



Texas Teacher's Supplement

Introduction

Confronting Climate Change in the Gulf Region: Prospects for Sustaining Our Ecological Heritage describes likely climate changes and potential consequences for ecosystems and the goods and services they provide to society, spanning the region from the southern tip of Texas to the Florida Keys. Texas lies in the western subregion of the Gulf Coast Region, with a climate that varies from subtropical to warm temperate and is characterized by warm and dry summers. Against a backdrop of significant variability over the past century, Texas has experienced a warming trend since the 1960s, and extreme rainfall events have become more frequent. Projected changes in climate include an increase in maximum summer temperatures, sea-level rise, and changes in precipitation, with possibly wetter conditions along the south Texas coast, drier conditions along the northern Texas coast, and wetter or drier conditions in upland regions.

The activities in the curriculum guide can easily be adapted to focus on specific ecosystems and places in Texas. The Big Thicket in East Texas and Laguna Madre in the South Texas Coastal Plain are two of the featured ecosystems in the Gulf report (pages 24 and 45–46, respectively). They could be used as case studies for several of the activities in the guide. The Texas Gulf Coast has many other unique natural areas threatened by human pressures and climate change. Austin, Houston, and Corpus Christi participate in the Clean Cities Program of the US Department of Energy, which supports and promotes the use of alternative fuel vehicles in order to reduce dependence on gasoline and diesel.

Internet resources for Texas natural areas, state agencies, and environmental non-profit organizations are quite comprehensive, and provide excellent background information for student research. Two general resources include

- The Texas Natural Resource Conservation Commission promotes environmental education in Texas. Several lessons plans are available on their web site. http://www.tnrcc.state.tx.us/exec/oppr/pubeduc/education_home.html
- The Texas Natural Resources Information System provides many links to geographic education sites, including some specific to Texas. <http://www.tnris.state.tx.us/geolinks.htm>

Texas Resource List and Teaching Hints by Activity

Activity 1 – Warming Up to Global Warming

In this activity students research newspaper articles to better understand how global warming is portrayed in the media. Recent articles on the topic can usually be accessed at a newspaper's web page by doing a keyword search for "global warming."

Web sites for newspapers of the Gulf Coast region can be accessed at <http://newslink.org> For Texas, see <http://newslink.org/txnews.html>.

Louisiana's Baton Rouge Advocate recently did a series of articles about climate change (10/21/01–10/23/01). These can be accessed at http://www.theadvocate.com/news/global_warming.asp

Web sites for Texas newspapers

Austin American-Statesman: www.statesman.com

Dallas Morning News: www.dallasnews.com

Corpus Christi Caller-Times: www.caller.com

Galveston County Daily News: www.galvnews.com

Houston Chronicle: www.chron.com

San Antonio Express-News: www.mysanantonio.com/expressnews

Activity 2 – Understanding Climate Change

The goal of the extension exercise (**Extension #2: Contribution from cars alone in the Gulf Coast region**) is to help students appreciate the magnitude of carbon dioxide emissions from motor vehicles. The calculations can be done at any scale, ranging from all the cars in the US to just those for a particular state or county.

For extension #1, a carbon calculator developed by the Texas State Energy Conservation Office, with an accompanying guide to the results, is available.

<http://www.infinitepower.org/calculators.htm>

For extension #2, Texas motor vehicle statistics are available from the Texas Department of Transportation.

<http://www.dot.state.tx.us/vtrinfo/vtrinfo.htm>

The number of registered vehicles for the state for the period from September 1999 to August 2000 was 17,202,097. On the web site the data are also broken down by district.

Texas retail gasoline prices for the current week are available from the US Energy Information Administration.

http://www.eia.doe.gov/oil_gas/petroleum/data_publications/wrgp/mogas_home_page.html

Texas Energy data – provides additional information on energy consumption in Texas.
http://www.eia.doe.gov/emeu/states/main_tx.html

Activity 3 – Gulf Coast Climate

In this activity students gain an appreciation for the physical and cultural characteristics that define the Gulf Coast region. Texas's place within the Gulf Coast region—physically, socially, and economically—can be explored through a US atlas, as well as maps available on the Internet. A good starting point is the University of Texas's map library.

Texas Maps

<http://www.lib.utexas.edu/maps/texas.html>

Several examples of interconnections that may be less familiar to students can be found on “The Energy Market Map of Texas and Louisiana,” which shows electric transmission lines, gas pipelines, and ports.

http://www.eia.doe.gov/emeu/reps/states/maps/w_g_c.html

Similar maps for the other Gulf Coast states are also available.

<http://www.eia.doe.gov/emeu/reps/states/maps/>

Activity 4 – Know Thy Ecological Homes

In this activity students develop their knowledge of the plants and animals and physical processes characteristic of Gulf region ecosystems. Students will gain a better understanding of the biological diversity of the region if natural areas from several different Gulf States are studied. The Gulf Ecological Management Sites (GEMS) Program web site is the best resource for quick access to regional natural areas <http://www.epa.gov/gmpo/gem2.html>. If teachers choose to focus on Texas ecosystems, there are several web resources specific to Texas that serve as appropriate starting points, or are useful for more extensive student research.

Texas Ecoregions

The map “Ecoregions of Texas” illustrates the ecoregions for Texas and is a good introduction to the activity.

http://www.tpwd.state.tx.us/publications/wildlife_habitat/pdf_docs/ecoregions_tx_color_map.pdf

Links to descriptions of the vegetation and habitats of the natural regions of Texas.

<http://www.tpwd.state.tx.us/nature/tx-eco95.htm>

An excellent overview chart of the features of the Gulf region—topography and characteristics, rainfall, vegetation, and wildlife.

<http://www.tpwd.state.tx.us/expltx/gulfchart.htm>

An interactive map with links to all Texas regions can be found at

<http://www.tpwd.state.tx.us/expltx/etframe.htm>

The Texas GEMS program web site has links to all designated TEXAS GEMS sites <http://www.tpwd.state.tx.us/consERVE/txgems/index.htm>. It is a user-friendly site providing information about the habitats and ecological functions of 16 Texas natural areas.

Nature Conservancy Preserves in the Texas Gulf Coast region

<http://www.texasnature.org/profiles/>

Texas Climate

Average Annual Precipitation (Oregon State University)

<http://www.ocs.orst.edu/pub/maps/Precipitation/Total/States/TX/tx.gif>

Office of the Texas State Climatologist

<http://www.met.tamu.edu/met/osc/osc.html>

Other

Historical Maps for Texas cities

http://www.lib.utexas.edu/maps/historical/historic_tex_cities.html

EPA Texas state atlas

<http://www.epa.gov/ceisweb1/ceishome/atlas/stateatlas/texas.html>

The Handbook of Texas Online – an encyclopedia of geographic, cultural, and historical information <http://www.tsha.utexas.edu/handbook/online/>.

Activity 5 – Nature's Bounty

This activity introduces to students the concept of “ecosystem goods and services,” the societal benefits received from the natural environment.

The Texas GEMS website provides descriptions of the ecological functions of the 16 GEMS sites.

<http://www.tpwd.state.tx.us/consERVE/txgems/index.htm>.

Texas Parks and Wildlife has a web site describing wetland functions and values.

http://www.tpwd.state.tx.us/wetlands/ecology/functions_values.htm

Activity 6 – What Could Happen Here?

In this activity students explore how climate change might affect plants and animals of the Gulf Coast region. Teachers can choose a local ecosystem—such as a lake, wetland, or forest near their school—or a specific natural area of significance, such as a wildlife refuge, or state or national park (e.g. one of the case study areas highlighted in the report). If possible, the activity should be accompanied by a field trip, so that students have a better understanding of the ecological characteristics of the study area. As an alternative, a visit to a managed ecosystem such as a managed forest, aquaculture facility, or farm is an opportunity for students to consider the vulnerability of economic activities to climate and land use changes.

Several Texas sites would serve as good case studies for detailed analysis of climate change impacts.

- Aransas National Wildlife Refuge – winter home for the endangered whooping crane.
<http://southwest.fws.gov/refuges/texas/aransas.html>
- Attwater Prairie Chicken National Wildlife Refuge
<http://southwest.fws.gov/refuges/texas/apc.html>
- Big Thicket National Preserve – an area of coastal prairies and forests that serve as habitat for several endangered bird species, also threatened by invasive species.
<http://www.nps.gov/bith/>
- Laguna Madre – a hypersaline lagoon providing nursery grounds for commercially-important fisheries and several rare and endangered species.
<http://www.tpwd.state.tx.us/consERVE/tXgEmS/lAgmAdR/lAgmAdR.htm>

Additional resources for important plant and animal species

Texas Wildlife Department

<http://www.tpwd.state.tx.us/nature/nature.htm>

Texas WetNet – photographs and descriptions of Texas wetland native species.

<http://www.glo.state.tx.us/wetnet/>

Texas Threatened and Endangered Species List

<http://www.tpwd.state.tx.us/nature/endang/>

US Fish and Wildlife Service Region 2 includes Texas: <http://southwest.fws.gov/>

Endangered species lists by county for Texas can be accessed from

<http://southwest.fws.gov/consERVE2.html>

Activity 9 – Reducing Our Impact on the Global Environment

For this activity students research possible solutions to reduce the amount of greenhouse gases emitted into the atmosphere and thus slow global warming. The emphasis is that global problems need local solutions and activities, and that individual actions do matter.

A number of organizations and city governments are working to promote energy conservation in Texas. One of the best web sites for educators and students is InfinitePower, <http://www.infinitepower.org/>, an education program of the Texas State Energy Conservation Office. The site focuses on renewable energy, providing lesson plans and fact sheets about wind, solar, biomass, and geothermal energy. Descriptions of ongoing wind power and solar power projects in Texas are available.

Energy Market Map – shows major Texas cities participating in the Clean Cities program.

http://www.eia.doe.gov/emeu/reps/states/maps/w_g_c.html

Texas State Energy Conservation Office lists contact information for clean city programs.

http://www.seco.cpa.state.tx.us/Alt_cc.htm

Clean Cities Program Home Page

<http://www.cities.doe.gov/>

The US Department of Energy provides information on renewable energy resources available in Texas and links to additional resources.

http://www.eren.doe.gov/state_energy/mystate.cfm?state=tx

Texas State Energy Conservation Office

<http://www.seco.cpa.state.tx.us/>

Texas citizens groups promoting action on air quality and global warming

Sustainable Energy and Economic Development (SEED) Coalition

<http://www.seedcoalition.org/>

Texas Public Citizen

<http://www.citizen.org/texas/>

CoolTexas

<http://www.cooltexas.net/>

Texas Campaign for the Environment

<http://www.texasenvironment.org/>

Ties to Texas Learning Standards

SCIENCE

Activity	Biology	Environmental systems			Geology, meteorology, oceanography		
	Conc. 12	Conc. 4	Conc. 5	Conc. 8	Conc. 10	Conc. 12	Conc. 13
1				√			
2						√	√
3		√	√		√		√
4	√	√	√		√		
5	√	√	√	√	√		
6	√	√	√	√	√		
7			√	√			
8				√			
9							
10			√	√			

Biology

Concept 12. The student knows that interdependence and interactions occur within an ecosystem

Environmental systems

Concept 4. The student knows the relationships of biotic and abiotic factors within habitats, ecosystems, and biomes (A, B, C, D, E)

Concept 5. The student knows the interrelationships among the resources within the local environmental system (C, E, F)

Concept 8. The student knows that environments change (A, B)

Geology, meteorology, oceanography

Concept 10. The student knows the interactions that occur in a watershed (B)

Concept 12. The student knows the characteristics of the atmosphere (C)

Concept 13. The students knows the role of energy in governing weather and climate (A, B, C)

Reference: Texas Administrative Code (TAC), Title 19, Part II, Chapter 112. Texas Essential Knowledge and Skills for Science.

<http://www.tea.state.tx.us/teks/>

Texas Learning Standards (continued)

SOCIAL STUDIES

Activity	History	Geography			Economics	Citizenship	Science, technology, and society		Social Studies skills		
	2	4	8	9	12	15	19	20	21	22	23
1						√	√	√	√	√	
2			√			√	√	√	√	√	
3			√	√			√			√	
4		√	√	√					√	√	
5	√	√	√		√				√	√	
6			√				√		√	√	
7							√		√	√	
8							√			√	
9					√	√	√	√	√	√	√
10					√	√	√		√	√	√

World Geography Studies

(2) History. The student understands how people, places, and environments have changed over time and the effects of these changes on history (A)

(4) Geography. The student understands the patterns and characteristics of major landforms, climates, and ecosystems of Earth and the interrelated processes that produce them (A,C)

(8) Geography. The student understands how people, places, and environments are connected and interdependent (A,B,C)

(9) Geography. The student understands the concept of region as an area of Earth's surface with unifying geographic characteristics.

(12) Economics. The student understands the economic importance of, and issues related to, the location and management of key natural resources (C)

(15) Citizenship. The student understands how different points of view influence the development of public policies and decision-making processes on local, state, national, and international levels (A,C)

(19) Science, technology, and society. The student understands the impact of technology and human modifications on the physical environment (A,B)

(20) Science, technology, and society. The student understands how technology affects definitions of, access to, and use of resources (B)

(21) Social studies skills. The student applies critical-thinking skills to organize and use information acquired from a variety of sources including electronic technology (A,C,E)

(22) Social studies skills. The student communicates in written, oral, and visual forms

(23) Social studies skills. The student uses problem-solving and decision-making skills, working independently and with others, in a variety of settings (A,C,D)

Reference: Texas Administrative Code (TAC), Title 19, Part II, Chapter 113. Texas Essential Knowledge and Skills for Social Studies.

<http://www.tea.state.tx.us/teks/>