures and begin building their watershed model.
4. Discuss the follow-up questions for each part of the activity.

ASSESSMENT:

Activity 1	Have students randomly read their predictions.
Activity 2	Use a checklist to monitor the identification of terms.
Activity 3	Use a checklist to monitor student progress in following procedures to build their model. Have students turn in their model-building handout with group answers to the follow-up questions.

EXTENSION
Demonstrate land building through sedimentation

Procedure
1. Mix soil into a beaker of water and stir
2. Tear coffee filters into strips and tack them to the clay along the river in such a manner that water can pass through, but cannot go directly under.
3. Pour the soiled water down the river at a rate too high for the river to hold. In other words, flood parts of your model along the river. DO NOT flood the model completely. The water should still be able to reach the Gulf area.
4. Gradually pour the water out of the model into the bucket.
5. Observe your coffee filters.

Follow-Up Questions:
1. What did you observe left on the coffee filters? ***Soil particles from the water.***
2. Why did this occur? ***The water passed through while the debris filtered out.***
3. Where did the water go? ***The water went through the filter and back into the river.***
4. How is the coffee filter similar to land? ***Land filters water as it passes through it.***
5. If the muddy Mississippi River were to flood every year, what would you expect to happen to the elevation of the land around it? Why? ***The land around the Mississippi River would rise due to the sediments being filtered out of the water by the land and the water passes through it.***

Student Handout 1

Algae Bloom Data Sheet

I. EXPERIMENTAL DESIGN. As your teacher prepares the class experiment, fill in the following:

Where did the sample of water come from? _____
Volume of water in each beaker: _____
Amount of fertilizer added to beaker 2: _____
Amount of fertilizer added to beaker 3: _____
Are all beakers clearly labeled? _____

What is the independent variable? _____
What is the dependent variable? _____

II. PREDICT. Following the preparation of the experiment, complete the following:

Predict what will happen in each beaker compared to the other over the next several days:

III. OBSERVATIONS. Observe the beakers everyday and complete the following data table of observations beginning with today. Be very specific in your observations. Disregard weekends while observing.

Day# / Date	Observations of the Control Beaker	Observations of Beaker 2	Observations of Beaker 3
1/			
2/			
3/			
4/			
5/			
6/			

IV. DATA ANALYSIS (to be completed on Day 6)

1. According to your observations, what is the major difference between the 3 beakers of water?

2. Why do you think this major difference occurred?

3 How might fertilizers enter a natural body of water?

V. Conclusion

Was your prediction made on Day I proved or disproved? Why? (Give specific evidence you have collected to back up your conclusion.)

Student Handout 2

WETLANDS GLOSSARY

BARRIER ISLAND. Long narrow strips of sand that protect inland areas from ocean waves and storms. They also provide unique habitats for birds, fish and sea turtles.

BRACKISH MARSH. Marshes occurring where salinity ranges from 3-15 parts per thousand (ppt); dominated by *Spartina patens* (wiregrass).

CHANGES IN LIVING RESOURCES. The changes in population and/or location of living organisms in an ecosystem due to natural and man-made causes

DELTA. An area formed from the deposition of sediments at the mouth of a river

DREDGING. The removal of sediment from a channel to produce sufficient depths for navigation, or to provide adequate flood protection/drainage.

ESTUARY. An environment where terrestrial, freshwater, and seawater (saline) habitats overlap; the area where freshwater and saltwater meet and mix.

EUTROPHICATION: a condition that occurs when too many nutrients, such as phosphorus and nitrogen, are found in the water. Results in excessive algae growth and low oxygen conditions, which can lead to fish kills.

FOOD CHAIN: transfer of food energy from plants to one or more animals; a series of plants and animals linked by their food relationships.

FOOD WEB: a series of linked food chains.

FRESHWATER MARSH: wetlands that occur along rivers and lakes; dominated by grasslike plants, including grasses, reeds, cattails, rushes and sedges. 0-2 ppt salinity limit.

GLOBAL WARM1NG: an increase of the earth's temperature by a few degrees resulting in an increase in the volume of water; contributes to sea-level rise.

HABITAT LOSS: the loss of life-supporting land and wetlands due to erosion and subsidence.

HYDROLOGIC MODIFICATION: the change by man of the natural flow of water through such practices as the building of levees and digging of canals.

MARSH: an environment where terrestrial & aquatic habitats overlap; a wetland dominated by grasslike plants.

PATHOGEN CONTAMINATION: the presence of disease-producing organisms such as bacteria and viruses.

PREDATOR: an animal that lives by capturing other animals for food.

PREY: an animal that is killed and eaten by another animal.

PRODUCER: any organism that is capable of producing its own food, usually through photosynthesis.

SALTWATER INTRUSION: the invasion of freshwater bodies by denser salt water

SALTWATER MARSH: saltwater (15-18 parts per thousand or greater) wetlands occurring along the coast; dominated by saltwater grasses such as *Spartina alterniflora* (oyster grass).

SEA-LEVEL RISE: a rise in the surface of the sea due to increased water volume of the ocean and/or sinking of the land.

SEDIMENT LOSS: the reduction in the amount of sediment carried by the Mississippi River to the wetlands.

SPOIL: the material removed from channels and canals by dredging; also called “dredged material.”

SUBSIDENCE: a gradual sinking of land with respect to its previous level

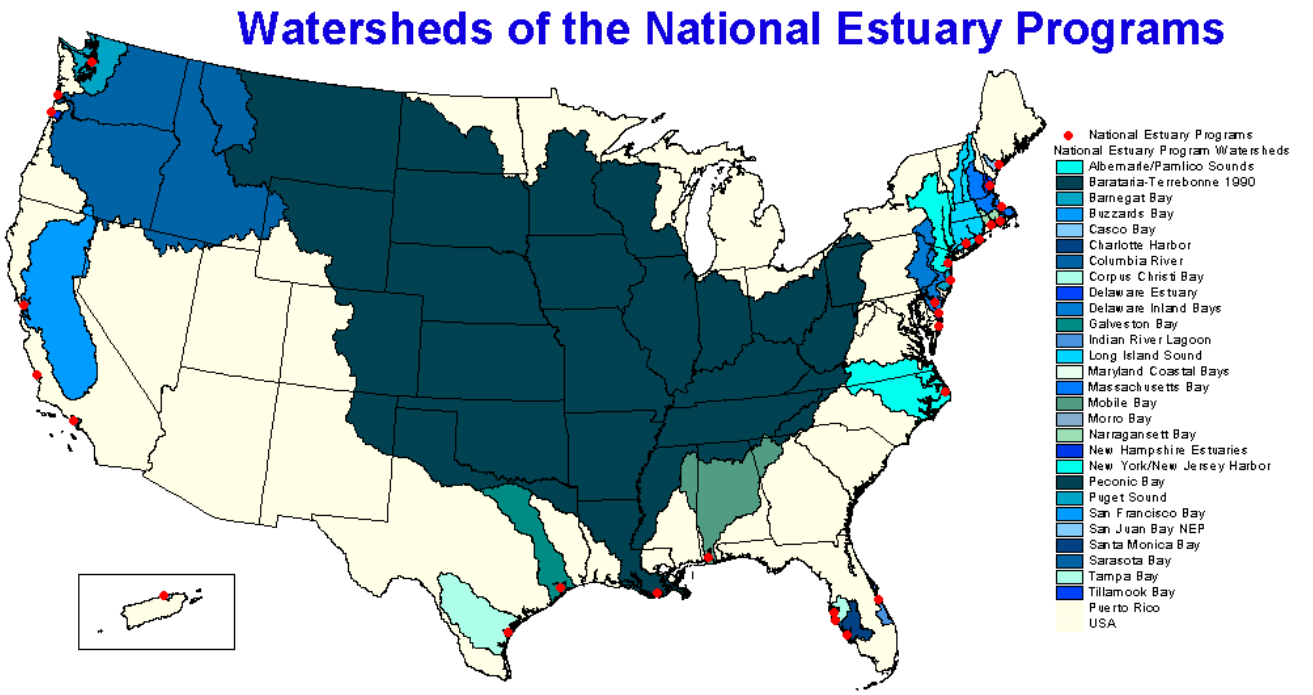
SWAMP: forested low, spongy land generally saturated with water and covered with trees and aquatic vegetation; may be a deepwater swamp, such as cypress tupelo, which has standing water all or part of the growing season.

TOXIC SUBSTANCES: chemical substances found in the water that may adversely affect living resources, including humans.

WETLANDS: land areas that are wet due to a close relationship to a body of water or groundwater, or land areas that are flooded regularly; they support vegetation adapted for life in saturated soil conditions.

Student Handout 3

MISSISSIPPI RIVER FLOW MAP



U.S. Environmental Protection Agency, 1999

Student Handout 4

Building a Watershed Model

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose: To follow scientific procedures in building a watershed model to demonstrate the flow of the Mississippi River and its distributaries.

Materials:

Student Handout 3 Mississippi River Flow Map
Tray (e.g., cafeteria-style tray, stream table, paint tray, cardboard box with plastic wrapping, etc.)

Wood peg	Modeling Clay	Stirring Rod
Pencil	Coffee Filters	Thumb Tacks
Beaker	Soil	
Bucket	Water	

Procedure:

1. Flatten modeling clay in a tray to represent land in the wetlands. Leave an area without clay to represent the Gulf of Mexico.
2. Mold the clay to gradually decline in elevation, as it gets closer to the Gulf of Mexico.
3. While looking at the Mississippi River Flow Map, use a pencil to mark the flow on the clay of the Mississippi River. Choose 4-6 of the flyer's major distributaries mark their flows on the clay as well
4. Use the wood peg to carve out the bodies of water making the Mississippi River slightly deeper than the distributaries but not so deep as to touch the bottom of the tray.
5. Gradually pour a beaker of water down the model beginning at the top to test your model for gradual decline in elevation. If the water does not flow to the area representing the Gulf of Mexico, adjust the elevation of the clay and retest.
6. Pour the water out of the model and into the bucket.
7. You have now made a watershed model to demonstrate the flow of water from the Mississippi River to the Gulf of Mexico. You will use this model periodically over the next two weeks

Follow-Up Questions:

1. When you poured the water into the model, did it flow downward or did you have to readjust?

   If you had to readjust, what did you do to make the water flow downward?

2. As the water flowed down the major channel of the Mississippi River, did any go into the distributaries?

   Why do you think this occurs?

3. Compare the speed of the water in the main channels with the speed of the water in the distributaries.

Student Handout 4

ANSWER KEY

Building a Watershed Model

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose: To follow scientific procedures in building a watershed model to demonstrate the flow of the Mississippi River and its distributaries.

Materials:

Student Handout 3 Mississippi River Flow Map
Tray (e.g., cafeteria-style tray, stream table, paint tray, cardboard box with plastic wrapping, etc.)

Wood peg	Modeling Clay	Stirring Rod
Pencil	Coffee Filters	Thumb Tacks
Beaker	Soil	
Bucket	Water	

Procedure:

1. Flatten modeling clay in a tray to represent land in the wetlands. Leave an area without clay to represent the Gulf of Mexico.
2. Mold the clay to gradually decline in elevation, as it gets closer to the Gulf of Mexico.
3. While looking at the Mississippi River Flow Map, use a pencil to mark the flow on the clay of the Mississippi River. Choose 4-6 of the flyer's major distributaries mark their flows on the clay as well
4. Use the wood peg to carve out the bodies of water making the Mississippi River slightly deeper than the distributaries but not so deep as to touch the bottom of the tray.
5. Gradually pour a beaker of water down the model beginning at the top to test your model for gradual decline in elevation. If the water does not flow to the area representing the Gulf of Mexico, adjust the elevation of the clay and retest.
6. Pour the water out of the model and into the bucket.
7. You have now made a watershed modal to demonstrate the flow of water from the Mississippi River to the Gulf of Mexico. You will use this model periodically over the next two weeks

Follow-Up Questions:

1. When you poured the water into the model, did it flow downward or did you have to readjust? ***This answer will vary for each group.***

   If you had to readjust, what did you do to make the water flow downward? ***This answer will vary for each group.***

2. As the water flowed down the major channel of the Mississippi River, did any go into the distributaries? ***Yes.***

   Why do you think this occurs? ***Water flows into areas where there is the least amount of resistance.***

3. Compare the speed of the water in the main channels with the speed of the water in the distributaries. ***Generally water in the distributaries flows slower than in the main channel.***

LESSON 2 HYDROLOGIC MODIFICATION

OVERVIEW: This lesson is desired to develop the concept of hydrologic modification, the man-made changes in the flow of natural bodies water. It is imperative that students understand this concept and the results of it since it is a cornerstone of this unit.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
7: GLE-35	Identify resources humans derive from ecosystems. (SE-M-A1)
7: GLE-36	Distinguish the essential roles played by biotic and abiotic components in various ecosystems. (SE-M-A1)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)

OBJECTIVES:
* To demonstrate hydrologic modification.
* To analyze the impact of building levees on the flow of water and the building of land.

STUDENT HANDOUT:
5 Hydrologic Modification Activity (supplies needed)

TEACHER GUIDE:
5 Hydrologic Modification Activity

SUGGESTED PROCEDURES:

** Note: The same watershed models built in Day I will again be used for this activity. Materials should be ready for students to use, as they need them.*

Hydrologic Modification Activity (45 minutes)

1. Ask the students to reflect back on the previous day's lesson. Discuss with them again the concept of sedimentation and how it occurs with the flooding of a river carrying sediments and depositing them as over bank deposits. Ask the question: *What would happen if sedimentation stopped occurring?* (The land would stop building which would-then cause a loss of land as the land naturally sinks and as it is eroded.)
2. Tell the students that they will use their model to find out today how humans have affected the flow of natural bodies of water.
3. Pass out Student Handout 5.
4. Monitor students as they work on the hydrologic modification activity and answer questions as they arise.
5. Discuss the questions at the end of the activity with the class.
6. View the hydrologic modification section of the *Vanishing Wetlands. Vanishing Future* video as a reinforcement of the day's lesson. (10 minutes should be reserved for this.)

ASSESSMENT:
* Use a checklist or rubric to monitor student progress in demonstrating hydrologic modification on their models.
* Informally assess students during activity and discussion.
* Have each group turn in one copy of their activity sheet with the questions answered.

LESSON 2 | HYDROLOGIC MODIFICATION (continued)

SUGGESTIONS:
Students will be creating residential areas on their models during the activity today. Ask the students to bring in game pieces or to make cardboard figures to be used on the model to represent houses and other buildings. Encourage them to be creative in enhancing their models. Also, be sure to have enough extra clay for students to use in building levees. Allow the students to propose and test solutions to their problem of flooding even if it does not seem logical.

Student Handout 5

Hydrologic Modification Activity

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose:
1. To model the solution of flooding of a residential area due to rises in the water level of a river.
2. To analyze the impact of man-made solutions to problems in the wetlands

Materials:

Modeling clay	Watershed model	Figures to represent residential areas
Water	Bucket	Plastic Jug

Procedure:
1. Fill the plastic jug with warm and gradually pour water at the beginning of the river to again see the flow of water.
2 Pour the water out of the model into the bucket.
3. Build residential areas along the river and distributaries using available supplies (game pieces, pen caps, cardboard figures, etc.)
4. Again pour water in the model, but this time pour more water to simulate an increase in the flow of water due to rises in river level in the spring (Some areas should flood, so pour enough for this to occur.)
5. Propose a solution to prevent the flooding from occurring given the fact that the water rises to high levels every spring and is also possible during heavy storms.
6. Modify your model to reflect this solution and test. If the proposal does not work, make another one and test until a solution is determined.
7. When your model is complete and prevents flooding, answer the follow-up questions.

Follow-Up Questions:
1. What was your solution to the flooding problem? How does your solution prevent flooding?
   _____
   _____
   _____
2. Did your solution involve changing how the water flows when the water level rises to flood levels?
   _____
3. Will the land where the flooding used to occur be able to constantly build now that your solution has been put into place? Why or why not?
   _____
   _____
   _____
4. If the land can no longer build up, is the area more likely or less likely to have erosion problems? Explain.
   _____
   _____
   _____
5. Modifying or changing the flow of water is called _____.

Student Handout 5

ANSWER KEY

Hydrologic Modification Activity

Group Members: _____ Date: _____

_____ Period _____

_____

_____

Purpose:

1. To model the solution of flooding of a residential area due to rises in the water level of a river.
2. To analyze the impact of man-made solutions to problems in the wetlands

Materials:

Modeling clay	Watershed model	Figures to represent residential areas
Water	Bucket	Plastic Jug

Procedure:

1. Fill the plastic jug with warm and gradually pour water at the beginning of the river to again see the flow of water.
2 Pour the water out of the model into the bucket.
3. Build residential areas along the river and distributaries using available supplies (game pieces, pen caps, cardboard figures, etc.)
4. Again pour water in the model, but this time pour more water to simulate an increase in the flow of water due to rises in river level in the spring (Some areas should flood, so pour enough for this to occur.)
5. Propose a solution to prevent the flooding from occurring given the fact that the water rises to high levels every spring and is also possible during heavy storms.
6. Modify your model to reflect this solution and test. If the proposal does not work, make another one and test until a solution is determined.
7. When your model is complete and prevents flooding, answer the follow-up questions.

Follow-Up Questions:

1. What was your solution to the flooding problem? How does your solution prevent flooding?
   Levees should be built along the banks of the river and distributaries. Levees prevent water from overflowing when water levels in the river increase by keeping the water within the major channel.

2. Did your solution involve changing how the water flows when the water level rises to flood levels?
   Yes.

3. Will the land where the flooding used to occur be able to constantly build now that your solution has been put into place? Why or why not? ***No. because now the water can no longer flood onto the land, nor can the sediments that the water carries reach the land. These sediments are instead carried by the river into the deep water of the Gulf of Mexico where no land building occurs.***

4. If the land can no longer build up, is the area more likely or less likely to have erosion problems? Explain.
   The land will be more likely to have erosion problems because the land continues to subside and be eroded by wind and waves, the river will no longer be able to replenish the lost land by depositing sediments.

5. Modifying or changing the flow of water is called ***Hydrologic modification.***

Student Handout 5b

Hydrologic Modification Activity – Spoil Banks

Extension: Relate the effects of levees on wetlands to spoil banks from building canals.

Background: Due to the location of many offshore oil and gas drilling sites, it is sometimes necessary to build canals in the wetlands in order to transport supplies to and from oil rigs. Spoil banks are created when the canal is dug and the soil is placed on the sides of the canals.

Questions:

1. How is placing the spoils of digging the canal like building levees?
   _____
   _____
   _____
2. What will happen to the plant life underneath where the spoil is placed?
   _____
   _____
   _____
3. What happens to the weight of the land where the spoil is placed?
   _____
   _____
   _____
4. How will this weight affect the natural sinking of the land?
   _____
   _____
   _____

** If time permits, construct a canal on your model with spoil banks.

Student Handout 5b

ANSWER KEY

Hydrologic Modification Activity – Spoil Banks

Extension: Relate the effects of levees on wetlands to spoil banks from building canals.

Background: Due to the location of many offshore oil and gas drilling sites, it is sometimes necessary to build canals in the wetlands in order to transport supplies to and from oil rigs. Spoil banks are created when the canal is dug and the soil is placed on the sides of the canals.

Questions:

1. How is placing the spoils of digging the canal like building levees? ***The land is built up around the canal and does not allow water to cover the surrounding land. Sediments can no longer be deposited in the wetlands.***

2. What will happen to the plant life underneath where the spoil is placed? ***The plant life underneath the spoil banks will die. Being placed underneath the soil will not allow light and air to reach the plant (which is needed for photosynthesis). The weight of the soil will also crush the plants.***

3. What happens to the weight of the land where the spoil is placed? ***The weight of the land will increase tremendously.***

4. How will this weight affect the natural sinking of the land? ***Since gravity depends on the mass of objects, the addition of soil in the area cause gravity to be stronger and natural sinking will occur at a faster rate.***

** If time permits, construct a canal on your model with spoil banks.

LESSON 3 SEDIMENT LOSS

OVERVIEW:
This lesson focuses on the loss of sediment, which is one of the major issues concerning LA wetlands today. Various human factors have led to sediment loss, along with natural phenomena, such as subsidence.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
8: GLE-20	Describe how human's actions and natural processes have modified coastal regions in Louisiana and other locations. (ESS-M-A8)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)
8: GLE-53	Distinguish among several examples of erosion (e.g., stream bank, topsoil, coastal) and describe common preventive measures. (SE-M-A10)

OBJECTIVES:
* To distinguish the man-made and natural causes of sediment loss.
* To identify extraction of products from the ground as a cause of increased subsidence.

STUDENT HANDOUTS:
6. Causes of Sediment Loss
7. Take It from the Ground

TEACHER GUIDES:
6. Causes of Sediment Loss
7. Take It from the Ground

Activity 1 (45 minutes)
1. View the "Sediment Loss" section of the Vanishing Wetlands, Vanishing Future video.
2. Pass out **Student Handout 6** and divide students into cooperative groups to work on the assignment.
3. After students have completed the concept map, have students share their maps and discuss what they now know about levees, spoil banks and sediment loss.
4. Pass out **Student Handout 7** and have students complete the activity as outlined on the worksheet. *NOTE: All of the materials should be ready for students to get immediately in order for enough time to be available for completion of this activity.*
5. Using the follow-up questions, lead students in discussing the concepts learned through this activity.

Assessment
* Use a checklist to monitor student progress during group work. Collect concept maps (either group maps or individual maps). A rubric may be useful for assessing the concept maps.
* Monitor students informally as they complete the activity. Randomly choose groups to orally answer the follow up questions.

Student Handout 6

Causes of Sediment Loss

I. Read the following passage.

There are several factors that have led to the decrease in sediment being carried to south Louisiana by the Mississippi River. Locks and dams on the Missouri, Ohio and upper Mississippi rivers have created a situation that allows less sediment from other parts of the country to flow downstream. Also, agricultural interests in other states have implemented conservation measures to prevent their soil from being eroded. This means less sediment reaches the Mississippi River. There has also been a reduction in land clearing to preserve forested areas. This also means that less sediment reaches the river.

Closer to home, leveeing of wetlands, navigation canals, spoil banks from dredging, and upstream diversions of the Mississippi River are causes of reduced sediment flows. None of these sediment loss causes would be a big problem if it were not for the natural sinking of land, called subsidence. Compaction of loose sediments causes the land to sink, or subside. In the past, sediments built the land at a rate greater than the rate of subsidence and kept the land above the level of the sea. However, due to sediment loss, many areas are sinking faster than they can be replenished with sediment and are slowly sinking under water.

To a lesser degree, man has also contributed to subsidence by extracting minerals, groundwater, and petroleum from the ground, draining wetlands for development, and urbanizing. The more weight we place on the land and the more we take out of the land, the faster the land will compact and subside.

II. Draw a concept map below showing the causes of sediment loss. Be sure to clearly distinguish man-made and natural causes.

Student Handout 7

Take It from the Ground

Group Members: _____ Date: _____
_____ Period _____
_____
_____

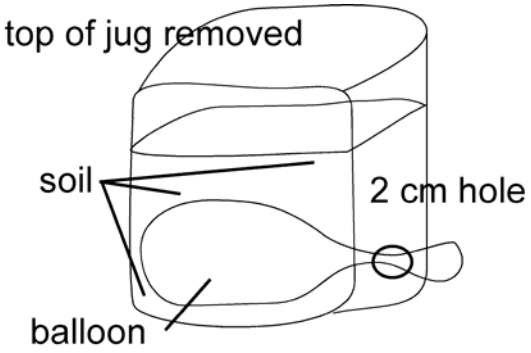
Purpose:

1. To demonstrate the effects of extracting materials from underground on the surface elevation of the land.

Materials:

Clear plastic jug soil scissors balloon

Procedure:



1. Cut off the top of the plastic jug about ¼ of the way from the top.
2. Cut a small hole in the side of the jug about 2/3 from the bottom of the jug. The hole should be about 2 cm in diameter.
3. Fill the bottom of the container with soil until the soil is just below the hole cut out on the side.
4. Blow up the balloon to a size that can fit inside the jug (do not tie the balloon). Place the inflated balloon inside the jug on top of the oil sticking the mouthpiece through the hole. Someone must continually pinch the neck of the balloon to keep the air from escaping the balloon.
5. Fill the remainder of the jug with soil around the balloon. The balloon should be completely buried in the soil.
6. Release air from the balloon and observe. Record your observations in the data section below.

Data & Observations:

1. Observations after air was released from the balloon: _____
_____.
_____.

2. Draw what happens after you let the air out of the balloon. ➔

Follow-Up Questions:

1. How does this activity model extracting minerals and petroleum from the ground?
_____
_____
_____
_____

2. Does this type of extraction increase the rate of subsidence?
_____
_____
_____
_____

Student Handout 7

ANSWER KEY

Take It from the Ground

Group Members: _____ Date: _____
_____ Period _____
_____
_____

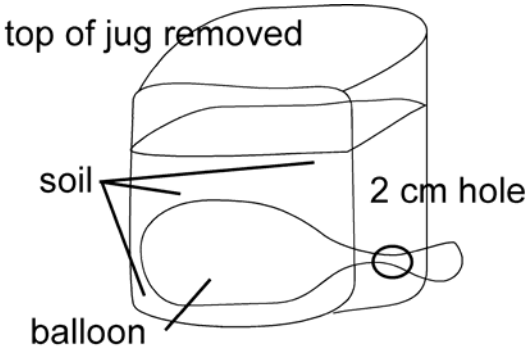
Purpose:

1. To demonstrate the effects of extracting materials from underground on the surface elevation of the land.

Materials:

Clear plastic jug soil scissors balloon

Procedure:



1. Cut off the top of the plastic jug about ¼ of the way from the top.
2. Cut a small hole in the side of the jug about 2/3 from the bottom of the jug. The hole should be about 2 cm in diameter.
3. Fill the bottom of the container with soil until the soil is just below the hole cut out on the side.
4. Blow up the balloon to a size that can fit inside the jug (do not tie the balloon). Place the inflated balloon inside the jug on top of the oil sticking the mouthpiece through the hole. Someone must continually pinch the neck of the balloon to keep the air from escaping the balloon.
5. Fill the remainder of the jug with soil around the balloon. The balloon should be completely buried in the soil.
6. Release air from the balloon and observe. Record your observations in the data section below.

Data & Observations:

1. Observations after air was released from the balloon: ***Students should observe that when the air is released out of the balloon, the soil above it sinks.***
   _____.
2. Draw what happens after you let the air out of the balloon. ➔

Follow-Up Questions:

1. How does this activity model extracting minerals and petroleum from the ground?
   When minerals and petroleum are extracted from the ground, an empty space is left inside the layer of rock where the minerals or petroleum used to be, just like the releasing of air from the balloon.
2. Does this type of extraction increase the rate of subsidence? Explain
   Yes. The Earth's crust will sink just like when the soil in the jug sank when the air was let out of the balloon. The more petroleum removed from the subsurface, the more the ground will sink in response.

LESSON 4 HABITAT LOSS

OVERVIEW:
This lesson is designed to make students aware of the causes of land loss in the Louisiana wetlands. Students will also explore the problems associated with species attempting to adapt to new environments.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-48	Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population. (SE-M-A2)
5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
7: GLE-35	Identify resources humans derive from ecosystems. (SE-M-A1)
7: GLE-36	Distinguish the essential roles played by biotic and abiotic components in various ecosystems. (SE-M-A1)
7: GLE-38	Evaluate the carrying capacity of an ecosystem. (SE-M-A2)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)
8: GLE-53	Distinguish among several examples of erosion (e.g.,stream bank, top-soil, coastal) and describe common preventive measures.(SE-M-A10)

OBJECTIVES:
* To identify causes of habitat loss in Louisiana wetlands.
* To explore the impact of habitat loss on species.

STUDENT HANDOUTS:
8. Causes of Habitat Loss
9. Thrown into a New Environment

TEACHER GUIDE (S):
8. Causes of Habitat Loss
9. Thrown into a New Environment

Activity 1 Video Clip and Follow-up (25 minutes)
1. View the "Habitat Loss" section of the ***Vanishing Wetlands, Vanishing Future*** video.
2. Pass out **Student Handout 8** for students to complete in cooperative learning groups.
3. Monitor the students as they work on the video follow-up activity and answer any questions that may arise.
4. Have the groups report their findings from the handout.

Activity 2 Impact of Habitat Loss on Species (20 minutes)
NOTE: If time will be a problem for Activity 2, the teacher may cut out the pieces of paper in advance and skip the procedures on Student Handout 9 that explain how to cut or punch the paper (Steps 1-2).

1. Pass out **Student Handout 9** and have the students begin working on the activity in cooperative groups.
2. When students have answered the pre-activity questions and have punched out or cut out the appropriate pieces of each color of paper, make an area of the classroom for the remainder of the activity to be finished.
3. Begin collecting data as described in the procedure of Student Handout 9.
4. Discuss the follow-up questions with the class.

LESSON 4 | HABITAT LOSS (continued)

Assessment

* Activity 1: Randomly call on students to answer questions and/or collect one paper from each group or individually to be graded.
* Activity 2: Informally assess based on class discussion and/or collect the activity handout from each group to be graded.

Student Handout 8

Causes of Habitat Loss

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose: Read the following passage and answer the questions that follow.

Studies have indicated that from 1956 to 1978 over 11,500 acres of land a year were being loss due to subsidence and other factors in the coastal areas of the Barataria-Terrebonne basins. That's a football field size chunk of land disappearing every 30 minutes! The rate in 1990 was estimated at almost 13,500 acres per year. Scientists have calculated that over 294,000 acres of marsh have been converted to open water between 1956 and 1978. This tremendous loss of land is very alarming.

Habitat loss can occur due to many activities. Sediment loss, along with the natural sinking of marsh, is the most significant cause. Sediment loss is caused by hydrologic modification, as well as by a decrease in sediments due to human activities in the Mississippi River watershed. Sea level rise and erosion also contribute to the problem, as can human activities such as canal dredging and construction of navigation channels. Saltwater intrusion is a major problem due to these activities. Shoreline erosion caused by the wakes from commercial and recreational boating also contributes to habitat loss. Also, overgrazing by mammals, such as nutria, destroys plant communities that hold soil in place. Studies have indicated that hurricane damage is increased in marshes that have been impacted by herbivory, for example, areas heavily grazed by nutria. Storm surges and winds that accompany severe tropical storms and winter cold fronts are additional natural forces that cause changes in habitat and land loss.

1. List three natural occurrences that cause a loss in habitat.
   _____
   _____
   _____

2. List three human activities that cause a loss in habitat.
   _____
   _____
   _____

3. As coastal areas are eroded away, what happens to the people who live in these areas?
   _____
   _____
   _____

4. What do you believe happens to freshwater plants as saltwater intrudes and how does this contribute to habitat loss?
   _____
   _____
   _____

Challenge: How do you think global warming may affect habitat loss in coastal Louisiana?
_____
_____
_____

Student Handout 8

ANSWER KEY

Causes of Habitat Loss

Group Members: _____ Date: _____

_____ Period _____

_____

_____

Purpose: Read the following passage and answer the questions that follow.

Studies have indicated that from 1956 to 1978 over 11,500 acres of land a year were being loss due to subsidence and other factors in the coastal areas of the Barataria-Terrebonne basins. That's a football field size chunk of land disappearing every 30 minutes! The rate in 1990 was estimated at almost 13,500 acres per year. Scientists have calculated that over 294,000 acres of marsh have been converted to open water between 1956 and 1978. This tremendous loss of land is very alarming.

Habitat loss can occur due to many activities. Sediment loss, along with the natural sinking of marsh, is the most significant cause. Sediment loss is caused by hydrologic modification, as well as by a decrease in sediments due to human activities in the Mississippi River watershed. Sea level rise and erosion also contribute to the problem, as can human activities such as canal dredging and construction of navigation channels. Saltwater intrusion is a major problem due to these activities. Shoreline erosion caused by the wakes from commercial and recreational boating also contributes to habitat loss. Also, overgrazing by mammals, such as nutria, destroys plant communities that hold soil in place. Studies have indicated that hurricane damage is increased in marshes that have been impacted by herbivory, for example, areas heavily grazed by nutria. Storm surges and winds that accompany severe tropical storms and winter cold fronts are additional natural forces that cause changes in habitat and land loss.

1. List three natural occurrences that cause a loss in habitat.
   Natural sinking of land, overgrazing by animals (herbivory), storm surges and wind from storms, and fronts, sea level rise, erosion.

2. List three human activities that cause a loss in habitat.
   Hydrologic modification, canal dredging, shoreline erosion from boating, and decreases in sediment due to human activities (damming of rivers, etc.).

3. As coastal areas are eroded away, what happens to the people who live in these areas?
   The people living in these areas will eventually be forced to more to higher ground once their properties are threatened by going underwater.

4. What do you believe happens to freshwater plants as saltwater intrudes and how does this contribute to habitat loss?
   Freshwater plants that do not adapt, which most do not, to saltwater will die. Plants are a source of holding soil together – without plant roots, the soil will be eroded more easily by water and wind causing habitat loss.

Challenge: How do you think global warming may affect habitat loss in coastal Louisiana?
Global warming causes more ice to melt at the poles, which results in higher sea level. Higher sea level then causes more land in low-lying coastal areas to be underwater causing loss of habitat.

Student Handout 9

Thrown Into a New Environment

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Pre-Activity Questions:

1. Various species of life hide themselves from predators. For example, lizards change color and flounders partially bury themselves in the sea floor so that they blend into the sediments. What is this process called? _____
2. As land that animals live on becomes covered with water, what happens to the animals? What must they do? _____
3. Do you think all of these displaced species will survive in a new environment? Explain your answer.
   _____
   _____

Purpose: To simulate the effects on a species moving into a new environment.

Materials: Bulletin board paper (15 cm x 15 cm of four different colors for each group of students)
Bulletin board paper (2-4 feet sections taped side by side, of only one color).
Ruler and Scissors or Hole puncher
Paper or plastic cup

Procedure:

1. Each group should cut out twenty-five 1cm x 1cm squares of four colors of poster paper. (An alternate way to accomplish this is to use a hole puncher to punch 25 holes in each of the four colors of poster paper.) Each of the four colors represents a species of animal. Place all the pieces in a paper cup.
2. Multiply the number of groups by 25 for each color paper to attain a total number of pieces for each color. Record these numbers in the data table of this worksheet.
3. Clear an area of floor that will be designated as the habitat area in the classroom.
4. All of the cut paper squares should be dumped and spread out in the designated habitat area.
5. The teacher will allow one student from each group (or any appropriate number of students) 10 seconds to pick up as many pieces of paper as they can. Following the 10 seconds, each group will count how many pieces of each color they have and report to the class to obtain a total number of each color picked up. Record these class totals in the data table of this worksheet.
6. Pick up all of the pieces of paper and place them back in the cups. Now place the taped 4-foot sections of 1 color of paper in the designated habitat area. This represents a new area that your species have been forced to move due to habitat loss.
7. Repeat steps 4 and 5. Record data.

Data Table

Total number of each color of pieces of paper:
_____

Total pieces of paper:
_____

Color of the taped 4-foot poster paper sections:
_____

Species/ Color	# picked up bare floor	# picked up on color paper
Species A Color: _____		
Species B Color: _____		
Species C Color: _____		
Species D Color: _____		

Thrown Into a New Environment (PAGE 2)

Follow-Up Questions:

1. Was there a significant difference between how many pieces of each color was picked up during the first trial on the bare floor? _____

2. Were you able to see all colors clearly when the paper was on the plain floor? Explain.
_____
_____

3. Was there one color during the second trial with the colored paper on the floor that was not picked up as much as the others? _____ If so, which color? _____

4. Why do you suppose one color might be more difficult for you to pick up once the colored paper was placed in the habitat area?
_____
_____
_____

5. Do you believe when animals are forced to move into new environments they might be easier for predators to find? Explain your answer, comparing it to the data collected in this activity.
_____
_____
_____

Challenge: How might habitat loss cause the extinction of a species living in the Louisiana wetlands?
_____
_____
_____

Student Handout 9

ANSWER KEY

Thrown Into a New Environment

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Pre-Activity Questions:

1. Various species of life hide themselves from predators. For example, lizards change color and flounders partially bury themselves in the sea floor so that they blend into the sediments. What is this process called? ***camouflage***
2. As land that animals live on becomes covered with water, what happens to the animals? What must they do? ***Most animals will have to move to a new area to find habitat. Many animals simply do not live in the water***
3. Do you think all of these displaced species will survive in a new environment? Explain your answer. ***All of the species may not survive the move to a new environment. They are adapted to their present environment and when they move into a new environment, they may become easy prey for other species.***

Purpose: To simulate the effects on a species moving into a new environment.

Materials: Bulletin board paper (15 cm x 15 cm of four different colors for each group of students)
Bulletin board paper (2-4 feet sections taped side by side, of only one color).
Ruler and Scissors or Hole puncher
Paper or plastic cup

Procedure:

1. Each group should cut out twenty-five 1cm x 1cm squares of four colors of poster paper. (An alternate way to accomplish this is to use a hole puncher to punch 25 holes in each of the four colors of poster paper.) Each of the four colors represents a species of animal. Place all the pieces in a paper cup.
2. Multiply the number of groups by 25 for each color paper to attain a total number of pieces for each color. Record these numbers in the data table of this worksheet.
3. Clear an area of floor that will be designated as the habitat area in the classroom.
4. All of the cut paper squares should be dumped and spread out in the designated habitat area.
5. The teacher will allow one student from each group (or any appropriate number of students) 10 seconds to pick up as many pieces of paper as they can. Following the 10 seconds, each group will count how many pieces of each color they have and report to the class to obtain a total number of each color picked up. Record these class totals in the data table of this worksheet.
6. Pick up all of the pieces of paper and place them back in the cups. Now place the taped 4-foot sections of 1 color of paper in the designated habitat area. This represents a new area that your species have been forced to move due to habitat loss.
7. Repeat steps 4 and 5. Record data.

Data Table

Total number of each color of pieces of paper:
_____

Total pieces of paper:
_____

Color of the taped 4-foot poster paper sections:
_____

Species/ Color	# picked up bare floor	# picked up on color paper
Species A Color: _____		
Species B Color: _____		
Species C Color: _____		
Species D Color: _____		

Student Handout 9

ANSWER KEY

Thrown Into a New Environment (PAGE 2)

Follow-Up Questions:

1. Was there a significant difference between how many pieces of each color was picked up during the first trial on the bare floor? ***There should not be a difference.***

2. Were you able to see all colors clearly when the paper was on the plain floor? Explain.
   This will depend upon the colors of the paper and the color of the floor. If all of the four colors of paper clash with the color of the floor, then all the colors should be easily seen.

3. Was there one color during the second trial with the colored paper on the floor that was not picked up as much as the others? ***varies*** If so, which color? ***varies***

4. Why do you suppose one color might be more difficult for you to pick up once the colored paper was placed in the habitat area?
   One color should be more difficult because it will blend in with the color of the paper placed in the habitat area.

5. Do you believe when animals are forced to move into new environments they might be easier for predators to find? Explain your answer, comparing it to the data collected in this activity.
   Yes, because the animals are no longer camouflaged for the environment that they are living in just as none were camouflaged on the plain floor. But if placed in the same color, the animal was protected.

Challenge: How might habitat loss cause the extinction of a species living in the Louisiana wetlands?
This might occur in extreme cases where a species just does not adapt to a new environment. There could be a shortage of food supply or a major difference in climate. Or, predators could realistically wipe out a species that does not adapt.

LESSON 5 CHANGES IN LIVING RESOURCES

OVERVIEW:
This lesson is designed to introduce students to the broad impact that wetland loss has on organisms that live in Louisiana's coastal lands and waters.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-48	Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population. (SE-M-A2)
5: GLE-49	Identify and give examples of pollutants found in water, air, and soil. (SE-M-A3)
5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
7: GLE-35	Identify resources humans derive from ecosystems. (SE-M-A1)
7: GLE-36	Distinguish the essential roles played by biotic and abiotic components in various ecosystems. (SE-M-A1)
7: GLE-37	Identify and describe the effects of limiting factors on a given population. (SE-M-A2)
7: GLE-38	Evaluate the carrying capacity of an ecosystem. (SE-M-A2)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
8: GLE-50	Illustrate possible point and non-point source contributions to pollution and natural or human-induced pathways of a pollutant in an ecosystem. (SE-M-A3)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)

OBJECTIVES:
* To identify causes of changes in living resources.
* To analyze impact of detrimental changes in living resources.

STUDENT HANDOUT:
10. Changes in Living Resources

TEACHER GUIDE:
10. Changes in Living Resources

Activity 1 Brainstorming (5 minutes)
1. Have students list at least 5 people that they know and write what their occupations and hobbies are. (This will be used later in the lesson.)

Activity 2 Video Clip and Follow-Up (20 minutes)
1. View the "Changes in Living Resources" section of the ***Vanishing Wetlands, Vanishing Future*** video.
2. Pass out **Student Handout 10** for students to complete during whole class discussion.
3. Use Student Handout 10 to discuss with the students the causes of changes in living resources and to explore the impacts of this concept on mankind.
4. Connect the class discussion to the list that was made by the students at the beginning of class.

Activity 3 Graphic Organizer of Impact (20 minutes)
1. Give the students a blank sheet of paper and tell them to choose one species in the wetlands to be designated as "in danger" and write it down.

LESSON 5 CHANGES IN LIVING RESOURCES (continued)

2. Discuss briefly with the students the example graphic organizer and assign them to create their own graphic organizer showing the impact of the species in danger that they chose. (Assign the organizer to be completed for homework and turned in the next day since most students will not have time to complete their organizer in class.)

Assessment

* Activity 1: Monitor for completion of list.
* Activity 2: Informally observe and randomly call on students to answer questions.
* Activity 3: Collect graphic organizers to be graded. A rubric may be useful for this purpose.

Suggestion

If computers are available in the classroom or in a lab, Internet searches for endangered species in south Louisiana may be useful.

Student Handout 10

Changes in Living Resources

Name: _____ Date: _____ Period: _____

Directions: Answer the following questions while discussing in class the "Changes in Living Resources" section of the *Vanishing Wetlands, Vanishing Future* video.

1. What are the three major causes of changes in living resources, such as decreases in populations and relocation into new environments?
   a._____

   b._____

   c._____

2. How would a decrease in seafood affect fishermen and other people who rely on the seafood industry as a source of income?

3. Would hunters be affected by damage to the wetlands? Explain.

4. If damaging changes in living resources occur in the wetlands, how will this affect the people listed at the beginning of class?

Student Handout 10

ANSWER KEY

Changes In Living Resources

Name: _____ Date: _____ Period: _____

Directions: Answer the following questions while discussing in class the "Changes in Living Resources" section of the *Vanishing Wetlands, Vanishing Future* video.

1. What are the four major causes of changes in living resources, such as decreases in populations and relocation into new environments?
   a. ***Changes in habitat (hydrologic modification, erosion, subsidence)***
   b. ***Water pollution (toxic substances, pathogens, eutrophication)***
   c. ***Over harvesting by fishermen, hunters and trappers***

2. How would a decrease in seafood affect fishermen and other people who rely on the seafood industry as a source of income?

   A decrease in seafood would cause fishermen loss in income and cause many to find other ways of making money. Also, people in the business of processing seafood would also begin losing money and be forced to lay off people to make up for the loss of money. Basically anyone who relies on the seafood industry would lose money and many would be forced to find new jobs.

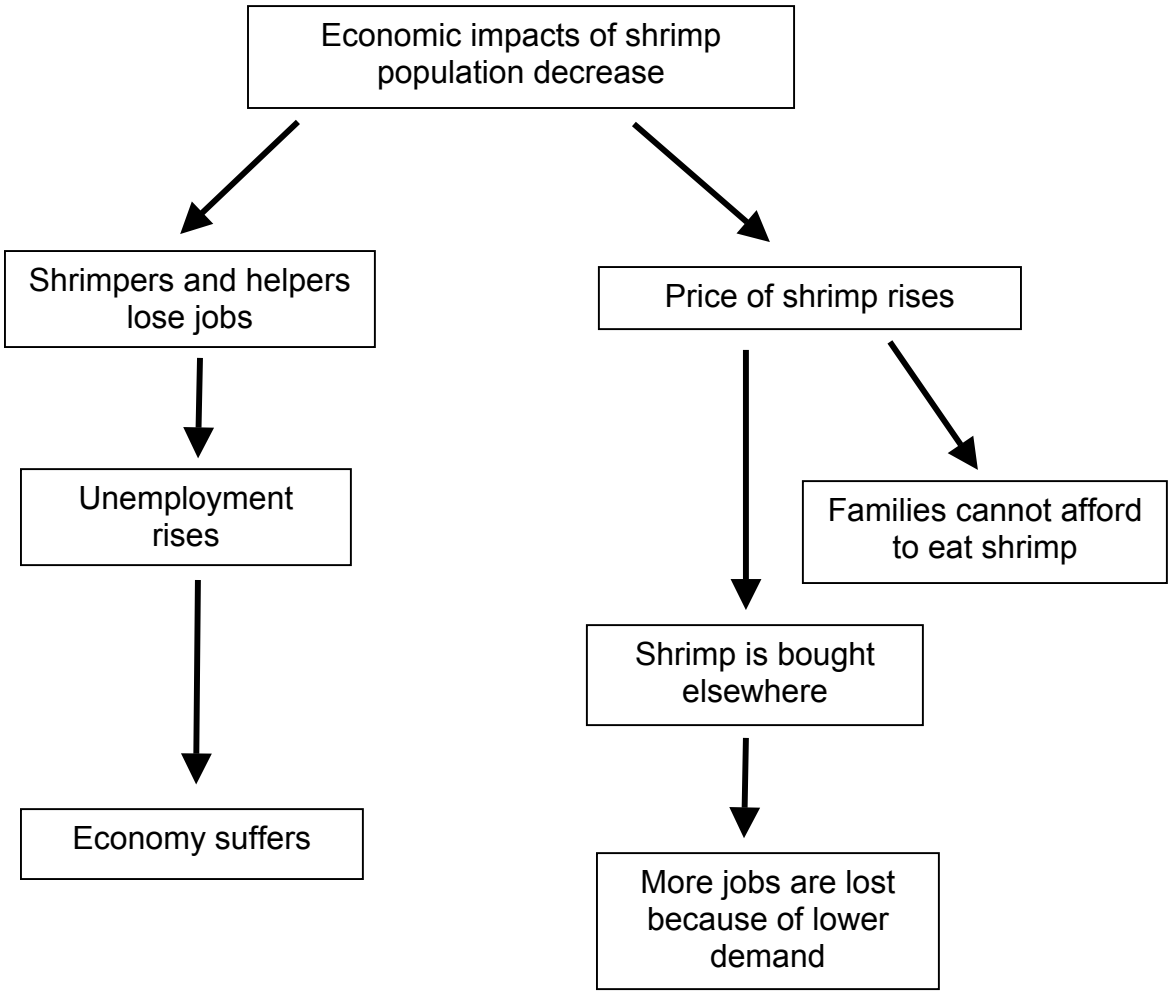
3. Would hunters be affected by damage to the wetlands? Explain.

   Yes, if the wetlands are damaged, there will be less habitat for animals hunted for recreational and commercial purposes. The populations of animals, such as alligators and turtles, will be forced to move into new environments, which will probably cause a decrease in population. Also, as animals move further inland, those that are already there, such as deer and rabbits, will have more competition for food and may suffer as well.

4. If damaging changes in living resources occur in the wetlands, how will this affect the people listed at the beginning of class?

   Answers will vary with each student depending upon the occupations they listed at the start of the lesson.

Graphic Organizer Example:



NOTE: This organizer deals mainly with economic impact. Graphic organizers may take on any other focus or a combination of many. A decrease in shrimp population, for example, also affects the fish population since there will be less food available for fish.

LESSON 6 EUTROPHICATION

OVERVIEW:
This lesson is designed to explore the causes of eutrophication, the presence of too many nutrients, such as phosphorus and nitrogen, in the wetlands and the impact of this condition.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-48	Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population. (SE-M-A2)
5: GLE-49	Identify and give examples of pollutants found in water, air, and soil. (SE-M-A3)
5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
6; GLE-47	Illustrate how various technologies influence resource use in an ecosystem (e.g., forestry management, soil conservation, fishery management). (SE-M-A8)
7: GLE-36	Distinguish the essential roles played by biotic and abiotic components in various ecosystems. (SE-M-A1)
7: GLE-37	Identify and describe the effects of limiting factors on a given population. (SE-M-A2)
7: GLE-38	Evaluate the carrying capacity of an ecosystem. (SE-M-A2)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
7: GLE-43	Identify and analyze the environmental impact of human's use of technology (e.g., energy production, agriculture, transportation, human habitation). (SE-M-A8)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)

OBJECTIVES:
* To identify sources of eutrophication.
* To discuss the impact of eutrophication on living organisms.

STUDENT HANDOUTS:
1. Algae Bloom Data Sheet
11. Where Does It Go?

TEACHER GUIDES:
1. Algae Bloom Data Sheet
11. Where Does It Go?

Activity 1 Algae Bloom Discussion (10 minutes)
1. Have students take out Student Handout 1 with all of their daily observations.
2. As a class, discuss the observations made by the students.
3. As a class, discuss the analysis questions and have students write their conclusion.

Activity 2 Sources of Nutrients and Video Clip (35 minutes)
NOTE: Students will be adding industrial and agricultural areas to their watershed models (residential areas should still be on the model). Encourage them to bring game pieces or any other appropriate manipulatives to represent these areas, or have art classes make manipulatives for you if possible.

1. Pass out **Student Handout 11** for students to complete.
2. Have the students read the procedure and begin working in cooperative groups. Monitor and answer questions as they arise.
3. View the "Eutrophication Section" of the *Vanishing Wetlands, Vanishing Future* video.

LESSON 6 EUTROPHICATION (continued)

4. Discuss the follow-up questions on Student Handout 11 with the class. If time permits, have the groups answer the questions first.

Assessment

* Activity 1: Informally monitor during discussion and collect the Algae Bloom Data Sheet to be graded.
* Activity 2: Use a checklist to assess students as they work in groups. Collect the handout from all individuals or one from each group to be graded.

Student Handout 11

Where Does It Go?

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose: To model the sources of nutrients into the Louisiana wetlands and to discuss the impact of eutrophication..

Materials: Watershed model
Spray Bottle
Kool-Aid (3 colors per group)
Water
Figurines to represent industrial, agricultural, and residential areas on their watershed models

Procedure:
1. Designate industrial, agricultural, and residential areas on the watershed model. Residential areas should still be in place from a previous lesson.
2. Sprinkle different colored powered Kool-Aid into each of the newly designated areas to represent nutrients used in these industries or communities.
3. Use a spray bottle to simulate rain in these areas and observe what happens.
4. View the "Eutrophication Section" of the *Vanishing Wetlands, Vanishing Future* video.
5. Answer the follow-up questions below.

Follow-up Questions

1. What did you observe about the Kool-Aid during the above activity?

2. What is eutrophication?

3. How do excess nutrients enter the wetlands of Louisiana?

4. How does the marsh help to control eutrophication in Louisiana's coastal zone?

5. How does the Algae Bloom Experiment relate to eutrophication?

Challenge: How are creatures in water, such as fish, affected by an increase in algae in the water?

Student Handout 11

ANSWER KEY

Where Does It Go?

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose: To model the sources of nutrients into the Louisiana wetlands and to discuss the impact of eutrophication.

Materials: Watershed model
Spray Bottle
Kool-Aid (3 colors per group)
Water
Figurines to represent industrial, agricultural, and residential areas on their watershed models

Procedure:

1. Designate industrial, agricultural, and residential areas on the watershed model. Residential areas should still be in place from a previous lesson.
2. Sprinkle different colored powered Kool-Aid into each of the newly designated areas to represent nutrients used in these industries or communities.
3. Use a spray bottle to simulate rain in these areas and observe what happens.
4. View the "Eutrophication Section" of the *Vanishing Wetlands, Vanishing Future* video.
5. Answer the follow-up questions below.

Follow-up Questions

1. What did you observe about the Kool-Aid during the above activity?
   As water was sprayed to simulate rain, the Kool-Aid dissolved into the water. The Kool-aid then followed the path of the water and ended up in the river and bayous, which eventually drained into the Gulf of Mexico.
2. What is eutrophication?
   Eutrophication is the condition that occurs when too many nutrients, such as phosphorus and nitrogen, are present in the water causing an increase in algae.
3. How do excess nutrients enter the wetlands of Louisiana?
   Excess nutrients enter the water through urban and agricultural runoff, sewage treatment plants, septic tanks, and loss of wetlands. The water draining into these areas carry the nutrients.
4. How does the marsh help to control eutrophication in Louisiana's coastal zone?
   The marsh helps to control eutrophication by filtering out and absorbing the nutrients before they reach more open waters, such as the Gulf of Mexico and coastal bays.
5. How does the Algae Bloom Experiment relate to eutrophication?
   This is how the experiment should turn out: The beaker of water fertilized as prescribed by the package should have the great algal growth. The excess fertilized beaker will either have the greatest algal growth, or virtually none if the fertilizer was at toxic levels. The control beaker should have little algal growth. This demonstrates the difference in algae growth compared to the amount of nutrients added to the water manually. The same results are likely to occur in nature and more nutrients are added to the waterways.

Challenge: How are creatures in water, such as fish, affected by an increase in algae in the water?
The increase in algae in the water initially increases the amount of oxygen available to living creatures through photosynthesis. However, the dissolved oxygen levels in the day may become dangerously high as the sun is shining. At night, the dissolved oxygen level drops dramatically, since photosynthesis cannot occur at night. At times, there could be dangerously low levels of dissolved oxygen in the water. Also, as algae decay, bacteria use up a large amount of dissolved oxygen in the water, depleting the needed oxygen levels. All creatures in need of oxygen are in danger as this process occurs. Fish kills often occur and many organisms move to more stable areas.

LESSON 7 PATHOGEN CONTAMINATION

OVERVIEW:
This lesson is designed to make students aware of the hazardous conditions that may exist in the Louisiana wetlands due to the existence of disease-producing organisms, or pathogens, such as bacteria and viruses.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-48	Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population. (SE-M-A2)
5: GLE-49	Identify and give examples of pollutants found in water, air, and soil. (SE-M-A3)
5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
7: GLE-35	Identify resources humans derive from ecosystems. (SE-M-A1)
7: GLE-36	Distinguish the essential roles played by biotic and abiotic components in various ecosystems. (SE-M-A1)
7: GLE-37	Identify and describe the effects of limiting factors on a given population. (SE-M-A2)
7: GLE-38	Evaluate the carrying capacity of an ecosystem. (SE-M-A2)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
8: GLE-50	Illustrate possible point and non-point source contributions to pollution and natural or human-induced pathways of a pollutant in an ecosystem. (SE-M-A3)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)

OBJECTIVES:
* To identify sources of pathogen contamination.
* To propose solutions to high levels of pathogens in wetlands.
* To explore the path that a pathogen takes into a living organism.

STUDENT HANDOUTS:
12. How Does an Oyster Eat?
13. Pathogen Contamination

TEACHER GUIDES:
12. How Does an Oyster Eat?
13. Pathogen Contamination

Activity 1 Feeding a Live Oyster (15 minutes)
NOTE: Read "Teacher Instructions for Oyster Lab" carefully and be sure to have oysters ready in advance. Teacher procedures should be carried out in advance of students beginning the lab.

1. View Place students into cooperative groups and pass out **Student Handout 12**. Read and explain the procedures with the students.
2. Monitor the students as they complete the oyster lab, or perform the teacher demonstration following the lab procedures.
3. Assign students to answer the follow-up questions.
4. Have students randomly answer the follow-up questions aloud.

LESSON 7 PATHOGEN CONTAMINATION (continued)

Activity 2 Video Clip and Follow-Up (30 minutes)

1. View the "Pathogen Contamination" section of the Vanishing *Wetlands, Vanishing Future* video.
2. Place students in cooperative groups and pass out **Student Handout 13** for students to complete.
3. Randomly call on groups to answer the follow-up questions.

Assessment

* Activity 1: Informally monitor student progress during the activity. Informally access follow-up questions through randomly calling on groups to answer questions and/or collect papers from individuals or groups to be graded.
* Activity 2: Use a checklist to monitor student progress in cooperative groups and/or collect completed handouts to be graded.

Alternatives to Oyster Activity

If supplies are not readily available for the oyster lab, alternate activities could include

- Use Fecal Coliform test kits to test for pathogens in surrounding bodies of water.
- Conduct an Internet search of foods in Louisiana that may carry pathogens.
- Brainstorm ways to prevent getting sick from eating foods that may be contaminated with pathogens

Teacher Instructions for Oyster Lab

Background:
Oysters feed through filtering food and nutrients out of the water that they live in as the water passes through their bodies. As a result, if pathogens are present in the water that the oyster lives in, the pathogen will be filtered out of the water and remain in the oyster. These bacteria and viruses are not harmful to the oyster, but may be deadly to humans. This lab is designed to simply show students how the oyster eats in order for them to develop an understanding of how pathogens may ultimately reach the human body. Those people with liver, blood, stomach, or immune system problems are very vulnerable to the dangers of some pathogens. The reason the oyster is used for this activity is that it is often eaten raw. Cooking food generally kills all of the dangerous pathogens, therefore posing no threat to humans.

Eating contaminated seafood is not the only danger to humans that pathogens pose. People have gotten sick, had body parts amputated, or even died from pathogens entering open wounds on the body. Pathogen contamination is a very serious problem that all students should be aware of.

Method:
This lab may be performed in cooperative groups or as a teacher demonstration. This decision will depend upon availability of supplies.

Lab Materials:
- Live oysters in the shell (1 for each group, or enough for the designated number of demonstrations. These may be obtained from your local seafood market)
- Beaker of water colored with food coloring (do not use water that has been chlorinated)
- Dropper
- Dissecting pan or tray
- Gloves and goggles for safety
- Oyster knife and hammer

Safety:
Goggles, gloves, and protective clothing should be worn for this lab. Also, there should be NO EATING of the oysters used in this lab.

Opening the Oysters:
The oysters will open easier if you hit the back end of the bivalve with a hammer. Place the oyster knife into the slit between the two shells and twist the knife. Move the knife around to different spots along the shell and twist again. Before pulling the two shells apart, slide the knife along the inside of the upper shell to release the oyster from that half of the shell. Leave the oyster on the bottom shell for the lab. Make sure students are not close by when you are opening the oysters due to the possibility of shell pieces flying off during the opening process.

See the ANSWER KEY for student Handout 12 for lab procedures and follow-up questions.

Student Handout 12

Oyster LAB

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose: To observe how oysters eat.
To discuss what might enter the oyster besides food and nutrients

Materials: live oysters on the half shell
beaker of dirty water
food coloring (dark color)
stirring rod
dropper
dissecting pan or tray
gloves and goggles

Safety: Goggles, gloves, and protective clothing should be worn for this lab. Also, there should be NO EATING of the oysters used in this lab.

Procedure:
1. Place an oyster (opened by the teacher) into a dissecting pan or tray.
2. Observe the oyster for signs of life.
3. Place several drops of a dark food coloring into the beaker of soiled water and stir.
4. Fill a dropper with the dyed dirty water.
5. Empty the dropper around the edges of the oyster.

Follow-Up Questions

1. Were you able to tell whether or not the oyster was alive before you fed it? Explain.
   _____
   _____
   _____

2. What happened to the colored water when you placed it around the oyster?
   _____
   _____
   _____

3. Assuming there was pollution in the water, would the oyster have consumed the pollution as well? Use you observations to explain your answer.
   _____
   _____
   _____

4. What types of pollution might there be in the water and where would the pollution come from?
   _____
   _____
   _____

Student Handout 12

ANSWER KEY

Oyster LAB

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Purpose: To observe how oysters eat.
To discuss what might enter the oyster besides food and nutrients

Materials: live oysters on the half shell
beaker of dirty water
food coloring (dark color)
stirring rod
dropper
dissecting pan or tray
gloves and goggles

Safety: Goggles, gloves, and protective clothing should be worn for this lab. Also, there should be NO EATING of the oysters used in this lab.

Procedure:
1. Place an oyster (opened by the teacher) into a dissecting pan or tray.
2. Observe the oyster for signs of life.
3. Place several drops of a dark food coloring into the beaker of soiled water and stir.
4. Fill a dropper with the dyed dirty water.
5. Empty the dropper around the edges of the oyster.

Follow-Up Questions

1. Were you able to tell whether or not the oyster was alive before you fed it? Explain.
   Depending upon the experience of the students, some will say yes, while others no. If the oyster is filtering water and students see movement, they will answer yes.

2. What happened to the colored water when you placed it around the oyster?
   If the oyster is alive, the colored water will begin being filtered by the oyster and it should be visible as it passes into the oyster.

3. Assuming there was pollution in the water, would the oyster have consumed the pollution as well? Use you observations to explain your answer.
   Yes, because as the oyster filters water, it consumes everything in the water just like it took in the food coloring in the demonstration.

4. What types of pollution might there be in the water and where would the pollution come from?
   Answers will vary. They may mention sewage, trash, poison, chemicals, dead animals, old appliances, etc. They may mention direct dumping, chemical plants, etc. as sources.

Student Handout 13

Pathogen Contamination

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Directions: Following viewing of the "Pathogen Contamination" section of the *Vanishing Wetlands, Vanishing Future* video, read the following paragraph and answer the questions that follow.

Pathogens are disease-producing organisms such as bacteria and viruses. The sources of these organisms are human waste, pasture runoff, and waste products of marsh animals such a nutria and birds. Physical contact with these natural pathogens while swimming or eating raw seafood can harm people who have liver, blood, stomach or immune system problems. Eating shellfish contaminated by human fecal pathogens can also cause illness such as gastroenteritis, salmonellas, and hepatitis A, and, in more severe cases, could cause death for people suffering from certain immune disorders.

1. What are pathogens and where do they come from?

_____
_____
_____

2. If a person is swimming in water, how might pathogens enter their body?

_____
_____
_____

Challenge: Name two pathogens mentioned in the paragraph above paragraph. How could man control these sources?

_____
_____
_____

Connection: Construct a graphic organizer that indicates how pathogens enter the wetlands and may ultimately reach the human body.

Student Handout 13

ANSWER KEY

Pathogen Contamination

Group Members: _____ Date: _____
_____ Period _____
_____
_____

Directions: Following viewing of the "Pathogen Contamination" section of the *Vanishing Wetlands, Vanishing Future* video, read the following paragraph and answer the questions that follow.

Pathogens are disease-producing organisms such as bacteria and viruses. The sources of these organisms are human waste, pasture runoff, and waste products of marsh animals such a nutria and birds. Physical contact with these natural pathogens while swimming or eating raw seafood can harm people who have liver, blood, stomach or immune system problems. Eating shellfish contaminated by human fecal pathogens can also cause illness such as gastroenteritis, salmonellas, and hepatitis A, and, in more severe cases, could cause death for people suffering from certain immune disorders.

1. What are pathogens and where do they come from?
   Pathogens are disease-producing organisms such as bacteria and viruses. They come from human waste, pasture runoff, and marsh animal waste that enter the water. Some pathogens are naturally occurring and are not associated with pollution, for example, the oyster pathogen Vibrio volnifices (?sp)

2. If a person is swimming in water, how might pathogens enter their body?
   If a person is swimming, pathogens might enter their body through open wounds, such as cuts or scrapes. Also, pathogens may enter through cavities in teeth if water goes into the mouth. Stings or bites from creatures in the water may also allow pathogens to enter into the human body.

Challenge: Name two pathogens mentioned in the paragraph above paragraph. How could man control these sources?

For those who enjoy eating seafood, to avoid being contaminated by pathogens, in most cases, seafood should not be eaten raw and cooked thoroughly. Also, consumers should buy seafood fresh and buy from sellers where regular health inspections occur.

Connection: Construct a graphic organizer that indicates how pathogens enter the wetlands and may ultimately reach the human body.

LESSON 8 TOXIC SUBSTANCES

OVERVIEW:
This lesson is designed to make students aware of the fact that toxic substances reach the wetlands of Louisiana through a variety of sources. It is also designed for students to understand the affects that toxic substances have on wetland ecosystems.

DURATION:
1 Class period

LOUISIANA GRADE LEVEL EXPECTATIONS (SCIENCE)

5: GLE-49	Identify and give examples of pollutants found in water, air, and soil. (SE-M-A3)
5: GLE-50	Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
6: GLE-47	Illustrate how various technologies influence resource use in an ecosystem (e.g., forestry management, soil conservation, fishery management). (SE-M-A8)
7: GLE-35	Identify resources humans derive from ecosystems. (SE-M-A1)
7: GLE-36	Distinguish the essential roles played by biotic and abiotic components in various ecosystems. (SE-M-A1)
7: GLE-38	Evaluate the carrying capacity of an ecosystem. (SE-M-A2)
7: GLE-39	Analyze the consequences of human activities on ecosystems. (SE-M-A4)
7: GLE-43	Identify and analyze the environmental impact of human's use of technology (e.g., energy production, agriculture, transportation, human habitation). (SE-M-A8)
8: GLE-50	Illustrate possible point and non-point source contributions to pollution and natural or human-induced pathways of a pollutant in an ecosystem. (SE-M-A3)
8: GLE-51	Analyze the consequences of human activities on global Earth systems. (SE-M-A4)

OBJECTIVES:
* To identify sources of toxic substances in wetlands.
* To explore the ways in which toxic substances accumulate in the tissues of organisms.

STUDENT HANDOUT:
14. Toxic Substances

TEACHER GUIDES:
14. Toxic Substances
Biomagnification Activity Guide
The Enigma of Lil' Sal Bayou

Activity 1 The Enigma of Lil' Sal Bayou (25 minutes)
NOTE: It is imperative that the teacher read the Biomagnification Activity Guide in advance of conducting the activity. Supplies should be prepared in advance of the activity..

1. Read the fictional situation, "The Enigma of Lil' Sal Bayou" to the class or have students read the story in small groups.
2. Follow the procedures listed in the Biomagnification Activity Guide for the remainder of the activity.
2. Orally discuss the activity with the students using the suggested questions following the activity and any other appropriate questions.

LESSON 8 TOXIC SUBSTANCES (continued)

Activity 2 Video Clip and Follow-Up (20 minutes)

1. View the "Toxic Substances" section of the Vanishing *Wetlands, Vanishing Future* video.
2. Pass out **Student Handout 14.** Discuss the questions in a whole class setting.

Assessment

* Activity 1: Informally monitor student progress during the activity. Informally assess follow-up questions through randomly calling on groups to answer questions.
* Activity 2: Informally assess by randomly calling on students to answer questions and/or formally assess by collecting the follow-up questions to be graded.

The Enigma of Lil' Sal Bayou

Lil' Sal Bayou is a small distributary that passes through the middle of a rural town called Bayberry Place. The people of Bayberry Place were mostly sugarcane and small garden farmers. The children of Bayberry Place used a part of Lil' Sal Bayou just north of town as a regular hang out spot. It was perfect for swimming and fishing because it was deep and had a huge limb of a massive oak tree hanging over the water. The children had a rope swing hanging from the branch where they tested each other's diving abilities. The fishing was also very good in this area of the bayou. Many bass and perch were caught out of this swimming and fishing spot.

Lil' Sal Bayou flows through a marsh on the way out of town. The marsh is called Cattail Hollow Marsh. The marsh is home to a great number of animals such as muskrat, nutria, egrets, herons, ducks, fish, crawfish, insects, and many other species. This is another area where the people of Bayberry Place frequent because of the relaxing atmosphere it provides.

Well, it seems that an alarming set of circumstances have come up in the next town. The Department of Health from the town just south of Bayberry has brought news about a small girl that is very ill. It seems that she has accumulated a toxic level of pesticide in her bloodstream. This is the same pesticide that is used on the crops in Bayberry. The strangest thing, it seems, is that the girl has never visited Bayberry, nor has left her hometown of Platterfox. When the drinking water of Platterfox was tested, there were no traces of the pesticide found. When the water from the bayou was tested, small amounts of the pesticide were found, but this was to be expected due to runoff from the farms. It was a mystery as to how this pesticide could have gotten into that little girl in the next town. News also came about three cases of the same type of pesticide poisoning in the state north of Bayberry Place. This really alarmed the Bayberry Place residents.

The farmers of Bayberry Place called a meeting to discuss the problem. They were very concerned because they were the only people anywhere in the region that used this pesticide. They were very confused because not a single person that lived in their town had become sick from eating the crops in Bayberry Place and none of the crops had been shipped out of town. If no one in Bayberry Place ever got sick, it could not be their pesticide, or could it? One farmer said that he did find a dead owl in his barn. He could not find any visible cause for the bird's death and did wonder about it for a while. It did seem strange to him at the time. Another farmer said he sometimes catches fish in the marsh to sell to the markets throughout the region for extra money for his family. Other than that, no one had a clue as to what could be going on.

Teacher's Background Information

There are two processes at work in the story of Lil' Sal Bayou: bioaccumulation and biomagnification. Bioaccumulation is an enrichment of a particular chemical caused by organisms taking in the chemical while feeding (or through another process) and then retaining the chemical in their tissues (instead of excreting it). Biomagnification is the concentration of a chemical with increasing trophic level. This is caused by bioaccumulation that occurs during each move up the trophic levels. Biomagnification causes organisms at the top of the food chain to have the highest chemical (toxin) concentrations. The following activity demonstrates both of these concepts, with biomagnification being demonstrated very well (beginning with one candy at the lowest trophic level ("duckweed") and ending with many candies at the highest level ("human").

Bioaccumulation is a process that occurs in one organism over its lifetime. Biomagnification is a process that occurs over time as organisms feed on one another and the toxins accumulate in the higher trophic levels.

Biomagnification Activity Guide

Materials: tab board cards (one tag board card for each student)
yarn (one length per student)
markers
hard candy (candy corn, M&M's Skittles, etc.)
paper cups (one per student)

Pre-Activity Preparation:
Note: These numbers are established for a class size of 28. Adjust the quantities to allow each student to participate

1. Label the tab board cards as follows
   7 cards as duckweed
   6 cards as minnow
   5 cards a crawfish
   4 cards as perch
   3 cards as bass
   2 cards as alligator
   1 card as human
2. Cut enough pieces of yarn for each tag board to be used as an identification card for each student. Attach the yarn to the tag board cards so that they will hang comfortably from around students' necks.
3. Set out enough cups so that each student will have a cup. Place one candy (representing a toxic substance) in each paper cup.
4. Place all of these supplies in a convenient location that is easily accessible for the activity.

Procedure:

1. After reading "The Enigma of Lil' Sal Bayou", have the students write their ideas down about how the little girl and other people got sick.
2. Place all of the labeled tag board cards face down and have each student select one and place around their necks to identify which organism they represent. Give each student a cup with the one candy (toxic substance).
3. Tell the students that each one of them will represent one component of the marsh ecosystem. Remind them to keep "The Enigma of Lil' Sal Bayou" in mind as they participate in the activity.
4. Have the entire "duckweed stand in front of the classroom. Ask:
   ➔ **What does the duckweed need to survive in the marsh?** ***Soil, water, sunlight, air***
   ➔ **According to the story, where were traces of the pesticide found?** ***In the bayou***
   ➔ **When the duckweed absorbs the water, does the pesticide go with it?** ***Yes***
   ➔ **Which of the labeled ecosystem components (fellow students) feed on duckweed?** ***Minnows***
5. Have all of the "minnows" stand in front of the classroom and pour the toxins from the "duckweed" into their cups, which represent their stomachs. Ask:
   ➔ **Which of the labeled ecosystem components might eat the minnows?** ***Crawfish.***
6. Have all of the "crawfish" go to the front of the room and eat the "minnows" by pouring their toxins into their cups. Ask:
   ➔ **What might eat the crawfish while still in the water?** ***Perch, bass.***
7. Have all of the "perch" and "bass" go to the front of the classroom and eat the "crawfish". Ask:
   ➔ **What might eat the perch and bass?** ***Alligator.***
8. Have the "alligator(s)" go to the front of the room and eat the "perch" and "bass". Ask:
   ➔ **What is left in our ecosystem that might eat the alligator?** ***Human(s).***
9. Have the "human" go up to the front of the room and eat the "alligator". Ask:
   ➔ **Does the human have more toxins in their body than it did before it ate the alligator?** ***Yes.***

Biomagnification Activity Guide Page 2

Follow-Up Questions

1. If the ”human” ate only one “alligator”, how did he or she end up with so many toxins?
   Every organism in the food chain has to eat in some way. As they do, they collect whatever toxins exist in their prey. When they are eaten themselves, these toxins are then transferred into the organism that ate them. Their bodies store these toxins. This is called bioaccumulation.

2. Do you think bioaccumulation and biomagnification could be dangerous to humans? Why?
   Yes, because if the body continues to store toxins, at some point there will be too many toxins for the body to handle. Different types of toxins would have different degrees of danger.

3. What do you think is the answer to the mystery at Lil’ Sal Bayou?
   The girl and other people got sick by eating fish out of the bayou due to the processes of bioaccumulation and biomagnification.

4. Was your answer to the mystery that you wrote down at the beginning of the activity correct?
   Answers will vary.

Student Handout 14

Toxic Substances

Name: _____ Date: _____ Period: _____

Directions: Following viewing of the "Toxic Substances" section of the *Vanishing Wetlands, Vanishing Future* video, answer the questions that follow.

1. How do toxic substances enter our waterways and eventually into the wetlands?

2. What types of problems could result from toxic substance levels being too high in wetlands?

3. How are humans endangered by toxic substances entering the wetlands?

4. Could a situation like the one at Lil' Sal Bayou really occur? Explain.

Student Handout 14

ANSWER KEY

Toxic Substances

Name: _____ Date: _____ Period: _____

Directions: Following viewing of the "Toxic Substances" section of the *Vanishing Wetlands, Vanishing Future* video, answer the questions that follow.

1. How do toxic substances enter our waterways and eventually into the wetlands?

   Through accidental spills, sewage plants, illegal dumping of toxic, industrial, and commercial waste, drilling fluids and produced waters, emissions of toxic materials from hazardous waste, recycling, and disposal facilities, agricultural runoff with pesticides and herbicides, storm and urban runoff, leakages from petrochemical pipelines and storage facilities, and atmospheric deposition.

2. What types of problems could result from toxic substance levels being too high in wetlands?

   Poisoning of wildlife and fish and the reduction of reproduction, decreases in wetland vegetation, contamination of oyster beds, decreases in underwater vegetation, loss or reduction in commercial and recreational sport fish and wildlife populations..

3. How are humans endangered by toxic substances entering the wetlands?

   Through eating contaminated seafood and wildlife. Also, by the contamination of drinking water supplies.

4. Could a situation like the one at Lil' Sal Bayou really occur? Explain.

   Yes, since toxic substances are really entering the wetlands and people do eat fish and wildlife from the wetlands. Biomagnification is real and could cause human beings to become ill.

LESSON 9 | SOLUTIONS

OVERVIEW:
This lesson is designed to make students aware of the various programs underway to restore Louisiana coastal wetlands and to recognize that they have a role in the protection of this natural resource.

DURATION:
1 Class period

OBJECTIVES:
* To develop an action plan to promote protection of the wetlands.

Activity 1 Video Clip and Follow-Up (45 minutes)

1. View the "Solutions" section of the Vanishing *Wetlands, Vanishing Future* video.
2. Brainstorm with students the possible ways that they can promote the protection of Louisiana wetlands.
3. Have the class select several projects that they can work on over the long term.
4. Develop an action plan with timelines for students to carry out the project(s) they decided on.

Assessment
* Informally assess students by observing them watch the video and participating in the brainstorming activity.
* Design a rubric to assess their long-term project.

Possible Projects
* Designing bumper stickers to be distributed
* Writing and placing newspaper ads and/or articles
* Writing articles
* Writing and sending letters to public servants
* Designing and selling T-shirts for the science club
* Attending a Parish Council meeting promoting wetland restoration efforts
* Producing a talk show or commercials to be aired on Channel One
* Inviting experts to speak to the school on the significance of Louisiana wetlands
* Producing a short video to be sent to the Governor and other elected appointed officials.

NOTE:
The teacher may notice very little structure for this lesson. This is due to the fact that it is intended to be a very open ended activity whereby students realize their potential role in protecting Louisiana wetlands. The effects of the lesson depend upon the ownership of the project(s) by the students. The above list of suggested projects is not intended to be used as assignments for students. They are merely a guide to the types of projects that could be useful and meaningful if students have a difficult time in the brainstorming activity. This lesson is designed for students to develop a long-term action plan to follow this two-week unit on wetlands.

LESSON 10 | ASSESSMENT

This day has been reserved as an assessment day for the two-week wetlands unit. The teacher should design an assessment tool in line with the lessons taught over the past two weeks. It is highly recommended to use some type of authentic assessment that will promote higher order thinking skills. Also, designing question that are similar in form to those of the Iowa Test of Basic Skill and/or the LEAP tests is encouraged.

If you are currently using portfolio assessment, you may want to include students' work over the past nine days in the portfolio and use this day to work on the project chosen in Day 9.