



## Mississippi 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 spanning the region from the southern tip of Texas to the Florida Keys. Mississippi lies in the central subregion of the Gulf Coast Region and has a warm temperate and humid climate. Against a backdrop of significant variability over the past century, Mississippi 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, a northward shift in the freeze line, and changes in precipitation, with a likelihood of less rainfall and reduced soil moisture along the Mississippi coast.

The activities in the curriculum guide can easily be adapted to focus on specific ecosystems and places in Mississippi. Changes in precipitation will impact Mississippi's forestry, aquaculture, and agriculture, while a decrease in runoff along the coast could threaten the water quality of bays and estuaries important to the state's fishing industry. Faster sea-level rise will increase coastal erosion and threats from flooding and storms to infrastructure supporting industry, recreation, and tourism.

Internet resources for Mississippi natural areas, state agencies, and non-profit organizations provide background information for student research.

### Mississippi 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 Mississippi, see <http://newslink.org/msnews.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](http://www.theadvocate.com/news/global_warming.asp)

Web sites for some Mississippi newspapers:

Biloxi Sun-Herald: [www.sunherald.com](http://www.sunherald.com)

Jackson Clarion-Ledger: [www.clarionledger.com](http://www.clarionledger.com)

Another potential source for news items is NASA's Stennis Space Flight Center, where some global change and earth system science research is conducted. News releases can be accessed from their home page.

<http://www.ssc.nasa.gov/>

## 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.

Motor vehicle statistics for Mississippi are available from the Mississippi State Tax Commission. As of November 2001, passenger car and pick-up truck registrations (not including specialized plates) totaled 1,843,445.

<http://www.mstc.state.ms.us/mvl/stats/main.htm>

Mississippi Energy Data – provides additional information on Mississippi's energy consumption.

[http://www.eia.doe.gov/emeu/states/main\\_ms.html](http://www.eia.doe.gov/emeu/states/main_ms.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. Mississippi'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. Some websites for Mississippi maps are

Mississippi Maps at University of Texas-Austin Map Library

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

Mississippi Historical Maps

<http://alabamamaps.ua.edu/historicalmaps/mississippi/index.html>

Several examples of interconnections that may be less familiar to students can be found on "The Energy Market Map-East South Central," which shows electric transmission lines, gas pipelines, and ports.

[http://www.eia.doe.gov/emeu/reps/states/maps/e\\_s\\_c.html](http://www.eia.doe.gov/emeu/reps/states/maps/e_s_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 Home

In this activity students develop their knowledge of the plants, animals, and physical processes characteristic of Gulf Coast regional 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 (<http://www.epa.gov/gmpo/gem2.html>) is the best resource for quick access to regional natural areas. If the teacher chooses to focus on Mississippi ecosystems, there are several web resources specific to Mississippi that are appropriate starting points, or are useful for more extensive student research.

##### Mississippi Natural Areas

Mississippi GEMS sites are described at the Mississippi Department of Marine resources web site. The descriptions include habitat types and unique characteristics.

<http://www.dmr.state.ms.us/Coastal%20Ecology/Gems/Gems%20Home.htm>

University of Southern Mississippi Gulf Coast Research Institute

[www.cms.usm.edu/gindex.htm](http://www.cms.usm.edu/gindex.htm)

Mississippi Natural Heritage Program – an online database of ecological communities, and plant and animal species of Mississippi.

<http://www.mdwfp.com/museum/html/heritage/heritage.asp>

Central Gulf Ecosystem – an overview of this ecosystem, which includes eastern Mississippi, most of Alabama and a small portion of southeast Louisiana.

<http://ecosystems.southeast.fws.gov/centralgulfeco.html>

Descriptions of the habitats at Mississippi Sandhill Crane National Wildlife Refuge— wet pine savannas, forested swamp, pine scrub and tidal marsh.

<http://mississippisandhillcrane.fws.gov/>

Mississippi State Parks

<http://www.mdwfp.com/parks.asp>

Nature Conservancy of Mississippi – descriptions of their preserves.

<http://nature.org/wherework/northamerica/states/mississippi/preserves/>

Mississippi National Wildlife Refuges

<http://southeast.fws.gov/maps/ms.html>

Mobile Bay National Estuary Program

<http://www.mobilebaynep.com/>

## Mississippi Climate

Mississippi Annual Precipitation Map

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

Mississippi State Climatologist Office

<http://www.msstate.edu/dept/GeoSciences/climate/index.html>

Southern Regional Climate Center (Temperature and Precipitation Summaries)

<http://www.SRCc.lsu.edu/index.html>

Environmental Protection Agency (EPA) Global Warming Impacts on Mississippi

<http://www.epa.gov/globalwarming/impacts/stateimp/mississippi/index.html>

## Other

EPA Mississippi State Atlas

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

Mississippi Wildlife Federation

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

Mississippi Forestry Association

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

Mississippi Audubon Society

<http://www.audubon.org/chapter/ms/ms/>

Ecosystems and Management Challenges

<http://www.epa.gov/region4/topics/ecosystems/index.html>

## **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 Mississippi GEMS website provides descriptions of the ecological functions of the 3 GEMS sites.

<http://www.dmr.state.ms.us/Coastal%20Ecology/Gems/Gems%20Home.htm>

Mississippi-Alabama Sea Grant

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

Mississippi Natural Resources Conservation Service

<http://www.ms.nrcs.usda.gov/>

Mississippi Department of Agriculture and Commerce  
<http://www.mdac.state.ms.us>

Mississippi Department of Marine Resources  
<http://www.dmr.state.ms.us/>

Mississippi Department of Wildlife, Fisheries, and Parks  
<http://www.mdwfp.com/>

Mississippi Soil and Water Conservation Commission  
<http://www.mswcc.state.ms.us/>

The web site of the Mobile Bay Estuary Program includes a description of the services and values of estuaries to the state of Alabama.

<http://www.mobilebaynep.com/estuaryworth.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. 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 natural areas in or near Mississippi would serve as good case studies for detailed analysis of climate change impacts.

- Gulf Islands National Seashore – a mosaic of barrier beaches, coastal marshes, and maritime forests that includes nesting areas for loggerhead turtles.  
<http://www.nps.gov/guis/GuisHome.htm>
- Mississippi Sandhill Crane National Wildlife Refuge  
<http://mississippisandhillcrane.fws.gov/>
- Ship Island Coastal Preserve  
<http://www.dmr.state.ms.us/Coastal%20Ecology/Gems/Ship%20Island.htm>
- Mississippi State Parks  
<http://www.mdwfp.com/parks.asp>

- National Wildlife Refuges in Mississippi  
<http://southeast.fws.gov/publications/pubref.html>

Additional resources for important plant and animal species:

US Fish and Wildlife Service Region 4 includes Mississippi.  
<http://southeast.fws.gov/>

Endangered species lists by county for Mississippi can be accessed from  
[http://ecos.fws.gov/webpage/webpage\\_usa\\_lists.html?state=MS](http://ecos.fws.gov/webpage/webpage_usa_lists.html?state=MS)

### **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.

The US Department of Energy provides information on current renewable energy projects in Mississippi and links to additional resources.  
[http://www.eren.doe.gov/state\\_energy/mystate.cfm?state=ms](http://www.eren.doe.gov/state_energy/mystate.cfm?state=ms)

### **Activity 10 – Reducing Our Impact on the Local Environment**

This activity and its extensions emphasize that climate change will amplify our present use of land, water and air resources. Students should be aware of the complexity of environmental issues—a result of the complex interactions within ecosystems, and between nature and humanity.

Mississippi organizations focusing on environmental issues:

Mississippi Department of Environmental Quality  
<http://www.deq.state.ms.us/>

Environmental Coalition of Mississippi  
e-mail: [ecomms@aol.com](mailto:ecomms@aol.com)

Forest and Wildlife Research Center  
<http://www.cfr.msstate.edu/index.html>

J.L. Scott Marine Education Center and Aquarium  
<http://www.aquarium.usm.edu/>

Mississippi Audubon Society  
<http://www.msaudubon.com>

Mississippi Biomass Energy Council

[http://www.mississippi.org/programs/energy/biomass\\_council.htm](http://www.mississippi.org/programs/energy/biomass_council.htm)

Mississippi Ducks Unlimited

<http://www.ducommunity.org>

Mississippi Natural Heritage Program

<http://www.natureserve.org/nhp/us/ms/>

Mississippi Wildlife Federation

<http://www.mswildlife.org>

Mississippi-Alabama Sea Grant Consortium

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

Nature Conservancy - Mississippi Field Office

<http://nature.org/states/mississippi/>

## Ties to Mississippi Learning Standards

### SCIENCE

Activity	Biology I	Biology II	Environmental Science			Earth Science		
	7	4	2	3	5	8	9	10
1					√	√		
2					√	√		
3	√				√		√	√
4	√		√	√				√
5	√				√			
6	√	√	√	√	√			
7	√	√	√	√	√			
8					√			
9					√			
10					√			

### COMPETENCIES and OBJECTIVES

#### Biology I

Comp.7. Investigate the interdependence and interactions that occur within an ecosystem  
 - Examine long and short-term changes to the environment as a result of natural events and human actions

#### Biology II

Comp.4. Investigate the role that natural selection plays in maintaining diversity  
 - Predict the successes and failures of a population when exposed to changing environmental factors  
 - Examine the factors that affect populations, such as distribution, competition, migration, isolation, and disease

#### Environmental Science

Comp.2. Explain the flow of matter and energy in ecosystems  
 - Investigate the role of biotic and abiotic factors within habitats, ecosystems, and biomes  
 - Identify indigenous plants and animals and their roles in different ecosystems

Comp.3. Describe the relationships and changes within an ecosystem  
 - Evaluate the effects of biotic and abiotic factors on local ecosystems and biomes

Comp.5. Summarize the interrelationships among the resources and human activities in the local environment

- Evaluate the impact of human activity and technology on the lithosphere, hydrosphere, and atmosphere
- Identify the effects of pollution (water, noise, air, etc.) on the ecosystem

### **Earth Science**

Comp.8. Describe the composition of the atmosphere

- Investigate the different layers of the atmosphere
- Research the greenhouse effect as it relates to the atmosphere

Comp.9. Describe the processes involved in weather and climate

- Compare and contrast the terms weather and climate
- Research the circulation of the atmosphere

Comp.10. Describe the process of the water cycle

## Mississippi Learning Standards (continued)

### SOCIAL STUDIES

Activity	Intro to World Geography			Advanced World Geography				Future Studies		Local Resource Studies	
	2	3	5	1	2	3	5	1	3	1	2
1		√						√			
2		√									
3	√	√	√	√	√		√	√	√		√
4	√		√	√	√	√	√	√	√	√	
5	√	√	√		√	√	√	√	√	√	√
6	√	√	√			√	√	√	√		
7	√										
8	√							√			
9		√									
10		√				√					

### COMPETENCIES AND OBJECTIVES

#### Introduction to World Geography

Comp.2. Distinguish the physical and human characteristics of places on Earth.

- a. Define terms used to describe physical characteristics of places associated with the lithosphere, hydrosphere, atmosphere, biosphere, and natural processes.
- c. Describe relationships among natural processes (e.g., control of erosion, etc.).
- d. Cite examples of how places can be changed as a result of natural process (e.g., catastrophic events, etc.).

Comp.3. Assess how people interact with, adapt to, and modify the environment.

- a. Identify why people interact with the environment.
- b. Illustrate how people interact with the environment.
- c. Cite examples of ways people use natural environments to extract needed resources, grow crops, and create settlements.
- d. Describe how the human ability to modify physical environments and create cultural landscapes has increased in scope and intensity through the use of technology.

Comp.5. Relate how regions are formed and changed.

- c. Cite examples of regions of varying scale (e.g., local, national, global).
- d. Explain how regions may be defined by cultural or physical features or by a combination of both.
- e. Examine factors that may influence change in regions (e.g., migration and technology).

## **Advanced World Geography**

1. Describe the relationship among people, places, and environments by mapping information about them.
  - a. Use maps and other geographic tools to acquire, process, and report information.
  - c. Analyze the spatial organization of people, places, and environments on the Earth's surface.
2. Recognize that the identities and lives of people and individuals are rooted in particular places and regions.
  - a. Identify human and physical characteristics of places.
  - d. Discuss how culture and experience influence people's perceptions of places and regions.
3. Explain how physical processes shape Earth's surface and interact with plant and animal life.
  - b. Explain how ecosystems are created, sustained, and modified.
5. Evaluate how the physical environment is modified by human activities.
  - a. Cite examples of how human activities affect physical systems.
  - b. Describe the ways in which human societies value and use Earth's natural resources.

## **Future Studies**

1. Examine the interrelatedness of history, geography, economics, and government in evolving societal systems and structures.
  - c. Analyze positive and negative consequences resulting from projected human alterations to the environment (e.g., destruction of the rain forests, use of pesticides on crops, draining of wetlands for construction of malls, parking lots, etc.).
3. Demonstrate the ability to use social studies tools
  - a. Use a variety of maps to locate places, regions, and topographical features of predicted future societies

## **Local Resource Studies**

1. Explain how geography, economics, and politics have influenced the use of natural resources in Mississippi.
  - c. Trace the development and use of natural resources in the state and local area.
2. Describe the geographic significance of natural resources.
  - a. Describe the geographic aspects of natural resources (e.g., location, impact on the region, etc.).