

**Coastal Citizenship:  
Preparing Youth to Continue the Stewardship of Coastal Wetlands**

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**INTRODUCTION**

Several years ago I attended a beachcombing workshop sponsored by the PBS affiliate KUHT in Houston. It was facilitated by Dr. Chuck Buddenhagen at the College of the Mainland in Texas City. We spent two great weekends on Galveston Island learning about all of the oddities that wash up on Gulf Coast beaches. While the focus of the workshop was on the beach environs, we did visit wetland areas of the island and bay. My knowledge of these areas remained limited. A year later, I participated in a cord grass planting project along the Interstate 45 estuary corridor leading onto Galveston Island. These two activities sparked an interest in learning more about the ecological systems of the coastal wetlands and the impact they have on the upper Texas coast.

My 7<sup>th</sup> grade Texas History classes always enjoy the unit I prepared as a result of the beachcombing seminar. We study the ecology of the beach environment and the creatures found there. My students have told me it is the most interesting thing I teach and they usually return from trips to the beach full of stories about the treasures they have found and how their beach experiences are now more meaningful. The wetlands which comprise the areas along Galveston Bay and its environs have remained a mystery. Through this new unit I will introduce the wetlands ecosystem to my students, relate it to the larger world in which they live, and encourage them to take an active role in the stewardship of this valuable natural resource.

**OBJECTIVES AND RATIONALE**

Lessons in this curriculum unit will focus on human life along the coast and the responsibilities and liabilities of being a coastal citizen. I want my students to realize that they can have an active say in what happens in their own communities. An important objective of this unit is to encourage community activism through volunteer efforts. My students will come to realize that the grasses of the wetlands are not just random weeds surviving in what appears to be an inhospitable and muddy wasteland. Rather, wetlands are important habitats that have an impact on the ecology, geography, and economy along the Texas Gulf Coast. When my students become adults, I want them to make intelligent decisions concerning issues such as port expansion, real estate development, and pollution and ecological habitat protection of coastal beaches and wetlands. Specific objectives for science, language arts, and Texas history are listed below:

- SCI.112.22b8C - The student will describe energy flow in living systems including food chains.
- SCI.112.23b.12A - The student will identify components of an ecosystem.
- SCI.112.23b.12B - The student will observe and describe how organisms including producers, consumers, and decomposers live together in an environment and use existing resources.
- *TEXH.7.2.a* - The student will locate and explain the importance of selected places and regions of Texas.
- *TEXH.7.2.b* - The student will compare regions of Texas and analyze the effects of physical and human factors on these regions.

- *TEXH.7.3.a* - The student will analyze the impact of human activities on the natural environment of Texas.
- *TEXH.7.5.c* - The student will investigate major Texas industries and evaluate their significance in the Texas economy.
- *TEXH.7.20.* - The student will use problem solving and decision-making skills to propose solutions to problems related to the use of resources and the environment in the late 20<sup>th</sup> and early 21<sup>st</sup> centuries and in the future.
- *ENG.110.23b.12I* - The students will be able to compare and contrast ideas in written and oral form.
- *ENG.110.23b.2B* - The student will analyze and use persuasive techniques.

## **UNIT BACKGROUND**

Each year, as we study coastal geography in my 7<sup>th</sup> grade Texas History classes, I tell my students to take notice of the salt marsh grasses which border the Interstate 45 estuary corridor as it approaches Galveston Island. Several years ago I volunteered to plant cord grass in these marshes as part of a revitalization effort spearheaded by an organization called Scenic Galveston. I describe trying to walk through the mud to complete the job. Lots of shoes and rubber boots were sucked off, never to be seen again. My students' faces seem to reveal their unexpressed thoughts. "Why would anyone walk through the mud?" "Who would want to plant weeds in the mud, especially if you are not getting paid for it?" And, finally, "I don't know what she is talking about, but I'm pretty sure it means she is crazy." In spite of their questions as to my sanity, the story about my experiences in the mud makes for an attention grabbing introduction to our study of the Texas coast, including its wetlands. Wetlands play an important role in our lives. As natural storage basins, they help control flooding and filter many kinds of pollutants (Stone). The grasses help prevent erosion from tidal forces (Stone). It should be noted that the purpose of this unit is to focus on the role of the citizen in preserving the wetlands, and not to conduct an in depth description of the wetland habitat itself.

### **Coastal Wetlands**

This unit will focus on the wetlands in the Galveston Bay area, as they are the closest in proximity to my students' homes. It is to this area that they will turn for recreation, fishing, and perhaps their livelihoods. Galveston Bay is a mixed use area. The Bay itself is the seventh largest estuary in the country (*GBF Gazette*). Fresh water from the Trinity and other rivers, along with that from area bayous, mixes with the salt water of the Gulf of Mexico. This brackish environment provides a nursery for juvenile finfish and shellfish. The protective environment of Galveston Bay is rated as one of the most productive estuarine systems in the world ("About the Galveston"). Without the protective nature of the wetlands, there would be an imbalance in the food chain as larger species would devour younger generations before they reach maturity, thus leaving an imbalance in future years.

Birdwatchers come to the upper Texas coast to observe numerous species. "Three-fourths of all North America's bird species, including several that are endangered, use the Galveston Bay habitat. The Bay is also in the flyway for birds migrating from South America" ("Galveston Bay Habitat"). During the 1820s and 1830s, early settlers to the bay area reported citing millions of geese, ducks, and water birds living in the estuary. "For several decades the meat and feathers of these birds were one of the main exports of the area. Large sailing vessels would annually carry thousands of bird carcasses to meat markets in New York, Philadelphia, and other cities on the east coast" (Whittington 11). The loss of wetlands and rice fields to urban development has greatly affected the bird populations of the bay (11). Monarch butterflies also stop in these coastal wetlands as they migrate south in wintertime.

This highly important natural environment must exist in close proximity to the nation's third largest port, the fourth largest metropolitan area, Houston, half of the nation's chemical production facilities, and one-third of the nation's oil refining facilities ("About the Galveston"). As future voters and guardians of our way of life, my students' actions and decisions will have an enormous impact on the health and perseverance of the bay and coastal wetlands.

### ***Problems for the Wetland Habitat***

One of the threats to the health and continuance of the wetlands is pollution. Some of the most serious pollution which affects the wetlands of the Galveston Bay area has its origins in the parking lots and streets of nearby Houston. This is called nonpoint source pollution because it cannot be traced back to its origination point ("Galveston Bay Habitat"). An example of this would be leakage from automobiles, such as oil, brake and transmission fluids, which join the natural runoff delivered by rain and eventually end up in the bay and gulf (Buddenhagen). Used oil dumped down drains from all over the state will make its way to the coast. Add to this the bilge water dumped by ships at sea, trash from cruise ships, and the natural seepage of petroleum from the bottom of the Gulf, and you have a formula for a polluted coast (Buddenhagen). Wetlands occupying the edges of the coastal waters and the wide range of species occupying the wetlands are negatively affected by this mixture of pollutants and can suffer an immediate impact with long range implications (Pennings).

Another serious problem is the actual loss of land occupied by the wetlands. "Losses of coastal wetlands and seagrass meadows have totaled more than 30,000 acres during the past four decades [in the Galveston Bay area]" ("Galveston Bay Habitat"). Primary causes for these losses are subsidence (the sinking of land), erosion, and sea level rise due to global warming which causes expansion of ocean waters (Pennings). "With the fourth largest metropolitan area [in the United States] near its shores, and the heavy petrochemical industry presence, the Galveston Bay area has experienced extensive subsidence due to groundwater withdrawals for drinking and industrial uses" ("Galveston Bay Habitat"). The erosion of unvegetated shorelines continues unabated in many areas even though the subsidence has been reduced near the bay ("Galveston Bay Habitat"). Galveston Island State Park provides an example of how quickly this transformation can occur due to subsidence. "As the elevation of the land surface dropped, marshes drowned and disappeared. Subsidence occurred quickly" ("Galveston Bay Habitat").

Before 1990, you could walk three-quarters to one mile out into the marsh along a trail at Galveston Island State Park without any more trouble than getting your feet a little wet. Now [in 1997] there isn't a trail or a marsh in that part of the park, but I guess you could wade out." Gordon Nunn, Galveston Island birder ("Galveston Bay Habitat")

Wetland acreage can also be lost when it is filled in and lost to commercial development in areas not protected by government regulation. Building along a coast susceptible to hurricanes and tropical storms is not wise under the best of conditions and invites problems. "Wetlands reduce the hazards of hurricanes and other coastal storms by protecting the coastal and inland properties from wind damage and flooding" (Whittington 128). Each mile of undeveloped wetland helps to dissipate the force of the wind and waves (128). Soil not held together by the wetlands extensive root systems faces immediate erosion during these major storms. Issues such as these, which affect the health of coastal wetlands, can be addressed through citizen involvement in the political process (Pennings).

### **The Role of the Coastal Citizen**

Through education our citizens can prepare themselves to make wise decisions about the use of local wetlands and whether the need exists to protect them. Various organizations and events that attempt to educate the public about these issues are listed below in Lesson Plan III. Please

note that this unit is tailored for use in the Galveston Bay area. Similar organizations exist all over the country and are easily found via the Internet. These organizations encourage the public to study the issues and contact their governmental representatives with their concerns and desires.

One of the organizations concerned with the health of Galveston Bay is the Galveston Bay Foundation, or GBF. The GBF and another organization, Scenic Galveston, are among the sponsors of *Trash Bash* which is mentioned in Lesson Plan III. *Trash Bash* is an annual cleanup of the Galveston Bay watershed. The *Trash Bash* website encourages a change in habits which are meant to help improve the health of the bay. All of these are simple and not only protect the bay, but also help conserve water and energy. These suggestions include fixing car leaks. "More oil ends up in the bay from runoff than from tanker spills" (*Trash Bash*). The use of mass transit and bicycles is also encouraged: less vehicles on the road result in less fluid seepage. The *Trash Bash* folks remind us that oil, antifreeze, tire particles, and other toxins from our nation's 100+ million cars and trucks are washing into our nation's waterways everyday. Other suggestions from their web site include the use of nontoxic household products and avoiding fertilizer and pesticide use on lawns. They encourage the public to wash automobiles over the ground where the water can seep into the soil rather than running off of the impermeable concrete driveway into the sewer system. Anything washing into the sewer system will eventually end up in the bay. That includes cigarette butts, styrofoam cups, other trash, plant refuse, and animal feces (*Trash Bash*). Boaters are reminded to use pumpout stations and to be prepared for oil/fuel spills with absorbent pads ("Galveston Bay Habitat"). "Don't drive boats or other personal watercraft too close to shorelines. The wake can uproot marshes and contribute to shoreline erosion" ("Galveston Bay Habitat").

In addition to individual action, citizens can protect coastal wetlands by influencing policies of local governments. Air pollution can settle into the local watershed as rainfall, wash into the storm drain system and on into the wetlands (*Trash Bash*). Poor urban planning and a propensity for runoff producing urban "sprawl" can result in too little green space to absorb runoff (*Trash Bash*). This rain water runoff, which under natural conditions would soak into the earth, affects the delicate balance of the brackish waters nurturing the wetlands. Too much runoff also prevents the natural replenishment of the water table. Local governments should "incorporate natural areas into management plans to serve development and lessen impacts on the ecosystem. Conserve natural areas around water bodies so they can filter runoff. Greenbelts can serve as parks, flood control, and habitat" ("Galveston Bay Habitat"). Large construction projects in the Houston area are now required to install retention ponds. These green spaces have depressions to gather rainwater runoff which is displaced by buildings and concrete expanses. This serves several purposes. First, the natural hydrological cycle is maintained because the water is retained allowing it to seep into the ground as it naturally would, replenishing the water table. Second, because the water does not rush into the bay, the detention ponds protect the natural salinity regime of the estuary preventing it from diluting the brackish atmosphere of the wetlands. Third, by trapping sediments, detention ponds prevent sediments and pollutants from entering the bay (Pennings). Subsidence is another issue to be considered by local governments. As land levels drop due to pumping of groundwater, wetlands are submerged and the deeper waters are unable to support local wetland plant species.

Government regulations pertaining to an area's watershed also affect the health of coastal wetlands. The straightening and channelization of streams for flood control destroys wetland habitats and provides a speedy vehicle for transport of nonpoint source pollution to the bay ("Galveston Bay Habitat"). New thinking in flood control is moving toward leaving floodplains for floods, through buyouts of structures in the floodplains, and using the floodplains for other community amenities, such as parks and playgrounds ("Galveston Bay Habitat"). Citizens,

through individual and group efforts, can serve as watchdogs to ensure that urban and coastal development does not endanger the health of the wetlands.

### **Stewardship and Volunteerism**

Acknowledging the importance of wetlands and agreeing with the need to restore and protect them is one thing. Accomplishing the task is another matter. Restoration and reclamation projects can be quite costly and are usually dependent upon governmental and private funding and/or grant monies. Scenic Galveston is an all volunteer group which has raised 4.5 million dollars since 1992 to purchase 2,500 acres of emergent inter-tidal salt marsh which fronts the I45 corridor as it leads onto Galveston Island (*Scenic Galveston*). Yet, because they are so costly, the majority of such projects would not come to fruition without the labor provided by community volunteers. Planting coastal marsh grasses is a labor intensive, hands on activity. Paying for such man power would be cost prohibitive. In the Galveston Bay area there are numerous organizations in need of volunteer hours. Those volunteer hours can translate into more than just labor. "In addition to the work carried out, the hours can be leveraged to acquire grant dollars. Another local volunteer organization estimates that each hour donated by a volunteer may be worth as much as \$14. in grant money" (*Scenic Galveston*).

Marsh Mania, an annual event sponsored by the Galveston Bay Foundation, was established to address the loss of over 30,000 acres of wetlands in and around Galveston Bay since the 1950s (*GBF Gazette*). This event has helped restore over 1,450 acres of salt marsh habitat, which in turn serve as protection for an additional 2,000 acres of various coastal and estuarine habitat areas (*GBF Gazette*). Volunteers have made this project a success with more than 4,000 participants attending the event since 1999. This represents 15,000 hours of community service (*GBF Gazette*). While volunteers can be found working throughout the year, Marsh Mania is a special event meant to increase community awareness and involvement. Scout troops work along side volunteers from airlines and local refineries. High school students earn required community service credits for graduation. Families create lasting memories as they struggle to plant grass stalks in the mud or gather trash from area beaches and estuaries. Marsh grasses are planted in the morning, followed by a group picnic, educational information, and door prizes.

In addition to habitat restoration, the Galveston Bay Foundation also provides the Bay Ambassadors Program and speaker's bureau which will make presentations to civic groups and schools.

To provide a forum for consideration of Galveston Bay issues, GBF brings together representatives of diverse bay users, including such groups as sport and commercial fishers, recreational boaters, conservationists, shipping interests, developers, business people and various levels of government and educational institutions. Emphasis is placed on non-adversarial approaches to problem-solving in the bay watershed, with a reliance on "good science" as a basis for decision making. GBF supports the concept of sustainable development for the Galveston Bay area, believing that it is possible to have a healthy, productive bay and continued economic development." ("Galveston Bay Habitat")

Another priority for the group is the acquisition and management of wetland property "which will provide a legacy of productivity within the bay for future generations" ("Galveston Bay Habitat"). The GBF has also established a citizen water quality monitoring program, reviews wetlands permits, and participates in state and federal planning efforts ("Galveston Bay Habitat"). It is through the efforts of organizations such as the GBF and others, such as the Galveston Bay Estuary Program and Restore America's Estuaries, that citizens can play a part in the protection and maintenance of the bay. These groups can give assistance to landowners along the coast who wish to preserve or restore wetland habitats on their property.

Families will find that participation in events and organizations such as those listed above will provide a springboard for other environmentally related family activities. In Gulf Coast communities, marsh grass planting has become an experience by which young people gain an insight into the value of their natural environment. Such activities can begin to foster a life long commitment of giving back to their communities. To further foster an interest in learning about Galveston Bay habitats, the GBF produces *The Galveston Bay Drive and Discover Guide* available free through their web site. The guide provides information on over 70 sites in the Galveston Bay watershed which have cultural, historical, or environmental significance. A map is included showing both automobile and bicycle routes. Another not-for-profit organization is Artist Boat, “which promotes awareness and preservation of coastal margins and the marine environment through the disciplines of the sciences and the arts” (*Artist Boat*). Artist Boat provides workshops on the ecosystems of Galveston Bay followed by canoe and/or kayak trips in the bay area in which participants record what they observe through the use of watercolors. Ages 10 and older are welcome on the tours. There is a nominal fee. These kayak tours are a great way to observe wetland habitats without sloshing through the mud. The program also conducts vessel tours with an emphasis on data collection (*Artist Boat*). Other area organizations are listed in Lesson Plan IV.

## **CONCLUSION**

“Eighty percent of the U.S. population is expected to call coastal regions home by the year 2010, and already more than 70 percent visit estuaries annually” (“Galveston Bay Habitat”). But there is more to the coast than the beach. And the health of the coastal regions is a reflection of the inland areas where my students’ families live. I want my students to recognize that the trash and pollution which we all contribute to Houston streets is more than just an eyesore. It represents an attack on a larger environment. Getting involved in community decisions and volunteering changes attitudes as to how urban neighborhoods, or environments, view themselves. Who would destroy something they have just created or saved? For example, citizens who create murals are less likely to destroy those walls with graffiti. The lessons in this curriculum unit are designed to encourage volunteerism and the sense of ownership and empowerment which that involvement creates.

For volunteers the coastal wetlands can provide numerous opportunities which affect the community as a whole. A small child sitting in a kayak painting watercolor pictures of salt marsh grasses may become a Texas Parks and Wildlife biologist in the future. High school seniors planting grasses may discover a calling in the environmental sciences or join a local preservation organization as an adult. Girl scouts participating in *Trash Bash* might become chemical engineers at a local refinery and develop a truly biodegradable plastic. Employees of local industries may return to their places of employment with a commitment to decrease pollution, subsidence and/or erosion. The coastal marshes provide a protective environment for the growth of coastal species as well as nurturing the growth of the human mind and spirit.

## **LESSON PLANS**

### **Lesson Plan I: Wetlands Mural**

#### ***Introduction and Objectives***

This lesson will visually illustrate and orally describe the variations of life within the coastal wetland. It is meant to provide a review of the functions of the wetlands previously studied in the science curriculum prior to these lessons dealing with the stewardship of coastal areas.

- SCI.112.22b8C - The student will describe energy flow in living systems including food chains.
- SCI.112.23b.12A - The student will identify components of an ecosystem.

- SCI.112.23b.12B - The student will observe and describe how organisms including producers, consumers, and decomposers live together in an environment and use existing resources.

**Materials Needed**

- Long roll of paper or series of posters which can be placed end to end. The final product could be reproduced on a wall.
- Colored pencils, crayons, or paint.
- Computer
- The following links go to sites with conceptual diagrams for drawing a mural and photos of wetland creatures:
  - “Wetlands.” *Coastal CRC*.  
<<http://www.coastal.crc.org.au/wetlands/index.html>>
  - “Wet Net.” *Coastal Issues*.  
<[http://www.glo.state.tx.us/res\\_mgmt/wetnet/species.htm](http://www.glo.state.tx.us/res_mgmt/wetnet/species.htm)>

**Activities**

Draw a side view of a coastal wetland. Activity below the surface and above should be illustrated. It is necessary to draw a long mural like picture so that the changing activity can be shown as the tide rises. Example: periwinkle snails will climb up the grass stalks as the tide rises to escape hungry crabs. The left side of the mural will show the wetland at low tide and gradually increase the water level as it approaches the right side, representing high tide. The bottom strip of the mural may be left blank so that explanatory phrases can be added. Another option would be to add captions above the mural. Red warning flags could be added to point out species or natural processes that might be harmed by different environmental threats such as those introduced in this unit (Pennings).

**Assessment and Closure**

Oral presentations will be given using the mural to assess an understanding of the wetland environment.

**Lesson Plan II: Locating Texas Coastal Wetlands.**

**Introduction and Objectives**

The students will create maps of Texas showing the decline and restoration of coastal wetlands in Texas.

- *TEXH.7.2.a* - The student will locate and explain the importance of selected places and regions of Texas.
- *TEXH.7.2.b* - The student will compare regions of Texas and analyze the effects of physical and human factors on these regions.

**Materials Needed**

Posters, colored pencils and computer.

The following links go to sites with coastal maps and diagrams showing the changes which have taken place in coastal wetlands:

- Allison, Mead A. “Can the Loss of Texas Coastal Wetlands Be Halted...or Reversed?”  
*Quarterdeck*.  
<<http://ocean.tamu.edu/Quarterdeck/QD5.2/allison.html>>

- “National Wetlands Inventory.” *U.S. Fish and Wildlife Service*.  
<<http://www.fws.gov/nwi/index.html>>
- “Texas Coastal Management Program.” *Coastal Coordination Council*.  
<<http://www.glo.state.tx.us/coastal/cmp.html#mapsdata>>
- “The Texas Shoreline Change Project.” *Coastal Studies Group*.  
<<http://www.beg.utexas.edu/coastal/imsindexNew.htm#>>

### ***Activities***

Classes will spend time in the computer lab finding at least two examples of wetland maps of Texas from the past and at least two maps showing the extent of wetlands along the Texas coast today. Students will also research and take notes on the importance of wetland habitats and the causes of their disappearance.

### ***Assessment and Closure***

Back in the classroom, pairs of students will develop a map of Texas, color-keyed, with dates showing the decline of coastal wetlands and areas of current reclamation. Based upon their knowledge of wetlands, and research done in the lab, each pair will produce a paper explaining the reasons for the disappearance of wetland habitats along the Texas coast. Sources of information must be cited on the back of the maps and within the written reports.

## **Lesson Plan III: Comparing the Protective Nature of the Wetland to that of the Human Experience.**

### ***Introduction and Objectives***

The objective of this lesson is to create an understanding of the importance of the coastal wetland habitat by making it more familiar through a comparison to the students’ own existence. Hopefully this will also encourage an understanding of the role they will play in the success of the immediate environment in which they live.

- ENG.110.23b.12I - The students will be able to compare and contrast ideas in essay form.
- *TEXH.7.3.a* - The student will analyze the impact of human activities on the natural environment of Texas.
- *TEXH.7.20*. - The student will use problem solving and decision-making skills to pose solutions to problems related to the use of resources and the environment in the late 20<sup>th</sup> and early 21<sup>st</sup> centuries and in the future.

### ***Materials Needed***

Posters and colored pencils.

### ***Activities***

Pairs of students will first be asked to make a comparison chart or diagram showing how humans and the species found in coastal wetlands protect and nurture their young before sending them out into the larger world. Example of topics to cover: Crabs and shrimp carry their eggs around on the female’s abdomen until they hatch (Pennings). Small fish, crabs, and shrimp live in the protective environment of the grass stalks away from larger predators. Once large enough, they venture out into Gulf waters. Humans provide a protected environment for their young until old enough to venture out alone.

Groups of four will form, study each others’ charts, and combine into one chart. Next they will discuss the implications of the above chain of events when the protective environment is upset. These groups will compare and contrast the similarity of the following issues and their impact on the natural or human environment:

- Pollution or drugs.
- Erosion of soil or family.
- Natural predators (or invasive species) or criminals.

The purpose of this last step is to allow them to see the role they will play in protecting the environment and to see that they too live in an “environment” which must be protected. They are to consider the implications of their actions on the future health of nature and society. These issues are meant to help them better understand their parents’ actions and hopefully prepare them for parenthood. Understanding the function of the wetlands may clarify this.

Groups will hold a class discussion. Teachers will provide leading questions. For example: How are parent’s rules similar to governmental regulations pertaining to the environment? What is the purpose of these rules or regulations?

### ***Assessment and Closure***

Write an essay or create a chart which will use the above information to compare and contrast the way nature (of which humans are a part) protects its young.

### ***Follow Up Activity***

Bring the lesson back full circle after Lesson V by asking how the students can in turn provide a protective environment for the wetlands. Brainstorm using information from Lesson IV.

## **Lesson Plan IV: Instilling a Sense of Community Responsibility**

### ***Introduction and Objectives***

The main purpose of this lesson is to instill a sense of community activism and responsibility. In this lesson the students will provide examples of community service projects which will enable them to become active in the stewardship of Gulf Coast wetlands. They will do this by developing a persuasive advertising campaign in support of local volunteer organizations.

- ENG.110.23b.2B - The student will analyze and use persuasive techniques.
- *TEXH.7.3.a* - The student will analyze the impact of human activities on the natural environment of Texas.

### ***Materials Needed***

Posters, colored pencils, paint, colored paper, computers for printing text.

### ***Activities***

In some high schools there is a graduation requirement for students to perform several hours of community service. This lesson is meant to provide examples of such opportunities and to foster a desire to become actively involved in and informed about the community which shapes our environment. Groups or individuals choose one organization and make billboards and/or brochures showing causes served, implications of not addressing those causes, phone numbers, and volunteer opportunities.

### ***Resources***

The organizations listed here would be of specific relevance to my students who reside in the Galveston Bay Area. Similar groups are found throughout the United States. Several of these groups provide free guest speakers to community and school groups. This is a partial list of groups found in the Galveston Bay area.

- Aransas National Wildlife Refuge  
<<http://www.fws.gov/southwest/refuges/texas/aransas>>

- Armand Bayou Nature Center  
<<http://www.abnc.org/>>
- Bayou Preservation Organization  
<[www.bayoupreservation.org](http://www.bayoupreservation.org)>
- Baytown Nature Center  
<[www.baytownnaturecenter.org](http://www.baytownnaturecenter.org)>
- Christmas Bay Foundation  
<[www.christmasbay.org](http://www.christmasbay.org)>
- Friends of Anahuac National Wildlife Preserve  
<<http://www.friendsofanahuacnwr.org/>>
- Friends of Galveston Island State Park  
<<http://www.fogisp.org/>>
- Galveston Bay Estuary Program  
<<http://gbep.tamug.tamu.edu>>
- Galveston Bay Foundation  
<<http://www.galvbay.org>>
- Marsh Mania  
<[www.galvbay.org/Marsh\\_Mania07.cfm](http://www.galvbay.org/Marsh_Mania07.cfm)>
- Scenic Galveston  
<[www.scenicgalveston.org](http://www.scenicgalveston.org)>
- Texas Marine Mammal Stranding Network  
<[www.tmmsn.org](http://www.tmmsn.org)>
- Trash Bash  
<[www.trashbash.org/](http://www.trashbash.org/)>

### ***Assessment and Closure***

The billboards and/or brochures are to be viewed as an advertising campaign aimed at soliciting volunteers through creativity and clear communication. Each group should be able to explain how the community will benefit from the organization's activities in a classroom presentation. Final assessment will be provided by a group of teachers who will judge the billboards and/or brochures for clarity, creativity, and persuasiveness.

### **Lesson Plan V: The Reality of Shared Use**

#### ***Introduction and Objectives***

This lesson requires students to compare and contrast the needs of protecting the environment to those of industry and development. They will explore the value of working with various organizations to reach a community consensus.

- ENG.110.23b.12I - The students will be able to compare and contrast ideas in written and oral form.
- *TEXH.7.3.a* - The student will analyze the impact of human activities on the natural environment of Texas.
- *TEXH.7.5.c* - The student will investigate major Texas industries and evaluate their significance in the Texas economy.
- *TEXH.7.20* - The student will use problem-solving and decision-making skills to compose solutions to problems related to the use of resources and the environment in the late 20<sup>th</sup> and early 21<sup>st</sup> centuries and in the future.

### ***Activities***

Choose a topic of current interest in your locale. Port of Houston expansion is currently a hot topic in our area, and will be used as an example below. Other topics might include limitations on the amount of housing allowed along beaches and wetlands or restricting the amount of fishing or shrimping allowed in an area. Break students into groups and assign each a topic for research. For example:

- Why is there a need for Port of Houston expansion?  
Will this provide employment opportunities?  
Will there be increased tonnage to and from our Port?  
Who will pay for it and how much will it cost?  
Will industry or the taxpayers pick up the cost?  
In the long run, will the taxpayer reap the benefits of this expansion?
- What are the necessary changes?  
How will they be implemented? If the ship channel is to be deepened, what will be done with the excess sediments from the dredging of the channel?  
How will these changes impact the environment of the wetlands?  
Positive impact?  
Negative impact?  
Will this project increase subsidence?  
Will the project increase or decrease wetland habitat?
- How will this impact the quality of life for citizens living in the area?  
Increase or decrease in recreational opportunities?  
Will the abundance of sea life be affected?  
How could erosion increase or the natural protection from storms decrease?

Each group will research the various regulations and statutes which affect their topics. The groups will submit written reports and prepare an oral presentation. After the presentations, one member from each group will meet with one member from each of the other groups. Thus, five new groups will be formed. The new groups will discuss how they will compromise on the above issues so that all members of the community feel their needs have been addressed. An oral report will be presented by each new group with areas of agreement and contention. Students should take individual notes during this process.

### ***Assessment and Closure***

At this point in the unit, the students will have become familiar with various interest groups in our area. Through a class discussion they will envision the role each of these groups might play in this issue. As an extra credit assignment they can earn points by identifying and clarifying the motives of interest groups who might oppose the environmentally friendly organizations. Finally, each student will write a two-page essay comparing and contrasting the costs and benefits of port expansion in Houston.

## ANNOTATED BIBLIOGRAPHY

### Works Cited

#### Books

Stone, Lynne M. *EcoZones: Wetlands*. Vero Beach, FL: Rourke Enterprises, Inc., 1989.  
A concise description of the various types of wetlands and the creatures found there.

Whittington, Dale, ed. *The Economic Value of Improving the Environmental Quality of Galveston Bay*. Galveston, TX: Galveston Bay National Estuary Program, 1994.  
Report on the environmental impact of improving Galveston Bay's ecosystem. It compares economic benefits of cleaning up with the costs of making those improvements. High school students would find the reports published by this organization to be useful in preparing for debates on the use and preservation of wetland areas.

#### Internet

"About the Galveston Bay Foundation." 2002. *Galveston Bay Foundation*. 20 Feb. 2007 <<http://www.galvbay.org/3-0.cfm>>.

The foundation's goals are to educate the public in making decisions which affect all aspects of life in the bay area. They provide guest speakers, volunteer opportunities and research information.

*Artist Boat*. 10 March 2007. <[www.artistboat.org/home.html](http://www.artistboat.org/home.html)>.

Eco – Art Adventures for children and adults in the Galveston Bay area. Offerings include kayak adventures into area wetlands. 409-770-0722.

"Galveston Bay Habitat Conservation Blueprint." 2002. *Galveston Bay Foundation*. 20 Feb. 2007.  
<<http://www.galvbay.org/f-1.cfm>>.

Comprehensive report on the efforts being made to conserve the bay's resources. Describes several of the successful projects in the area including the reclamation of the Brownwood subdivision in Baytown.

*GBF Gazette* 17.4 April/May 2006. *Galveston Bay Foundation*. 2 March 2007.  
<[http://www.galvbay.org/upload/Gazette\\_ApriMay05.pdf](http://www.galvbay.org/upload/Gazette_ApriMay05.pdf)>.

Information on happenings around and about Galveston Bay. This issue contained information about the annual Marsh Mania, the new *Drive and Discover Guide*, and an oyster shell recycling project started by a high school student.

*Scenic Galveston*. 25 Feb. 2007. <[www.scenicgalveston.org](http://www.scenicgalveston.org)>.

An all volunteer organization founded in 1992 to fulfill a dream of creating a marsh reserve along the I45 estuary corridor leading onto Galveston Island. Sponsors of *Trash Bash*.

*Trash Bash*. 3 March 2007. <<http://www.trashbash.org>>.

Promotes the stewardship of the Galveston Bay area through various governmental, private, and environmental groups. The annual Trash Bash cleans the bay's watershed. This provides a great opportunity for volunteer groups and school children to perform community service.

#### Seminars and Brochures

Buddenhagen, Chuck. *Beachcombing*. Seminar and field excursions. KUHT, PBS. Houston and College of the Mainland. Galveston Island and Bay. Sept. 1996.

Field notes from two wonderfully informative weekends exploring Galveston Island and Galveston Bay.

*The Galveston Bay Drive and Discover Guide*. 2002. Galveston Bay Foundation.

Free brochure with navigational maps which describes more than 70 sites around Galveston Bay of cultural, historical, or ecological importance. Available at the above Galveston Bay Foundation web site or by calling 281-332-3153.

Pennings, Steven C. *Wetland Ecology*. Houston Teachers Institute. University of Houston, Houston, Texas. Spring, 2007.

Series of seminars focused on various wetland habitats. Presented at the University of Houston.

#### Other Sources

#### Books

McLeish, Ewan. *Habitats: Wetlands*. NY: Thomson Learning, 1996.

Covers the importance of wetlands and provides excellent photographs and charts.

Morgan, Anita M. and Wen Y. Lee. *Sources and Distribution of Debris in the Galveston Bay Estuary*. TX: The Galveston Bay National Estuary Program, 1993.

Interesting data on the types and numbers of trash washing up on Galveston area shores in the 1990s.

White, William A. and Jeffrey G. Paine. *Wetland Plant Communities, Galveston Bay System*. TX: The Galveston Bay National Estuary Program, 1992.

Data compiled on the types of plants in the Galveston Bay area with emphasis on wetland species.

### **Internet**

“Science of Galveston Bay.” 2002. *Galveston Bay Foundation*. 2 March 2007. <<http://www.galvbay.org/5-2.cfm>>. Interactive workshops with lessons showing how to integrate information about the bay into curricula and programs. The ten learning modules in the Science of Galveston Bay series can be adapted for a range of grade levels.

“Texas Coastal Nonpoint Source Pollution.” 2006. *Coastal Council Control Program*. 2 March 2007. <<http://www.fws.gov/texascoastalprogram/index.htm>>.

Management measures and implementation of federal government grant to regulate water pollution.

“Texas Coastal Program Projects.” 2004. *United States Fish and Wildlife Service*. 4 March 2007. <<http://www.fws.gov/texascoastalprogram>>.

Contains descriptions and photographs of various wetland restoration projects in the Galveston Bay area. Good source of photographs.

“Wet Net.” *Coastal Issues*. 5 May 2007. <[http://www.glo.state.tx.us/res\\_mgmt/wetnet/species.html](http://www.glo.state.tx.us/res_mgmt/wetnet/species.html)>.

Provides numerous links for information on the biodiversity of coastal wetlands.

### **Slide and Video**

Albert, Larry. “Back to Nature.” 2000. *Houston Wet*. 5 March 2007. <<http://www.rice.edu/~lda/wet/index.htm>>.

Excellent web documentary about the subsidence and eventual loss of the Brownwood subdivision in Baytown, Texas. Good slide presentation showing the return of the subdivision to its natural state. Shows the recklessness of building along the coast. Today the site is the location of the Baytown Nature Center. Be sure to use the above web address, others may not open.

*Life on the Gulf*. Texas Parks and Wildlife. 1995.

This video studies different aspects of life along the Texas coast including a group of volunteers planting cord grass along the edges of Galveston Bay and the impact of the Port of Houston on the area economy. Other segments cover the shrimping industry and the creation of artificial reefs in the Gulf using old drilling rigs. Provides a nice conclusion activity as it addresses several of the issues presented in the unit.