

The Wetlands Conflict from a Social Studies Perspective

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INTRODUCTION

With the world's population at 6.6 billion and rising, large urban areas are facing the complex challenge of coexisting with nature while predictably degrading it to accommodate growing human development. In an era characterized by a growing awareness of the importance of preserving the natural environment, students should become acquainted with the emerging political and economic issues related to wetland loss and preservation. Preserving wetlands has become a global issue that has many intriguing economic and environmental facets and perspectives. As a global citizen, each student should be aware of the economic and environmental trade-offs associated with preserving our earth's wetland regions.

My urban high school's student body consists of 89% at-risk learners among whom over a third (38%) carry the label "LEP" (limited English proficiency). This reality requires a teacher to be highly sensitive to English vocabulary usage and to clearly develop academic concepts and learning skills. These constraints make it necessary to model vocabulary words as much as possible as a means to illustrate the comprehensive meaning of a word. In addition, in teaching a unit on wetlands and wetland preservation to students, one must approach the classroom learning activities from a multitude of "intelligences."

OBJECTIVES

This unit will satisfy Houston Independent School District, Texas objectives in social studies. The student will:

- identify the distribution of plant and animal life in a region
- analyze impact of climate, vegetation, soil, and geology on wetland distribution
- compare different points of view on geographic issues in a given region
- assess how technology has changed primary economic activities
- analyze how these changes impact the environment
- determine how geographic characteristics can impact US politically
- express and defend a point of view related to a contemporary issue
- cite examples of changes in the American culture that inspired changes in public policy
- evaluate the impact of political change on the environment
- assess the extent to which new technology has expanded global markets
- identify ways humans from various world regions have adapted and modified their environment
- explain how scientific discoveries and technological innovations can create the need for new rules and regulations to protect individuals, businesses, and the environment
- use a problem solving process to identify a problem, gather information, list action options, choose and implement a solution

The aforementioned TEKS objectives represent are: *WGS.7.04, WGS.2.07, WGS.5.03, WGS.7.03, WGS.2.17, Gov.2.01, Gov.6.01, Gov.5.16, Eco.7.05, Eco.8.0, and Eco.8.12.*

RATIONALE

During the course of a school year, I rarely spend instructional time discussing the natural characteristics of the wetlands' fluctuating ecosystem. However, as civilization moves toward a more global and environmentally-sensitive future, students need to understand the physical characteristics that make wetlands a remarkable ecosystem resource that provides multiple benefits to humanity. Wetlands naturally occur at the intersection of terrestrial and aquatic habitats in an assortment of climates and locations throughout the world. Because they are mobile and dynamic, they assume numerous forms and unique characteristics and are easily destroyed if the hydrological and geographical conditions that create them are altered.

Wetlands are endangered because of the pressing issues of overpopulation and urban area growth. In many parts of the world, regional population numbers are increasing at alarming rates. Regions with growing populations generally contain *Less Developed* countries that do not have the capital or technology to use their farmland efficiently. (Less developed country is a term used to describe a country's economic and educational resources that directly affect the nation's standard of living. Less developed suggests that the country lacks the economic and educational resources necessary to provide its citizens with the comforts of modern life.) Therefore, it is their public policy (as it was in the United States until the 1950s) to extinguish other landforms in an effort to create more farm land to feed a growing population. In addition, the growth of cities worldwide has caused numerous nations to bulldoze farmland and natural habitats around cities to construct new housing to accommodate the pressures of expanding urban areas. In coastal areas, wetlands are often situated in highly desirable locations for marinas, ports, and housing developments, making them vulnerable to urban "improvements."

UNIT BACKGROUND

Local Perspective

Houston features a number of wetland areas beginning with its urban bayou system.

The bayou system can offer a wetlands model that is easily accessible. To introduce my students to this landform, I would like to arrange a field trip to a local bayou and have the students observe the functions and benefits of wetland ecosystems. Many of Houston's bayous are the subjects of ongoing professional studies that could further elaborate on specific wetland benefits. This local exposure would enable the students to extend their understanding of the unique ecological functions served by wetlands that make them more than a drainage ditch. In fact, even a drainage ditch is more than a simple water avenue for surface water run-off. A drainage ditch serving as an unusual wetland supports a dynamic community of plants and animals.

The city of Houston serves as a good example of how attitudes toward wetlands have changed over time. In the past Houston followed the nation's policy of eliminating wetlands whenever they were located in urban growth areas. However, in the mid-twentieth century as water became more polluted and hazardous materials were dumped daily into America's streams and rivers, public sentiment shifted toward demanding more protection and preservation of our water resources. Now we are restoring wetlands along Houston's bayous and backyards (retention pools) because we realize that wetlands serve our community by controlling flooding, supporting wildlife, and purifying water.

Building on their local experience and knowledge, my students could begin perceiving the pressures that wetlands face both nationally and globally. My students need to understand the

political and economic history of wetlands in light of a constantly changing American landscape. At the founding of America, productive farmland was plentiful. As America's population grew, population growth was accommodated by converting wetlands into more farmland, which was considered an efficient economic trade-off.

In the twentieth century emphasis on land use changed from farming to industrialization, creating new problems for wetlands. Wetlands began to be used as dumping areas for industrial waste and eliminated for the sake of accommodating the expanding urban populations. In 1980, due to the triple threat of farmland, industrial pollution and urban expansion, the total wetlands area in America was reduced to less than 50% of its acreage in 1780 (Gosselink 690).

Using wetland perspectives in each of my social studies classes, I will lead my students into a discussion that will provide historical background and current data relevant to modern society's exploitation and preservation of wetland sites. My students will review the policy of "no net loss" and how this policy will always be inherently flawed for a number of reasons beginning with the fact that net increases in wetland acres do not ensure sustaining wetland functions. It has been noted that when an established wetland is drained, its functions may never be recovered, even though a similar wetland is restored or created (Hansen 6).

In recounting the worldwide loss of wetland habitat due to the increasing support needs of a growing world population, students will examine the frameworks and guidelines for future development as proposed by international bodies seeking to protect the biological diversity and ecological and hydrological functions provided by wetlands (San Jose Conference). Though the benefits of wetlands have repeatedly been affirmed through scientific studies, most of the world, including the United States, continues to destroy thousands of wetland acres a year. My students will address the difficulties encountered by government agencies in defining wetland areas and learn why wetland conversion scenarios are difficult to evaluate and monitor.

In my planned US Government unit, I will lead my students in analyzing current national and international government policies that address the diverse issues related to wetland destruction and preservation. Students will evaluate the causes for the changing public opinion and conflicting government responses to the "no net loss" policy that is advanced by government officials regarding wetlands management.

One of the most important categories of ecosystem services provided by wetlands is its hydrological. Wetlands moderate flooding and improve water quality. With fresh water resources becoming taxed due to the growth in global population, students will examine the hydrologic function provided by the wetlands and the role wetlands could assume in addressing future anticipated fresh water shortages.

Global Perspective

As part of considering reasons why world governments need to adopt wetland preservation measures, students will also study how wetlands impact both the abiotic system and biotic life in different global regions. They will consider the political tensions generated in both *Less Developed* and *More Developed* (countries that feature access to technology and innovations to improve human living conditions) countries between economic and political forces seeking to either preserve the wetlands and their ecological benefits or capitulate to the pressures of modern civilization's quest for more space to accommodate the demands imposed by growing population numbers.

Students will review what supranational groups are doing to confront governments who are still developing and destroying wetlands to accommodate their attempts to modernize their nation. Both my Human Geography and US Government curriculum units will confront students with the conflicting political realities of balancing the growing population and urban expansion

with the need to design public policies that save the remaining wetland areas and restore some of the previously destroyed wetland regions.

Classroom Perspective

Below I outline four lessons that can be mixed and matched for use in different classes to address wetlands issues as a short instructional theme or a longitudinal perspective. Teaching about wetlands preservation (or destruction) would benefit from the insights gained from additional academic viewpoints. It would be my hope to collaborate with our biology teachers to generate interdisciplinary curriculum units that would reinforce our wetland instruction. One possible interdisciplinary lesson would feature a biology class presenting details on the hydrologic functions of a nearby wetlands (Galveston) and a Human Geography class discussing the human development activity that we can witness occurring in that location. Together, we could have the students predict environmental as well as recreational changes that will occur if the wetlands are destroyed.

World Geography

In World Geography, students are expected to understand how human migration has changed the local topography as humans interact with their environments during human settlement. The initial World Geography unit can serve as a vehicle to convey the scale of the earth's wetlands, how they provide life sustaining benefits, and how they are being eliminated in the quest for more land for agriculture, industry and housing. My World Geography students would note the regions where wetlands are prevalent, including the association of climate type, latitude, and soil characteristics with specific types of ecosystems and biomes.

Human Geography

In Human Geography students study the impact of globalization on spatial interaction, human distribution, and changing attributes of place. In each of these topics the students study the spread of global technology and how it has altered the management of the "natural" environment. This unit will identify humans' attempt to manipulate nature through exploitative technologies, review the negative impact on the environment of many of these manipulations, and examine the reasons why governments are currently making efforts to save remaining wetland areas.

As part of World Geography and Human Geography's instructional goals, students need to understand the net impact that destroying wetlands is having on our local quality of life. The paving over or plowing under of wetlands has accentuated the effects of natural disasters and replaced the natural landscape with an environmentally unhealthy human landscape littered with pollution and declining sources of fresh water.

A review of current case studies of human exploitation of wetlands will serve as an effective tool to create a real world context to study this modern day dilemma. The scope of wetland destruction in the Netherlands in the name of agricultural reclamation would serve as a model where the country's population is beginning to reconsider the environmental damages incurred by this policy. Nationally, the Florida Everglades has recently been revisited by national and state officials who have decided that the building of canals to control flooding, assist the growth of the sugar cane industry and provide land for housing development has created significant damage to the natural benefits offered by the "river of grass." Other "current event" wetland regions include Iraq's destruction of its ancient Mesopotamia salt marshes for political reprisals and Houston's filling of marshes for development and channeling of bayous for port expansion.

US Government

Due to the efforts of science to inform societies of the natural repercussions of population growth, wetland preservation has become an important political issue on a global scale.

Ultimately, wetland preservation rests with the creation and enforcement of environmentally friendly governmental policies. In my US Government class students study the impact of government policies on the quality of life in America. Since wetlands are directly linked to sustaining fresh water as a renewable source, one would think that wetlands preservation would be high on this country's political agenda. The social reality in America is that if the public does not recognize the benefits of wetland preservation, then wetlands will not be preserved. The unit will recount the history of government wetland regulation and how it vacillates between preservation and exploitation. This in part is due to the difficulty in legally defining the precise nature of wetlands and assessing the quality of their conversion. Indecisive government policy also reflects the struggle of protecting individual rights against providing the benefits to the society as a whole (tragedy of the commons).

Economics

In the curriculum unit's final chapter I will provide background to the economic factors related to wetlands preservation and the difficulty governments have in developing policies that effectively balance the need to protect wetlands with the desire to promote economic progress. Most people recognize that wetlands have numerous and widespread benefits; however, they have little commercial value and almost no market value. In a *More Developed* nation whose economy is driven by the efficient use of resources, wetlands do not offer a promising increase to the "bottom line." Conversely, to save wetlands will cause communities to incur greater costs in bypassing wetland areas and developing already improved sections of a region (Fellmann 387).

In *Less Developed* countries (LDC), 90% of raw sewage from urban areas is discharged totally untreated into streams and other surface water supplies including wetlands (Fellmann 379). LDCs do not have the capital or resources to implement sustainable conservation practices. Their domestic growth policies often include exploiting wetlands and other landforms in order to accommodate growing urban population centers. Therefore, more developed countries (MDCs) must provide economic incentives to LDCs to preserve their natural resources while giving them economic assistance to address the basic needs of their citizens.

LESSON PLANS

Lesson One: World Geography

Lesson Overview: The purpose of this lesson is to have students learn the rationale used by humans in interacting with the environment when creating a settlement. Students will analyze the conflict between ecosystems and the establishment of human infrastructures. To serve as the lesson's focus, students will compare America's west coast topographical features of salt marshes with salt marshes situated on the Gulf and East Coasts. They will learn that the West Coast wetlands are suffering a 95% loss due to their location near the ocean and the sparse open land that exists for possible marina and port usage. The West Coast shoreline features cliffs and rugged, rocky highlands that make access to the ocean difficult in most places, whereas the Gulf and East Coasts have many more miles of unobstructed shorelines that lend themselves to the development of marinas, ports, and housing. This topographical reality suggests that further West Coast development will eventually force salt marshes into extinction. While also threatened, salt marshes on the East Coast (coastal Boston, much of Washington, DC) are more numerous and not in immediate danger.

TAKS Objectives

- *WGS.7.04 – Assess how technologies have changed primary economic activities and analyze the environmental impact of those changes.*
- *WGS.2.07 – Identify the distribution of plant and animal life in a region and analyze the impact that climate, soil, vegetation, and geology have on this distribution.*

- WGS.5.03 – Identify and compare different points of view on geographic issues in a given region.

Introduction: 10 minutes

1. Display and comment on the transparency entitled “Features of a salt marsh ecosystem.”
2. Ask students to turn to p. 34 in their textbook and notice where marshes are located on the “Landform” map.
3. Display transparency “Comprehensive Natural Coastal Program” map that depicts critical issues facing all US coastal regions. Ask students to identify the regions where the critical issues are “wetland habitat loss” and “watershed modifications.”
4. Ask students to record what region would suffer the most from the loss of coastal wetlands (salt marshes). Ask them to defend their positions.

Concept Development: 45 minutes

Key Concepts

1. Salt marshes perform important hydrologic roles in flood control and renewing clean water in its soil-root interface.
2. Salt marsh areas attract developers because of their topography and proximity to the ocean.
3. Because their number is greater than that of West Coast salt marshes, East Coast salt marsh loss represents a smaller percentage of the total salt marsh acreage loss in America.

Key Vocabulary

Salt marsh, ecosystem, topology, landform, estuary, organic detritus, upper marsh, lower marsh, Venn diagram, mitigation

Procedures

1. Mention that each state with a coastal shore has a vested interest in protecting its shoreline while growing a healthy economy for its citizens. Ask students to write down the environmental benefits offered by salt marshes which also benefit human activity.
2. Take the class to the computer lab and distribute plain paper to each student. Explain the function of a Venn diagram then ask students to create a Venn diagram outline on their paper. Tell them to take notes on the assigned websites as information relates to West and East coast salt marshes.
3. Ask students to access the following websites:
 - a. <http://www.dep.state.fl.us/coastal/habitats/saltmarshes.htm>
 - b. <http://www.wapms.org/plants/spartina.html> (review *Detrimental* portion of article)
 - c. <http://www.epa.gov/nep/about1.htm>
4. Return to the classroom. Using the information they have collected on the websites, students will fill their Venn diagrams with the information gathered online.
5. Review the patterns depicted in the students’ Venn diagrams.

Student Practice: 15 minutes

1. Distribute outline maps of the United States.
2. Ask students to indicate regions on both coasts where salt marshes are located.
3. Have students identify the salt marshes characteristics of each coast’s by creating symbols for each characteristic and then have them explain the characteristic in a legend that they add to the outline map.

Assessment: 15 minutes

1. Ask students to write a paragraph explaining why salt marshes are more threatened on the West Coast than on the East Coast.
2. For homework, ask students to determine what our local Houston-Galveston area is doing to promote the preservation of salt marshes. Bring in a newspaper or Internet article.

Closure: 5 minutes

Remind students that human activities disrupt, impair or reengineer ecosystems each day and that we need to support programs that preserve our natural heritage just as we would defend our political heritage.

Key Questions

1. What is the relationship between salt marshes and flood control?
2. What are some examples of animal and plant ecosystems found in salt marshes?

Materials

1. Transparency – “Features of a salt marsh ecosystem”

“Salt marshes are coastal wetlands that occur in a zone between the low and high tides (also called tidal marshes). Salinity, frequency, and extent of flooding of the marsh determine the types of plants and animals found there. Salt marsh plants are typically various shades of green, brown, and gray. They provide food and cover for animals at different stages of their life cycle.” Pictures available at:

<http://www.bchs.uh.edu/~steve/Salt%20marsh%20community%20ecology.htm>

2. Transparency – “Comprehensive Natural Coastal Program” map found at:

<http://marine.usgs.gov/fy2000/cmg-program2000.html>

Lesson Two: Human Geography

Lesson Overview: In our unit on global development, students will be introduced to global patterns of wetland destruction. Our textbook mentions this activity as a non-political factor in a poor country’s effort to create more farmland to feed a growing population. This lesson is designed to assist students in understanding the wetlands’ global interconnectiveness and their link to common biodiversity and ecosystems found throughout the world.

They will analyze urban expansion and the threats this growth poses to ecosystems. As a concluding exercise, students will create posters advocating wetland preservation in exchange for other economic and/or social benefits to less developed countries.

TAKS Objectives

- WGS.7.03 – *Assess the extent to which new technology has expanded existing markets, created new markets, and redefined what elements of earth’s resources are exploitable.*
- WGS.7.01 – *Evaluate major technological innovations that have been used to modify the physical environment.*
- WGS. 2.17 – *Identify ways humans from various world regions, cultures, and levels of development adapt to and modify their environment.*

Introduction: 15 Minutes

1. Ask students to assume the role of a very poor person who has never owned his own piece of land. One day the government offers him a very small piece of land that happens to be

saturated with water for twelve months a year. He can use this land as farmland if he could find someone with two truck loads of dirt to fill-in the wet area.

2. Require students to take out a piece of paper and write what they would do if they were the poor farmer. They have five minutes to complete this task.
3. Ask students to turn to their neighbor on their left and within a two-minute timeframe, explain to her what he gave for an answer. At the end of two minutes his partner will summarize the answer he gave. The student pair switches places and repeats the same exercise.
4. Using the board (or overhead), the teacher will ask for student remarks and write them for the whole class to see. Within two minutes, ask two students to summarize the actions that the class proposed.
5. Summarize the remarks concluding with the fact that human population growth causes a strain on existing natural resources.

Concept Development: 35 minutes

Key Concepts

1. Human population growth threatens to ravage the wetland ecosystems.
2. Farming methods and urban expansion have led to the destruction of over half of the world's wetland regions.
3. Although people from less developed countries are more likely to exploit wetlands out of necessity, citizens from more developed countries use technology to more effectively destroy wetlands for commercial gain.
4. Technology is used by citizens in both LDC and MDC countries to increase the food supply and to enlarge urban areas. Technology can also be used to preserve critical ecosystems.

Key Vocabulary

ecosystem, degradation, sustainability, regulatory body, mitigation banks, hazardous waste, interdependence

Procedures

1. Write on the board "When we try to pick out anything by itself, you will find it hitched to everything else in the universe." – John Muir
2. Ask students to write a single paragraph interpreting what that quote means to them.
3. Ask students to share what they have written and extend it to the world today, especially as it relates to environmental issues.
4. Distribute a blank graphic organizer that has a large circle in the middle (earth) and three circle extensions that have three lines extending from each small circle.
5. Provide the students with the following word bank and ask them to place the words on their correct lines on the graphic organizer.
 - a. Major headings – earth, life, environment, human activity
 - b. Descriptor words – basic human needs, renewable resources, population, conflict and peace, sustainability, consumption, human migration, non renewable resource, renewable resource, poverty, and equity.
6. Call on students to share their answers. Comment on how nature and human activity are related.

Student Practice: 20 minutes

1. Ask students to read pp. 305-309 in Fellmann text and create a poster that incorporates each component part of the graphic organizer.
2. Distribute a rubric that explains how the poster will be assessed and review its content with the class.
3. Add the requirement that each student's poster should create an awareness of the interdependence of wetlands with human existence.

Assessment: 15 minutes

Ask students to write a paragraph on what actions should be taken to require human expansion to preserve wetlands natural functions.

Closing: 5 minutes

Discuss the problems of enforcing a global policy like “no net loss” in a world where levels of development vary to the extreme. What can we anticipate in the future of wetlands if human expansion is not curtailed?

Materials:

Poster Board, colors

Lesson Three: US Government

Lesson Overview: This lesson will examine the question of whether true parity can be achieved if destroying a wetland in location X can be legally mitigated by restoring or constructing a wetland in location Y. Besides distance from the original wetland site, this lesson will consider other factors that influence the concept of mitigated or banked wetlands as a means of satisfying “no net loss” government policy.

For background understanding, students will debate government policies transitioning from older policies that supported wetlands destruction to current policies that attempt to preserve the existing wetland acreage. Students will select legislative, executive and judicial activity that demonstrates the difficulty in sustaining a consistent enforcement of wetlands preservation.

After learning how wetland policies have changed over time, students will compare the efforts of the various levels of government and their agencies and recommend who should have the ultimate oversight of the “no net loss” wetlands policy.

TAKS Objectives:

- Gov.2.01 – Determine how the location and governing characteristics of selected places can impact the US politically and environmentally.
- Gov.5.16 – Express and defend a point of view related to a contemporary issue in the United States.
- Gov.6.01 – Cite examples of changes in American culture that inspired changes in public policy, and evaluate the impact of political change.

Introduction: 15 minutes

1. Ask students to explain/discuss how Houston's growing population is changing the natural landscape. Ask a few students to respond to the question.
2. Ask students to explain the connection between plants and animals. Why do you find certain animals living in certain regions of the earth?

3. Display a picture of a Houston bayou and ask the students what types of animal and plants are supported by this landform. Then ask what would happen if the bayou were diverted and the area filled in with dirt and concrete. What would happen to the animals and plants, and would their loss cause public concern?
4. Distribute handout “Classroom Debate” and explain that in a democracy the people hold the power to government (make public policy), and they use debate as a means to determine the most feasible position on an issue. Discuss how we will use this format to explore the issues of government policy regarding wetlands.

Concept Development: 50 to 90 minutes

Key Concepts

1. In a democracy the divisions of government (federal and state) conduct debates to generate public policies supported by the majority of people.
2. In a capitalistic society economic growth and the changes induced by its expansion are encouraged regardless of the cost to the environment (this attitude has been slowly changing).
3. The federal government has taken the lead in preserving wetlands, but this is a recent and uneven effort. States must also support conservation agencies’ efforts to protect wetlands through enforcement of taught public policies.

Key Vocabulary

wetlands, wetlands management, “no net loss,” mitigation, functioning assessment, hydrogeomorphic approach

Procedures

1. Project PowerPoint “Overview of US Wetlands Regulation and Policy.”
2. Distribute prepared handout on the PowerPoint presentation that will allow the students to organize their note-taking.
3. Reviewing the presentation’s content, the teacher will discuss the function of wetlands and modern day pressures to degrade their existence.
4. Forming teams of four, the teacher will review the handout “Classroom Debate.”
5. Ask students to form teams of two presenters and two researchers. Class time and assistance will be given to ensure that each team is well prepared in their debate presentations.
6. Each team will be assigned an arguing position for either one of the two classroom propositions:
 - a. Wetland preservation should be a high priority in making public policy for the twenty-first century.
 - b. The current government policy of “no net loss” must be upheld without exception.

Student Practice: 60 to 90 minutes

1. Ask each team member to write out their argument strategy including:
 - a. A brief introduction summarizing your position
 - b. Defining the terms you intend to use
 - c. Presenting the important issues of the topic
 - d. Presenting the evidence that you are using to support your issues
 - e. Anticipating cross examination questions and challenges that may require your response.

2. Encourage students to use information that they have collected from the PowerPoint presentation as well as their Internet searches (research time in the computer lab will be made available)

Assessment: 10 minutes

1. Distribute a debate grading sheet to each student not participating on a team that is currently debating. Each student will use the grading spreadsheet to record his or her evaluations of each debating team's performance in the areas of delivery, organization, argument, evidence, and rebutting. The rating criterion will be a 1 for poor performance, 2 if the performance is fair, 3 if the performance is good, and 4 if the performance on a given criteria is excellent.
2. Grading sheets will be collected and tabulated and returned to each team following the teacher's remarks and overall grading of the team's performance.

Closing: 5 minutes

Ask students to project the future landscape of Houston regarding its natural environment and what types of laws will be necessary to protect the environment from urban expansion.

Materials:

PowerPoint presentation "Overview of US Wetland Regulation and Policy"

Lesson Four: Economics

Lesson Overview: In many instances, the destruction of wetlands is a pragmatic economic decision. Whether it occurs in an *MDC* or an *LDC*, wetlands are sacrificed to perceived economic necessity. This lesson will have students evaluate alternative financial remedies to wetland destruction. A significant part of this economic discussion centers on the fact that current market-based economic theories (neoclassical economics) do not adequately value non-market items. Clean air is a national value (law), but clean air cannot literally be bought or sold. Therefore, the pollution of clean air does not have an economic cost.

"Ecological Economics" is a recent attempt to quantify these non-market values of natural systems and add them to the discussion. Ecological economists acknowledge that the "quality of life" is not analyzable from a neoclassical economic standpoint, but suggest that an interdisciplinary approach combining social and natural sciences may allow non-market items to be included in economic analyses.

TAKS Objectives:

- *Eco.7.05 – Explain how scientific discoveries and technological innovations can create the need for new rules and regulations to protect individuals and businesses.*
- *Eco.8.03 – Create a product on a contemporary economic issue or topic using critical methods of inquiry.*
- *Eco.8.12 – Use a problem solving process to identify a problem, gather information, list various options, choose and implement a solution, and evaluate the effectiveness of the solution.*

Introduction: 15 minutes

1. Distribute a questionnaire that contains the following questions:
 - a. What would a person pay for a glass of clean water in the following circumstances?
 - i. In the hallways at Lee High School _____
 - ii. On a Houston street at 2 PM in 100 degreee/100% humidity _____
 - iii. In a region of the world where there is no clean water _____

- iv. For a glass of dirty water in a region that has no water available nor can you obtain any water for 24 hours _____
2. Ask the students to complete the questionnaire.
3. Have students turn to their shoulder partner. The one with the longest hair shares first while the other partner listens. At the end of two minutes the listening partner repeats what he heard his partner say. Then the listening partner explains what he has written while the other partner listens and the activity is repeated.
4. Call on students to share what their partner would pay for a glass of water in each of the scenarios.
5. Write on the board the price range that students would pay for water in each of the scenarios and discuss the concept of “ecological economics.”
6. Emphasize that there is economic value to natural resources and it has only been recently that economists have begun to quantify the non-market values of natural systems.

Concept Development: 30 minutes

Key Concepts

1. Wetlands provide real benefits therefore they have economic value.
2. Ecological economics represents a systemic change in thinking about market values of natural systems.
3. Value is measured in terms of what people are willing (and able) to give up in order to acquire something.
4. Economists think of evaluation techniques as establishing prices.

Key Vocabulary

wetlands, ecological, systemic, economic value, hectare, sustainable, equity, optimum, natural capital, quantitative, qualitative, contingent, risk, uncertainty

Procedures

1. Conduct a brief introduction to the concept of cost-benefit analysis using wetlands.
2. Distribute handout on PowerPoint presentation “The Economic Valuation of Salt Marshes.”
3. Display the PPT by Craig Brett, Canadian Research Chair in Canadian Public Policy.
4. Discuss main points of presentation:
 - a. Types of value – Direct use, Indirect use, Non-use
 - b. Valuation Methods: Contingent Valuation, Related Markets, Dose Response
 - c. Global Estimate of the Value of Salt Marshes
 - d. Why Some Wetlands Have More Economic Value than Others
5. Lead a discussion on the meaning of economic value (p. 13 in textbook)
 - a. What are the types of value that wetlands offer?
 - b. What are three methods economist use to arrive at value?
 - c. Why do some wetlands have more economic value than others?

Student Practice: 25 minutes

1. Distribute copy of “Valuing Ecosystem Services” to each student.
(found at: http://earthtrends.wri.org/pdf_library/feature/eco_fea_value.pdf)

2. Form student pairs and ask them to read the first three pages of the article and answer the following questions:
 - a. What amount does a team of global researchers place on the value of worldwide ecosystem services? (US \$33 trillion per year)
 - b. What are some reasons other than direct value to humanity that cause ecosystems to have value? (moral, ethical, and aesthetic)
 - c. Why doesn't the value of ecological services normally receive consideration in the marketplace? (its benefits fall outside the marketplace, not measured by the money economy)
 - d. According to the chart (Figure 2) on page 2, what is the most valuable ecosystem in the world today? (Soil formation - \$ 17.1 trillion US dollars)
 - e. Whom does the ecological economist see benefiting by assigning this valuation concept to ecosystems? (local and regional land-use decisions)
 - f. Using an ecological valuation system, what was the cost-benefit finding for the Hadejia-Jama'are flood plain region in northern Nigeria?(the wetland is far more valuable to more people in its current state than diverted for irrigation)

Assessment: 15 minutes

Ask each student pair to create a poster persuading people to consider sustainable ecologically-friendly measures in pursuing economic goods, rather than using traditional consumption-based market purchases.

Closing: 5 minutes

Ask students to comment on how they envision the future of wetlands and other ecosystems if there is no global agreement on their economic value.

Materials

PowerPoint "The Economic Valuation of Salt Marshes"

<http://www.mta.ca/rstp/Salt%20Marsh/TheEconomicValuationofSaltMarshes.ppt>

ANNOTATED BIBLIOGRAPHY

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