Atchafalaya
NATIONAL HERITAGE AREA

Natural Resources:
Habitat and Environment
Education Resource

Atchafalaya National Heritage Area Habitat and Environment
www.atchafalaya.org
© 2012

Developed by the Education staff of Lieutenant Governor Jay Dardenne and the Department of Culture, Recreation and Tourism

For more information, please contact

Richard Hartley
Special Projects Director
Office of the Lieutenant Governor
rhartley@crt.la.gov

Debra Credeur
Atchafalaya National Heritage Area Director
Dept. of Culture, Recreation and Tourism
dcredeur@crt.la.gov

Lieutenant Governor Jay Dardenne
Our country’s landscape is rich and mysterious. It is filled with twisting bayous, backwater lakes, vast marshes, and America’s largest river swamp. We have fields of sugar cane and cotton, ancient live oaks and towering cypress. Alligators, raccoons, and even bears roam our lands while 270 species of birds take to our skies. From our waters come catfish, shrimp, and the crawfish that make us so well known.

From this bounty, our country has created food unique to the entire world. Our cuisine is an intricate mixture of European as well as African and Native American descent using ingredients such as roux, picante, the trinity – onion, bell pepper and celery, filé, and tasso. We eat boudin, gumbo, étouffée, and gateau sirop.

With food comes celebration. Our country’s musicians have inspired the world of rock and roll, country, gospel and rockabilly. Our native music is a complex melding of culture to create the Cajun rhythm and the staccato of zydeco. We use the frottoir and the accordion, the triangle and the fiddle. We dance the two-step, the waltz, and the jig.

The music and food are emblems of our country’s rich culture. From the Diaspora of L’Acadie in Canada and colonial French influence comes our French speaking tradition. This melded with our deep Native American and African American roots created our Cajun dialect. Ours is a history of man and nature in an often-foreboding and always majestic environment. Our history and culture remain intact and we celebrate it with a joie de vivre unmatched in other lands. Our country is vast and varied but we share the story of water and swamp, man and survival around the river we call the Atchafalaya, still traveling our waters as did our forebears.

We invite you to journey through our country and explore our mysterious landscape, dine on our rich cuisine, celebrate with our music, and immerse yourself in our culture. Our country requires no passport, because our country is right here in America.

The Atchafalaya National Heritage Area,
America’s Foreign Country

A partnership with
The National Park Service
www.nps.gov/index.htm
A national heritage area is a nationally distinctive landscape shaped by natural, cultural, historic and recreational resources that is recognized by the U.S. Congress. A heritage area tells a nationally important story through its geography, its manmade structures and the traditions that have evolved within its landscape.

Since 1984, Congress has created forty-nine national heritage areas, stretching from the Essex National Heritage Area in Massachusetts to the newly designated Kenai Mountain-Turnagain Arm National Heritage Area in Alaska.

Louisiana has two national heritage areas, the Cane River National Heritage Area and the Atchafalaya National Heritage Area.

Atchafalaya National Heritage Area

"Atchafalaya" is an American Indian word meaning “long river.” The Atchafalaya Basin and region is among the most culturally rich and ecologically varied regions in the United States. It is home to the widely recognized Cajun culture as well as a diverse population of European, African, Caribbean and Native American descent.

Within the Atchafalaya, a penchant for adventure, adaptation, ingenuity, and exploitation has created a unique cultural legacy. Atchafalaya National Heritage Area (AHNA) is a national treasure of history, culture, and nature in south central Louisiana. This region is one of the most complex and least understood places in Louisiana and the nation. Yet, the stories of the Atchafalaya National Heritage Area are emblematic of the broader American experience. Here there are opportunities to understand and witness the complicated, sometimes harmonious, sometimes adversarial interplay between nature and culture.

The Atchafalaya National Heritage Area was designated on October 6, 2006 by the National Heritage Act of 2006. The ANHA stretches across 14 parishes in south-central Louisiana: Ascension, Assumption, Avoyelles, Concordia, East and West Baton Rouge, Iberia, Iberville, Lafayette, Pointe Coupee, St. Landry, St. Martin, St. Mary and Terrebonne.

The National Heritage Act of 2006 gave the existing Atchafalaya Trace Commission, an agency of the Louisiana Department of Culture, Recreation and Tourism under the Office of the Lieutenant Governor, the authority to oversee the development of a federal management plan and to coordinate the implementation of its recommendations. The Commission is composed of 14 members appointed by the governing authority of each parish within the heritage area, with terms not to exceed three years.
Atchafalaya National Heritage Area

Natural Resources: Habitat and Environment

Overview .................................................................................................................. 6

Content

Geology, Physiography, and Soils .............................................................................. 6
Floodplains ................................................................................................................ 8
Wetlands .................................................................................................................... 9
Water ......................................................................................................................... 9
Vegetation ............................................................................................................... 11
Wildlife .................................................................................................................... 13
Threats to Resources .............................................................................................. 20
Conservation of Resources ...................................................................................... 21

Classroom Lessons and Projects

Introduction to Wetlands .......................................................................................... 23
Soil Lessons ............................................................................................................. 27
Wetland Food Web ................................................................................................. 37
Water Cycle Lesson ................................................................................................. 49
Invasive Species Project ........................................................................................... 59

Reference

Atchafalaya National Heritage Area
MANAGEMENT PLAN / ENVIRONMENTAL ASSESSMENT
Vol. II SEPTEMBER 2011
Atchafalaya National Heritage Area
Natural Resources
Habitat and Environment

OVERVIEW

The Atchafalaya region contains the largest river swamp in the United States. The Atchafalaya swamp is a maze of streams and bayous and was once thickly forested with cypress and tupelo trees. The Basin provides habitat for a diverse array of wildlife, including the American bald eagle and Louisiana black bear. The area is home to more than 85 species of fish, crawfish, and other crustaceans; many migratory waterfowl; forest-dwelling mammals (such as deer, squirrel, and beaver); and other commercially important furbearers.

Well over 270 species of birds—some of them endangered—have been recorded in the Basin and its surrounding natural areas. The Basin forms part of the Mississippi Valley Flyway for migratory waterfowl and is a major wintering ground for thousands of these geese and ducks. In general, the Atchafalaya Basin has a significant proportion of North America’s breeding wading birds, such as herons, egrets, ibises, and spoonbills.

Natural resources in the Atchafalaya National Heritage Area have attracted attention for centuries and have supported subsistence, transportation/navigation, and commercial uses. Native Americans, early settlers, railroaders, road builders, loggers, and oil and gas explorers have all used the region. Cypress and other hardwood forests provided building material and fuel for fireplaces. Water resources provided transport. The fertile soils made good cropland.

The Atchafalaya Basin is managed by the U.S. Army Corps of Engineers (USACE) mainly for flood control and has been described as the largest managed floodway in the world. Because of the long history of artificial levee construction on the lower Mississippi, the Atchafalaya River is the only remaining distributary (i.e., a waterway which removes water from a river) above the mouth of the Mississippi. Based on discharge volume, it is also one of the largest rivers in the United States. The Atchafalaya is a highly dynamic hydrologic and geomorphic system and has one of the few remaining actively accreting delta regions within the United States.

Plant and animal habitat types include riparian zones, agricultural fields, mowed lawns, cypress swamps, hardwood forests, marshes and wetlands, and developed areas.

GEOLOGY, PHYSIOGRAPHY, AND SOILS

Geology and Physiography

The creation of the Atchafalaya Basin and River occurred during the geologic epoch known as the Holocene, about 12,000 of years ago; the Basin illustrates sedimentation and erosional processes on a continental and regional scale. Louisiana is within the Gulf Coastal Plain and is at the end of the extensive Mississippi River system, which drains more than 40 percent of the continental United States. The Atchafalaya National Heritage Area is within the Greater Atchafalaya Region. Eight of the fourteen parishes are within the Atchafalaya Basin (Assumption, Avoyelles, Iberia, Iberville, Pointe Coupée, St. Landry, St. Martin, and St. Mary), and the other six (Ascension, Concordia, East Baton Rouge, West Baton Rouge, Lafayette, and Terrebonne) are directly adjacent to the Basin.
Table 1. Geologic Map of Louisiana

OVERVIEW
The Atchafalaya region contains the largest river swamp in the United States. The Atchafalaya swamp is a maze of streams and bayous and was once thickly forested with cypress and tupelo trees. The Basin provides habitat for a diverse array of wildlife, including the American bald eagle and Louisiana black bear. The area is home to more than 85 species of fish, crawfish, and other crustaceans; many migratory waterfowl; forest-dwelling mammals (such as deer, squirrel, and beaver); and other commercially important furbearers. Well over 270 species of birds—some of them endangered—have been recorded in the Basin and its surrounding natural areas. The Basin forms part of the Mississippi Valley Flyway for migratory waterfowl and is a major wintering ground for thousands of these geese and ducks. In general, the Atchafalaya Basin has a significant proportion of North America’s breeding wading birds, such as herons, egrets, ibises, and spoonbills.

Natural resources in the Atchafalaya National Heritage Area have attracted attention for centuries and have supported subsistence, transportation/navigation, and commercial uses. Native Americans, early settlers, railroaders, road builders, loggers, and oil and gas explorers have all used the region. Cypress and other hardwood forests provided building material and fuel for fireplaces. Water resources provided transport. The fertile soils made good cropland.

The Atchafalaya Basin is managed by the U.S. Army Corps of Engineers (USACE) mainly for flood control and has been described as the largest managed floodway in the world. Because of the long history of artificial levee construction on the lower Mississippi, the Atchafalaya River is the only remaining distributary (i.e., a waterway which removes water from a river) above the mouth of the Mississippi. Based on discharge volume, it is also one of the largest rivers in the United States. The Atchafalaya is a highly dynamic hydrologic and geomorphic system and has one of the few remaining actively accreting delta regions within the United States.

Plant and animal habitat types include riparian zones, agricultural fields, mowed lawns, cypress swamps, hardwood forests, marshes and wetlands, and developed areas.

Geology and Physiography
The creation of the Atchafalaya Basin and River occurred during the geologic epoch known as the Holocene, about 12,000 of years ago; the Basin illustrates sedimentation and erosional processes on a continental and regional scale. Louisiana is within the Gulf Coastal Plain and is at the end of the extensive Mississippi River system, which drains more than 40 percent of the continental United States. The Atchafalaya National Heritage Area is within the Greater Atchafalaya Region. Eight of the fourteen parishes are within the Atchafalaya Basin (Assumption, Avoyelles, Iberia, Iberville, Pointe Coupée, St. Landry, St. Martin, and St. Mary), and the other six (Ascension, Concordia, East Baton Rouge, West Baton Rouge, Lafayette, and Terrebonne) are directly adjacent to the Basin.
Soils

According to the Natural Resources Conservation Service, soils within the heritage area are generally very thick, alluvial materials such as clays, silt loams, and mucks that are rich in organic matter, are poorly drained, and are highly susceptible to flooding and water erosion. Table 1 on page 7 is a generalized geologic map of Louisiana and shows Holocene alluvium as the predominant deposit in the heritage area, followed by Pleistocene terraces and coastal marshes. Erosive forces cause significant, sometimes dramatic, and long-lasting changes in physiography that include land accretion in some areas and delta erosion and land subsidence in other areas.

Precipitation rates are much greater than evaporation; this creates very high soil moisture conditions throughout the year, which encourages plant growth. Modification by use or development causes loss of soils. This soil damage is quick to heal because of the amount of precipitation and steady plant growth.

Silt loams in the heritage area are very deep, poorly drained, slowly permeable soils. The parent material is loess or loess-like with low sand content. Typical landforms where this soil is found are stream terraces and floodplains within the coastal plain landscape, with slopes from 0-1 percent. These soils are mainly found in pastures, cultivated areas, or woodlands. Vegetation is predominantly forest species such as water oak, sweetgum, and American elm. (NRCS 2010a)

Clays in the heritage area are very deep, very poorly drained, impermeable soils. The parent material is typically clayey alluvium. Clays are found in meander scars on alluvial plains, and in ponded backswamp areas within the coastal plain landscape, with slopes generally less than 1 percent. These soils are mainly used for growing timber and for wildlife habitat. Vegetation is predominantly bald cypress, water tupelo, and red maple. (NRCS 2010a)

Mucks in the heritage area are very deep, very poorly drained soils that have very low permeability. They are continuously saturated and flooded. The parent material is generally highly decomposed organic deposits derived from woody materials. Typical landforms where this soil is found are freshwater swamps on broad floodplains within the coastal plain landscape, with slopes at 0-1 percent. These soils are mainly kept as forested areas and used as wildlife habitat. Vegetation includes red maple, sweetgum, swamp chestnut oak, water oak, sweet bay (swamp magnolia), ferns, sedges, grasses and mosses. (NRCS 2010a)

FLOODPLAINS

The Atchafalaya National Heritage Area lies within the 100- to 500-year floodplain. At its heart is the Atchafalaya Basin, with its primary purpose as navigation and flood control. The Atchafalaya and Mississippi rivers are levied and have interior drainage systems and diversion channels.

With respect to cubic-feet-per-second discharge, the Atchafalaya River ranks among the top five rivers in the United States. It consists of three floodways: the Morganza Floodway, the West Atchafalaya Floodway, and the Atchafalaya Basin Floodway. The river’s average annual flow is 180,000 cubic feet per second and the projected flood flow is 1.5 million cubic feet per second. The Atchafalaya Basin is an important component of the USACE Mississippi River and Tributaries Flood Control Project. The Atchafalaya Basin Floodway is designed to contain 1.5 million cubic feet of water in flood conditions (Cajun Coast 2010).
There is currently only one dam on the Atchafalaya River—the “Old River Control Structure” is operated by the U.S. Army Corps of Engineers, and it is located at river mile 315 (315 miles from the Gulf of Mexico), approximately at the juncture of Concordia, Pointe Coupée, and West Feliciana Parishes. There are no dams in the lower portion of the Mississippi River.

Floodplains are threatened by the elimination of wetlands due to commercial and residential development and road construction. The loss of wetlands in floodplains means the loss of buffers from hurricanes and storm surges. Development removes vegetation and either removes or compacts the soil; along with paving, this creates an impermeable surface. The more impermeable surface that exists, the more flooding that will occur due to the lack of soil or vegetation resources to absorb the water, thus reducing the functional value of the floodplain.

**WETLANDS**

Louisiana contains 40 percent of the nation’s coastal wetlands and marshes. The Atchafalaya Basin contains the most extensive overflow riverine wetland and includes the largest contiguous wetland forest in the United States. The Basin includes ten distinct aquatic and terrestrial habitats ranging from large rivers to backwater swamps (Cajun Coast 2010).

Wetlands within the heritage area are either seasonally or permanently flooded, and are dominated by palustrine forest, palustrine scrub/shrub, palustrine emergent, estuarine scrub/shrub, and estuarine emergent vegetation communities (LA DNR 2009b).

These wetlands provide important habitat for crawfish and fish; wading birds and waterfowl; alligators and other reptiles and amphibians; and white-tailed deer, muskrat, otter, and other mammals, all of which are an important economic resource for area residents. The wetlands also provide an important natural buffer for flood control from heavy rains and hurricanes, as they retain and slow rapidly moving floodwaters.

Every year, 25 to 35 square miles of wetlands are lost in the United States, with Louisiana bearing 60-80 percent of the overall loss. Wetlands are threatened by hydrologic alterations such as in-filling for development; drainage for development and farming; dredging and channelization for navigation and flood control; diking and damming, flow diversion, and the addition of impervious surfaces; pollution from agricultural, industrial, and urban runoff; air pollution from vehicles and factories; toxic effluent from landfills, boat activities, and oil drilling; and damage to vegetation by grazing, logging, the introduction of nonnative species, and peat mining (EPA 2001).

**WATER**

**Water Resources**

The heritage area’s main surface water resources are the Mississippi and Atchafalaya rivers, which drain about 41 percent of the conterminous United States, including all or part of 30 states. The Mississippi River Basin, including its distributary (the Atchafalaya River), is the largest river basin in North America and the third largest in the world (USGS 2000).

The Mississippi River runs parallel to the Atchafalaya, bordering or flowing through several parishes within the heritage area. These parishes include Concordia, Pointe Coupée, East Baton Rouge, West Baton Rouge, Iberville, Ascension, and Assumption. The Atchafalaya River begins at the
confluence of the Red and Mississippi rivers at approximately the juncture of Concordia, Pointe Coupée, and West Feliciana Parishes. In addition to the Atchafalaya and Mississippi rivers, the heritage area contains many thousands of acres of braided streams that are part of the Atchafalaya Basin’s vast distributary network. The Atchafalaya Basin contains over 400,000 acres of low-current water bodies including extensive swamps, freshwater marshes, shallow lakes, dead-end canals, and borrow pits. These aquatic communities are in a dynamic state, affected by annual spring floods, sedimentation, regional subsidence, and water management projects. They are exceptionally productive, primarily due to the annual cycle of flooding and dewatering, and the extraordinarily rich nutrient load carried by the river.

The heritage area’s water resources are managed by a number of different federal and state entities including the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. Geological Survey, Louisiana Department of Natural Resources and Louisiana Lands Office.

Water Quality

The water quality in the Atchafalaya Basin is generally in good condition and continually improving. This determination is based on the level of nitrates and organic nitrogen (dissolved and particulate), dissolved oxygen (DO), and species composition. Issues generally affecting water quality in the heritage area include siltation, agricultural runoff, and impaired water movement.

Nitrates from fertilizers and mineralized soil nitrogen, animal manure, atmospheric deposition, groundwater, soil erosion, urban runoff, and municipal and industrial point sources contribute to the development of temporary hypoxic conditions. Hypoxia occurs when concentrations of dissolved oxygen decrease to less than 2 mg/L, which can cause stress or death in aquatic organisms and generates algal blooms such as those seen in the Gulf of Mexico in the hypoxic zone. This zone is where the Mississippi and Atchafalaya River basins discharge into the Gulf of Mexico (USGS 2000).

According to the U.S. Geological Survey, nitrogen concentrations in the Mississippi River basin have tripled since the late 1950s from a six-fold increase in commercial fertilizer and soil mineralization. There is year-to-year variability in the amount of nitrate transported through the Basin into the Gulf, based on the amount of precipitation and the amount of soluble nitrate stored in soil and groundwater systems. In dry years, the nitrate flux is low; in wet years, it is high (USGS 2000).

From October 1, 2007 to September 30, 2008, the U.S. Army Corps of Engineers, with the U.S. Geological Survey, performed monitoring and analysis of water quality and fish communities at 40 sites within the Henderson Lake Management Area in the Atchafalaya Basin. During the 12 month period, 19 percent of the surface DO samples were hypoxic and the average DO for all sites in the area was 0.23 mg/L. Fish abundance sampling identified 13 genera, a total of 101 individuals, at an estimated rate of 0.67 individuals per minute, which had not changed significantly since the previous year (USACE 2009).

The management implications from the 2007-2008 U.S. Army Corps of Engineers and U.S. Geological Survey water quality and fish community analysis state that the hydrographic variability in the Atchafalaya Basin can affect the magnitude and number of incidences of hypoxia. Flushing pulses of water—especially water resources that are high in dissolved oxygen—can help the Basin recover from periods of hypoxia and may possibly decrease or prevent widespread fish kills (USACE 2009).
Under the USACE Mississippi Rivers and Tributaries project, many improvements and flood control measures within the Atchafalaya River Basin have been authorized and constructed. The project directs half of the flow from the Old River, at the top of the Basin down the Atchafalaya Basin Floodway, and the other half down the Mississippi River (USACE 2010).

As part of the Mississippi River and tributaries projects, from Old River to the Wax Lake Outlet, the following projects, improvements, and flood control measures are in place: the Atchafalaya Basin Floodway System, low sill control structures, overbank control structures, auxiliary control structures, hydroelectric power plant, navigation locks, levees, bank stabilization programs, rehabilitation programs, gated- control structures, drainage structures, landside drainage improvements (such as borrow pit enlargements, drainage canals, bayou enlargements, culverts, and diversion channels and control structures), dredging, floodgates, locks, and the Wax Lake Outlet. (USACE, no date on document, received March 9, 2010)

The negative effects of these flood control measures include sedimentation, disrupted natural flows, shoreline erosion, wetland loss, land accretion, and possible detrimental impacts on fish and other wildlife species.

Water quality in the heritage area is continually threatened by the disruption of natural flows due to river control methods and structures; erosion hastened by the dredging of canals for navigation and oil and gas pipelines; and pollution from municipal, industrial and agricultural runoff (National Audubon Society 2010a).

Overall, the system is very productive, the resources respond favorably to the natural cycles. The system is, however, not without its issues, especially when flood control measures area placed in a higher level of importance, over resource protection. The Louisiana Department of Natural Resources, the U.S. Army Corps of Engineers, and other state, federal, and nongovernmental agencies and organizations are working to better protect these water resources—there is a new and expanding consciousness of the need to not be so entirely driven by flood control, that the resources are simply disregarded. Now some protection efforts include activities like flushing the system if it nears hypoxic conditions, directing more flow down the Atchafalaya, bank stabilization projects, and removing old structures that are no longer in use.

It is not a perfect system; some of the current threats will likely continue, such as dredging (as this will always be a navigation canal), water diversion for flood control in major wet seasons and years, hurricanes, oil and gas pipelines, agricultural practices upstream or adjacent to the Basin, and growing urban centers attributing to runoff from the newly created impermeable surfaces. Despite these threats, the agencies and organizations mentioned above are continually working toward improvements as new data, science, techniques, technologies, and engineering advances provide more tools to improve the water quality in the Basin.

VEGETATION

The Atchafalaya River is within the Southeastern Evergreen Forest Region of the Eastern Deciduous Forest biome. It contains the largest remaining bottomland and river swamp in America, and is the largest remaining segment of what was once a 24 million acre forest that covered portions of seven states. Because of the sedimentary history of the Basin, forest types vary from continuously inundated, through seasonally inundated, to natural levee ridge forests that rarely flood. Ongoing sedimentary processes are reflected in many examples of primary succession from aquatic to terrestrial communities. South of
the Basin, the successional changes continue through various marsh types to open mudflats forming in Atchafalaya Bay. The diversity of vegetative types is a result of the dynamic nature of the Atchafalaya system. The area exhibits examples of disturbed ecology and succession as the landscape recovers from the impacts of Hurricanes Andrew, Katrina, Rita, Gustav and Ike, with Hurricanes Andrew and Ike doing the most damage in the Basin.

Vegetation Types
Moving from north to south, there are three major vegetation types in the Atchafalaya Basin Region: bottomland hardwoods, bald cypress-water tupelo swamps, and coastal marshes.

Bottomland Hardwood Forests
Bottomland hardwood forests occupy natural levees and other land built-up by sediments. Such areas are the highest and driest lands in the delta and have always been the first locations to be developed for human use. With the influx of sediments from the Red and Mississippi rivers into the Basin, most of the marshes and swamps in the northern portion have been converted to bottomland hardwood forests. Subsequently, much of this bottomland hardwood forest has been converted to agricultural fields.

The bottomland hardwood communities provide important habitat for both game and nongame species. Of particular importance are the large unfragmented forests that provide resting, feeding, and breeding areas for many species of neotropical migrant birds.

Common forest species in bottomland hardwoods include water oak (*Quercus nigra*), live oak (*Quercus virginiana*), American elm (*Ulmus americana*), sweetgum (*Liquidambar styraciflua*), hackberry (* Celtis occidentalis*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvania*), and water tupelo (*Nyssa aquatic*). Palmetto (*Sabal minor*) is frequently in the understory. The overstory on newly accreted sites are willows (*Salix spp.*) along sandbars and cottonwood (*Populus spp.*) and sycamore (*Plantanus occidentalis*) found along river banks.

Bald Cypress-Water Tupelo Swamps
Swamps are forested wetlands that occupy sites with longer hydroperiods (i.e., the amount of time each year that soils are saturated) and more water depth than bottomland hardwoods. Swamps in the region are typically dominated by bald cypress (*Taxodium distichum*) and water tupelo in association with black willow (*Salix nigra*), red maple, and green ash.

Coastal Marshes
The predominant species in freshwater include bulltongue (*Sagittaria falcate*), softstem bulrush (*Scirpus validus*), pennywort (*Hydrocotyle bonariensis*), iris (*Iris giganticaerulea*), smartweed (*Polygonum spp.*), spikerush (*Eleocharis spp.*), and alligator weed (*Alternanthera philoxeroides*). Open water associated with freshwater marshes contain duckweed (*Lemma spp.*) and often have a dense floating mat of water hyacinth (*Eichhornia crassipes*), and exotic, invasive species. Some freshwater marshes also form floating mats, known as flotant marshes, which may support wax myrtle (*Myrica cerifera*) and other shrubs.

Non-native Invasive Plant Species
Non-native invasive species compete with native species for nutrients, habitat, and other resources important for the survival and stability of the ecosystem. The presence of invasive species can cause erosion, disturb soil properties, and disrupt ecosystem processes. For example, invasive plant species may affect wildlife populations as they have the ability to outcompete the natural species, thereby reducing vegetation important to wildlife for forage and habitat. The following table...
lists the nonnative invasive plant species found within the heritage area.

Natural vegetation in the heritage area is threatened by commercial and residential development; logging; road construction; extraction industries, including oil exploration and production; the introduction and proliferation of nonnative invasive species; flood control measures leading to erosion and inundation of brackish water; and natural phenomenon (flooding, hurricanes, etc.)

**WILDLIFE**

The Atchafalaya Basin represents the largest remnant of the Mississippi River alluvial floodplain forest. It contains the largest population of the original flora and fauna of the Mississippi alluvial ecosystem. The abundant water and variable sedimentary terrain of the Basin have resulted in a diversity of highly productive terrestrial and aquatic habitats. An exceptionally rich assemblage of fish and wildlife occurs, including game mammals, furbearers, and over 100 species of fish, crawfish, crab, and shrimp.

**Reptiles**

The American alligator (*Alligator mississippiensis*) is designated as the Louisiana state reptile. It generally inhabits freshwater rivers, lakes, swamps, and marshes throughout the national heritage area. The American alligator was once listed as endangered; it was nearly extinct throughout most of its range from overhunting until fully recovered in 1987. Currently, the American alligator is listed as “threatened due to similarity of appearance,” as it resembles several species of threatened or endangered crocodiles and caimans.

(USFWS 2008) The main threats to American alligators are habitat loss and encounters with humans. Monitoring, hunting prohibitions, harvest regulations and legal trade continue to protect the American alligator.

**Birds**

According to the National Audubon Society, over 270 bird species can be found in the Basin, including many birds of prey, globally significant numbers of wood storks, and world-famous numbers of American woodcock. The Basin offers prime wintering habitat for birds of the Mississippi Flyway and provides important breeding habitat for several species on the Audubon Watch List (a list for species whose declining status merits close scrutiny). Rookeries can be found within the Basin that include the continent’s largest population of breeding heron, ibis, and egret (National Audubon 2010b and Cajun Coast 2010).

---

**Table 2. Non-native Invasive Plant Species**

<table>
<thead>
<tr>
<th><strong>Terrestrial Plants</strong></th>
<th>Chinese tallow (<em>Sapium sebiferum</em>), cogon grass (<em>Imperata cylindrica</em>), purple loosestrife (<em>Lythrum salicaria</em>), catclaw vine (<em>Macfadyena unguis-cati</em>), and privet hedge (<em>Ligustrum spp.</em>)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aquatic Plants</strong></td>
<td>Alligator weed (<em>Alternanthera philoxeroides</em>), Brazilian waterweed (<em>Egeria densa</em>), common salvinia (<em>Salvinia minima</em>), giant salvinia (<em>Salvinia molesta</em>), Eurasian watermilfoil (<em>Myriophyllum spicatum</em>), parrot feather (<em>Myriophyllum aquaticum</em>), hydrilla (<em>Hydrilla verticillata</em>), water lettuce (<em>Pistia stratiotes</em>), water hyacinth (<em>Eichhornia crassipes</em>), and wild taro (<em>Colocasia esculenta</em>)</td>
</tr>
</tbody>
</table>
**Table 3. Non-native Invasive Species**

<table>
<thead>
<tr>
<th>Mammals</th>
<th>Nutria (<em>Myocaster coypus</em>), Norway rat (<em>Rattus norvegicus</em>), and feral hogs (<em>Sus scrofa</em>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds</td>
<td>Monk parakeet (<em>Myiopsitta monachus</em>), European starling (<em>Sturnus vulgaris</em>), and cattle egret (<em>Bubulcus ibis</em>)</td>
</tr>
<tr>
<td>Fish</td>
<td>Bighead carp (<em>Hypophthalmichthys nobilis</em>), black carp (<em>Mylopharyngodon piceus</em>), common carp (<em>Cyprinus carpio</em>), grass carp (<em>Ctenopharyngodon idella</em>), silver carp (<em>Hypophthalmichthys molitrix</em>), Rio Grande cichlid (<em>Cichlasoma cyanoguttatum</em>), and tilapia (<em>Tilapia</em>)</td>
</tr>
<tr>
<td>Mollusks</td>
<td>Asian clam (<em>Corbula fluminea</em>), brown mussel (<em>Perna perna</em>), apple snails (<em>Pomacea spp.</em>), green mussel (<em>Perna viridis</em>), and zebra mussel (<em>Dreissena polymorpha</em>)</td>
</tr>
<tr>
<td>Reptiles</td>
<td>Brown anole (<em>Anolis sagrei</em>)</td>
</tr>
<tr>
<td>Insects</td>
<td>Africanized honeybee (<em>Apis mellifera scutellata</em>), Asian tiger mosquito (<em>Aedes albopictus</em>), formosan termite (<em>Coptotermes formosanus</em>), Mexican boll weevil (<em>Anthonomus grandis</em>), and red imported fire ant (<em>Solenopsis invicta</em>)</td>
</tr>
<tr>
<td>Other</td>
<td>Australian spotted jellyfish (<em>Phyllophora punctata</em>), Chinese mitten crab (<em>Eriocheir sinensis</em>), daphnia (<em>Daphnia</em>), and green crab (<em>Carcinus maenas</em>)</td>
</tr>
</tbody>
</table>

**Non-native Invasive Species**

Nonnative invasive species compete with native species for nutrients, habitat, and other resources important for the survival and stability of the ecosystem. The presence of invasive species can cause erosion, disturb soil properties, and disrupt ecosystem processes. Invasive plant species also affect wildlife populations as they outcompete and reduce native vegetation important to wildlife populations for forage and habitat. The following table lists the various nonnative invasive species found in the heritage area.

Threats to wildlife include loss of habitat due to commercial and residential development, road construction, encounters with automobiles, competition with nonnative invasive species, disturbances in mating and feeding due to harassment by people, and loss of or changes in habitat due to natural occurrences such as floods and hurricanes.

**Threatened and Endangered Species**

The 14 parishes of the Atchafalaya National Heritage Area is home to 24 federal- and state-listed threatened or endangered species, or species of concern, and three state-listed special status species (restricted or prohibited harvest).

**Louisiana Black Bear**

The largest remaining population of Louisiana black bear (*Ursus americanus luteolus*) (federally and state listed as threatened) is found in the Atchafalaya Basin. The U.S. Fish and Wildlife Service has designated areas of critical habitat for the Louisiana black bear in the Tensas River and Upper and Lower Atchafalaya River Basins of the Lower Mississippi River Alluvial Valley in Louisiana. Of the 15 parishes included within the critical habitat designation, seven are within the national heritage area boundary. They are Avoyelles, Concordia, Iberia, Iberville, Pointe Coupee, St. Martin, and St. Mary (*USFWS 2010a*).

Threats to the Louisiana black bear’s survival include habitat loss and fragmentation of forested habitat from logging and development, and other human-related mortality such as...
poaching and collisions with automobiles (USFWS 2010a).

**Birds**

The Atchafalaya Basin provides important habitat for eleven bird species that are currently on the WatchList maintained by the National Audubon Society and Partners in Flight. (WatchList species are common bird species that are in decline due to environmental challenges and therefore are in need of immediate conservation help.) The WatchList species identified in the Atchafalaya Basin are the wood thrush (*Hylocichla mustelina*), prothonotary warbler (*Protonotaria citrea*), Swainson’s warbler (*Limnothlypis swainsonii*), Kentucky warbler (*Oporornis formosus*), painted bunting (*Passerina ciris*), summer tanager (*Piranga rubra*), indigo bunting (*Passerina cyanea*), great crested flycatcher (*Myiarchus crinitus*), eastern tufted titmouse (*Baeolophus bicolor*), Carolina chickadee (*Poecile carolinensis*), and the Carolina wren (*Thryothorus ludovicianus*) (National Audubon Society 2010b).

The State of Louisiana identifies eight bird species as threatened or endangered, six of which are also listed as either threatened, endangered, or species of concern by the USFWS. The table on the next page shows the state and federally listed bird species.

---

### Table 4. Threatened, Endangered, or Species of Concern: Other Mammals

<table>
<thead>
<tr>
<th>Species</th>
<th>Federal Status</th>
<th>State Status</th>
<th>Location(s)</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finback whale (<em>Balaenoptera physalus</em>)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Coastal parishes</td>
<td>Development, habitat destruction, and ship collisions. (Whale Center of New England, 2010)</td>
</tr>
<tr>
<td>Humpback whale (<em>Megaptera novaeangliae</em>)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Coastal parishes</td>
<td>Entanglements in fishing gear, collisions with ship traffic, and pollution/habitat destruction of their coastal habitat from human uses. (Whale Center of New England, 2010)</td>
</tr>
<tr>
<td>West Indian Manatee (<em>Trichechus manatus</em>)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Ascension, East Baton Rouge, Iberia, St. Mary, Terrebonne</td>
<td>Collisions with boats; loss of warm water habitat; loss of natural springs from increasing demands on water usage from development pressure; crushing by flood gates and canal locks; fishing lines and trash; natural events (unusually cold winters, red tide blooms); harassment by divers, fishermen, and boaters interrupting feeding and breeding (USFWS, 2010b)</td>
</tr>
<tr>
<td>Species</td>
<td>Federal Status</td>
<td>State Status</td>
<td>Location(s)</td>
<td>Threats</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>--------------</td>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td>Bachman’s warbler <em>(Vermivora bachmanii)</em></td>
<td>Endangered</td>
<td>Endangered (considered extinct or nearly extinct)</td>
<td>Unknown</td>
<td>Alteration or loss of breeding and wintering habitat due to logging, vegetation removal, urbanization, and other land clearing events; hurricanes; lack of known migratory habitat or vegetation associations hampers effective management and protection; a large historic breeding range and low populations makes finding mates difficult for successful reproduction. (USFWS 2010c)</td>
</tr>
<tr>
<td>Bald Eagle <em>(Haliaeetus leucocephalus)</em></td>
<td>Delisted</td>
<td>Endangered</td>
<td>Ascension, Assumption, Avoyelles, Concordia, East Baton Rouge, Iberia, Iberville, Pointe Coupée, St. Landry, St. Martin, St. Mary, Terrebonne, and West Baton Rouge Parishes</td>
<td>Habitat loss, pollution and chemicals such as mercury, persistent organic chemicals and heavy metals (NWF 2010)</td>
</tr>
<tr>
<td>Black-capped vireo <em>(Vireo atricapilla)</em></td>
<td>Endangered</td>
<td>Endangered</td>
<td>Statewide</td>
<td>Threatened by brown-headed cowbird <em>(Molothrus ater)</em> nest parasitism, human disturbance, and loss of habitat to urbanization, fire exclusion, grazing, and brush control. (USFWS 2010d)</td>
</tr>
<tr>
<td>Brown pelican <em>(Pelecanus occidentalis)</em></td>
<td>Delisted</td>
<td>Endangered</td>
<td>Terrebonne, St. Mary, and Iberia Parishes</td>
<td>People, pollution, and ground nests are disturbed by natural events (hurricanes, floods, etc.) (USFWS 2009)</td>
</tr>
<tr>
<td>Ivory-billed woodpecker <em>(Campephilus principalis)</em></td>
<td>Endangered</td>
<td>Endangered (considered extinct or nearly extinct)</td>
<td>Unknown</td>
<td>Loss of habitat, encroachment/urbanization, and pesticides; hurricanes, drought, and beetle outbreaks contributing to habitat loss. (Defenders of Wildlife 2010a)</td>
</tr>
<tr>
<td>Least tern <em>(Sterna antillarum)</em></td>
<td>Endangered</td>
<td>Endangered</td>
<td>Concordia Parish</td>
<td>Decline of natural habitat by the flooding of nesting sites caused by dam construction and channelization; brush and tree overgrowth subtract from remaining nesting areas; increase in recreational use of sandbars is a major threat to the terns reproductive success; people</td>
</tr>
<tr>
<td>Species</td>
<td>Federal Status</td>
<td>State Status</td>
<td>Location(s)</td>
<td>Threats</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------------</td>
<td>--------------</td>
<td>----------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bachman's warbler (Vermivora bachmanii)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Unknown</td>
<td>Alteration or loss of breeding and wintering habitat due to logging, vegetation removal, urbanization, and other land clearing events; hurricanes; lack of known migratory habitat or vegetation associations hampers effective management and protection; a large historic breeding range and low populations makes finding mates difficult for successful reproduction. (USFWS 2010c)</td>
</tr>
<tr>
<td>Bald Eagle (Haliaeetus leucocephalus)</td>
<td>Delisted</td>
<td>Endangered</td>
<td>Ascension, Assumption, Avoyelles, Concordia, East Baton Rouge, Iberia, Iberville, Pointe Coupée, St. Landry, St. Martin, St. Mary, Terrebonne, and West Baton Rouge Parishes</td>
<td>Habitat loss, pollution and chemicals such as mercury, persistent organic chemicals and heavy metals (NWF 2010)</td>
</tr>
<tr>
<td>Black-capped vireo (Vireo atricapilla)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Statewide</td>
<td>Threatened by brown-headed cowbird (Molothrus ater) nest parasitism, human disturbance, and loss of habitat to urbanization, fire exclusion, grazing, and brush control. (USFWS 2010d)</td>
</tr>
<tr>
<td>Brown pelican (Pelecanus occidentalis)</td>
<td>Delisted</td>
<td>Endangered</td>
<td>Terrebonne, St. Mary, and Iberia Parishes</td>
<td>People, pollution, and ground nests are disturbed by natural events (hurricanes, floods, etc.) (USFWS 2009)</td>
</tr>
<tr>
<td>Ivory-billed woodpecker (Campephilus principalis)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Unknown</td>
<td>Loss of habitat, encroachment/urbanization, and pesticides; hurricanes, drought, and beetle outbreaks contributing to habitat loss. (Defenders of Wildlife 2010a)</td>
</tr>
<tr>
<td>Least tern (Sterna antillarum)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Concordia Parish</td>
<td>Decline of natural habitat by the flooding of nesting sites caused by dam construction and channelization; brush and tree overgrowth subtract from remaining nesting areas; increase in recreational use of sandbars is a major threat to the terns reproductive success; people disrupt breeding by harvesting eggs, inadvertently destroying nests and killing eggs or chicks by stepping on them or by running them over with off-road vehicles; jet skis causing increased turbidity in shallow waters may also decrease tern foraging success (Bentz 1998).</td>
</tr>
</tbody>
</table>

Table 5, Continued. Threatened, Endangered, or Species of Concern: Birds

**Peregrine falcon (Falco peregrines)**
- **Species of Concern**
- **Threatened/Endangered**
- **Terrebonne Parish**
- People have posed the greatest threat by shooting, taking of eggs and young, poisoning, and habitat destruction. Predators such as raccoons and great-horned owls occasionally take eggs or chicks from the nests. (USFWS 2010e)

**Piping plover (Charadrius melodus)**
- **Threatened**
- **Threatened**
- **Known to occur in Louisiana (St. Mary and Terrebonne Parishes within the NHA)**
- Habitat destruction, human disturbance, and predation continue to be the primary threats to Piping Plovers. Nests and young can be destroyed by unrestricted off-road vehicles, beach-goers, and unleashed pets. Inland plover populations can be threatened by water management practices on river systems; the release of water from dammed areas may flood nests and young and the redistribution of water during drought periods may disrupt nesting and feeding. (National Audubon Society 2010c)
### Table 6. Threatened, Endangered, or Species of Concern: Fish, Reptiles, Amphibians, and Invertebrates

<table>
<thead>
<tr>
<th>Species</th>
<th>Federal Status</th>
<th>State Status</th>
<th>Location(s)</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama heelsplitter (<em>Potamilus inflatus</em>)</td>
<td>Threatened</td>
<td>Threatened</td>
<td>Ascension and East Baton Rouge Parishes</td>
<td>Destruction of habitat (deforestation, riparian zone destruction) by siltation, dredging, channelization, impoundments, and pollution. Causes of decline in some species may be due to the loss of host fish needed to complete their metamorphosis. Zebra mussels have also had a serious impact on indigenous mussel species in some areas. (USACE 2005)</td>
</tr>
<tr>
<td>Alligator snapping turtle (<em>Macrolemys temminckii</em>)</td>
<td>Unlisted</td>
<td>Restricted Harvest</td>
<td>Avoyelles, Concordia, Iberia, and St. Landry Parishes</td>
<td>Loss of native habitat due to commercial and agricultural development of former bottomland hardwood forest and associated freshwater streams, as well as river and bankside modifications that alter or eliminate crucial nesting sites; over-collection of live adult turtles from the wild for human consumption and for export of live animals destined for the pet trade (USFWS 2005).</td>
</tr>
<tr>
<td>Diamondback terrapin (<em>Malaclemys terrapin</em>)</td>
<td>Unlisted</td>
<td>Restricted Harvest</td>
<td>Terrebonne Parish</td>
<td>Habitat destruction, road construction and drowning in crab traps. (Defenders of Wildlife 2010b)</td>
</tr>
<tr>
<td>Fat pocketbook (<em>Potamilus capax</em>)</td>
<td>Endangered</td>
<td>Unlisted</td>
<td>Concordia Parish</td>
<td>Impoundments and dredging for navigation, irrigation and flood control have altered or destroyed much of this mussel’s habitat, silting up gravel and sand habitat and probably affecting the distribution of its fish hosts. Other threats include pollution from agricultural and industrial runoff. These chemicals and toxic metals become concentrated in the body tissues, eventually poisoning it to death. (USFWS 2010f)</td>
</tr>
<tr>
<td>Green sea turtle (<em>Chelonia mydas</em>)</td>
<td>Threatened</td>
<td>Threatened</td>
<td>Iberia, St. Mary, and Terrebonne Parishes</td>
<td>Destruction and alteration of nesting and foraging habitats; incidental capture in commercial and recreational fisheries; entanglement in marine debris; and vessel strikes (NMFS 2010)</td>
</tr>
</tbody>
</table>
Table 6, Continued. Threatened, Endangered, or Species of Concern: Fish, Reptiles, Amphibians, and Invertebrates

<table>
<thead>
<tr>
<th>Species</th>
<th>Federal Status</th>
<th>State Status</th>
<th>Location(s)</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gulf sturgeon (Acipenser oxyrinchus desotoi)</td>
<td>Threatened</td>
<td>Threatened</td>
<td>Ascension, East Baton Rouge, Iberia, Iberville, St. Mary, and Terrebonne Parishes</td>
<td>Habitat loss was exacerbated by the construction of water control structures, such as dams and &quot;sills,&quot; mostly after 1950; habitat disturbances such as dredging, groundwater extraction, irrigation, and flow alterations; and poor water quality and contaminants, primarily from industrial sources. (NMFS 2010)</td>
</tr>
<tr>
<td>Hawksbill sea turtle (Eretmochelys imbricata)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Iberia, St. Mary, and Terrebonne Parishes</td>
<td>Destruction and alteration of nesting and foraging habitats; incidental capture in commercial and recreational fisheries; entanglement in marine debris; and vessel strikes (NMFS 2010)</td>
</tr>
<tr>
<td>Kemp’s ridley sea turtle (Lepidochelys kempii)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Statewide (Iberia, St. Mary, and Terrebonne Parishes within the NHA)</td>
<td>Destruction and alteration of nesting and foraging habitats; incidental capture in commercial and recreational fisheries; entanglement in marine debris; and vessel strikes (NMFS 2010)</td>
</tr>
<tr>
<td>Leatherback sea turtle (Dermochelys coriacea)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Iberia, St. Mary, and Terrebonne Parishes</td>
<td>Destruction and alteration of nesting and foraging habitats; incidental capture in commercial and recreational fisheries; entanglement in marine debris; and vessel strikes (NMFS 2010)</td>
</tr>
<tr>
<td>Loggerhead sea turtle (Caretta caretta)</td>
<td>Threatened</td>
<td>Threatened</td>
<td>Iberia, St. Mary, and Terrebonne Parishes</td>
<td>Destruction and alteration of nesting and foraging habitats; incidental capture in commercial and recreational fisheries; entanglement in marine debris; and vessel strikes (NMFS 2010)</td>
</tr>
<tr>
<td>Paddlefish (Polyodon spathula)</td>
<td>Unlisted</td>
<td>Prohibited</td>
<td>Avoyelles, Concordia, Iberia, St. Martin, and St. Mary Parishes</td>
<td>Loss of spawning and rearing habitat from dam construction, altered water flow and eliminated backwaters; pollution from industrial contaminants, illegal fishing, and overexploitation by commercial and recreational fishermen. (USFWS 2001)</td>
</tr>
</tbody>
</table>
Table 6, Continued. Threatened, Endangered, or Species of Concern: Fish, Reptiles.

<table>
<thead>
<tr>
<th>Species</th>
<th>Federal Status</th>
<th>State Status</th>
<th>Location(s)</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smalltooth sawfish (Pristis pectinata)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Statewide</td>
<td>Extreme vulnerability to overexploitation because of their propensity for entanglement in nets, their restricted habitat, and low rate of population growth; caught and killed as bycatch in various fisheries, especially in gill nets; and the loss of juvenile habitat (such as mangrove forests) due to development. (NMFS 2010)</td>
</tr>
<tr>
<td>Pallid sturgeon (Scaphirhynchus albus)</td>
<td>Endangered</td>
<td>Endangered</td>
<td>Ascension, Avoyelles, Concordia, East Baton Rouge, Iberia, Iberville, Pointe Coupee, St. Landry, St. Martin, St. Mary, and West Baton Rouge Parishes</td>
<td>Habitat loss through river channelization and dams (USFWS 2006)</td>
</tr>
</tbody>
</table>

**THREATS TO RESOURCES**

**Climate Change**

The Atchafalaya National Heritage area has a humid, subtropical climate, with long, hot summers and short, mild winters. In the summer the average daily maximum temperature is 91°F. Humidity averages from 63 percent to 89 percent annually. Rainfall averages 51.7 inches annually. In the winter, the average daily minimum temperature is 40°F. The area is vulnerable to tropical cyclones, hurricanes, flooding, and frequent thunderstorms. How the climate might change in the region is not completely understood at this time, nor is the rate of potential change.

Climate change has the potential to adversely affect the future resource conditions of the Atchafalaya National Heritage Area. As global and regional climates continue to change, a management approach that enhances the protection and resiliency of climate-sensitive resources is becoming increasingly important. The following section outlines a strategy that adapts to our growing understanding of climate change influences and the effectiveness of management to contend with them.

Climate change science is a rapidly advancing field, and new information is continually being collected and released; yet the full extent of climate change impacts on resource conditions is unknown. As such, park managers and policy makers have not determined the most effective response mechanisms for minimizing impacts and adapting to change. Because of this, this proposed management strategy does not provide definitive solutions or directions; rather it provides science-based management principles to consider when
implementing the broader management direction of the preferred alternative. Implementation of projects or programs to address climate change and associated impacts would be undertaken through partnerships.

**Development and Urbanization**

Development and urbanization are a threat well beyond the geographic boundary of the 14 parishes of the heritage area. The Atchafalaya River is a major distributary of the Mississippi River and therefore, development and urbanization upstream has the potential to negatively impact resources in the heritage area. These impacts include changes in sedimentation and deposition rates, pollution from upstream agriculture and urban areas and changes in hydrology including increase in flood pulse due to increased impervious cover and channelization.

Within the heritage area, urbanization and development pose a threat to cultural, historic, and natural resources. This threat is due to the likelihood of continued patterns of low-density, sprawling development. These patterns replace natural resources with human development and have the potential to adversely impact cultural and historic resources.

The conversion of natural areas to urbanized or developed areas poses a number of threats to heritage area resources. The following list is not exhaustive. Development in many of the heritage area parishes, particularly in the southern parishes, has the potential to lead to wetland reduction and/or loss of ecological services wetlands provide. Wetlands perform many beneficial functions, such as sediment and toxicant retention, flood flow alteration, and habitat for animals and plants, among others.

- Development and urbanization has the potential to lead to discontinuous, fragmented habitats for wildlife.
- Conversion from agricultural uses to urban land uses has the potential to threaten traditional cultural landscapes, traditional foodways, and the supply of locally grown food.
- The conversion of pervious surfaces to impervious surfaces has the potential to increase urban storm water problems and negatively affect water quality and the life that depends on clean water.
- Development in the form of increased transportation structure, particularly car based infrastructure, has the potential to reduce air quality. Air quality is not solely a localized phenomenon, and development and urbanization outside the heritage area can affect its resources.

**CONSERVATION OF NATURAL RESOURCES**

Conservation efforts are ongoing in the area including threatened and endangered species such as the ivory billed and red cockaded woodpeckers, the Louisiana black bear, Louisiana pearl shell (mussel), sea turtles, gopher tortoise, ringed sawback turtle, brown pelican, bald eagle, peregrine falcon, whooping crane, Eskimo curlew, piping plover, interior least tern, Bachman’s warbler, West Indian manatee, Florida panther, pallid sturgeon, gulf sturgeon, Attwater’s greater prairie chicken, whales and red wolf. Also important in conservation efforts are cypress forest and native vegetation. Audubon Society Coastal Initiative, Louisiana Wildlife Federation, Sierra Club, Friends of Atchafalaya, Atchafalaya Basinkeeper, Louisiana Black Bear Coalition and Barataria – Terrebonne National Estuary Program are but a few of the organizations that share the heritage area’s mission in conserving and protecting the resources.
What are Wetlands?

Natural wetlands are bridges between land (terrestrial) and water (aquatic) ecosystems. Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods during the year, including during the growing season. Wetland soils are wet, low in oxygen, and often black.

Why Are Wetlands Important?

Wetlands have many important functions that benefit people and wildlife. They are popular recreation areas for fishing, canoeing, hiking, and bird watching and are home to diverse species of wildlife and plants. Wetlands clean and purify the water we drink, and the air we breathe. They act as a filter for our lakes, rivers, and streams by absorbing sediments and pollutants, such as sewage and industrial waste. Wetland plants remove phosphates and other plant nutrients from surrounding soil. This reduces the growth of aquatic weeds that can rob the wetland plants and animals of the resources they need. Wetland plants also help control water erosion.

Wetlands serve as water storage basins, collecting rain and floodwater and then slowly releasing the water into lakes, streams, ground water, and the atmosphere during drier periods.
What are Wetlands?

Natural wetlands are bridges between land (terrestrial) and water (aquatic) ecosystems. Wetlands are areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods during the year, including during the growing season. Wetland soils are wet, low in oxygen, and often black.

Why Are Wetlands Important?

Wetlands have many important functions that benefit people and wildlife. They are popular recreation areas for fishing, canoeing, hiking, and bird watching and are home to diverse species of wildlife and plants.

Wetlands clean and purify the water we drink, and the air we breathe. They act as a filter for our lakes, rivers, and streams by absorbing sediments and pollutants, such as sewage and industrial waste. Wetland plants remove phosphates and other plant nutrients from surrounding soil. This reduces the growth of aquatic weeds that can rob the wetland plants and animals of the resources they need. Wetland plants also help control water erosion.

Wetlands serve as water storage basins, collecting rain and floodwater and then slowly releasing the water into lakes, streams, ground water, and the atmosphere during drier periods.
During severe weather, they serve as a buffer by protecting inland areas and limiting the destruction caused by hurricane-force winds and floods. Acting like giant sponges, wetlands absorb floodwaters and keep rivers at normal levels. Trees, root mats, and other wetland vegetation slow the speed of flood waters and distribute them more slowly over the floodplain, reducing water erosion.

Often called “nurseries of life,” wetlands provide food, shelter, and other resources for a wide variety of wildlife—mammals, birds, reptiles, amphibians, fish and invertebrates like crabs, crayfish, dragonflies and mosquitoes. They provide nesting and resting sites for migrating birds as well as spawning and nursery habitat for fish. More than one-third of the United States’ threatened and endangered species live only in wetlands. Often, wetlands are the only source of food and shelter for endangered species.

Our economy depends on the wealth of natural products derived from wetlands, including fish and shellfish, blueberries, cranberries, timber, and wild rice. Wetland soils and plants are used to produce medicines. Many of the nation’s fishing and shellfishing industries harvest wetland species.

What Threats Do Wetlands Face?

When a wetland ecosystem is in balance, it improves water quality protection, serves as a fish and wildlife habitat, provides floodwater storage, and reduces storm damage and erosion. However, a threatened wetland is less able to do these things. Any change in the wetland ecosystem can significantly alter the soil chemistry and plant and animal communities. Common threats to wetlands include:

- Drainage for development, farming, and mosquito control
- Dredging streams and rivers for navigation, development, and flood control
- Building dams to form ponds and lakes
- Diverting the flow of water to or from wetlands
- Building asphalt and other hard-surface roads increase water and pollutant runoff into wetlands
- Runoff from urban, agricultural, and mining areas
- Air pollution from cars, factories, and power plants
- Old landfills and dumps that leak toxic chemicals
- Marinas, where boats release pollutants
- Grazing by domestic animals
- Introduction of nonnative plants that compete with native species
- Removal of vegetation for peat mining

What Can You Do? Get Involved!

- Find out where wetlands exist near your home, try to learn more about them, and support educational efforts
- Support community wetland protection projects
- Encourage neighbors, developers, and state and local governments to protect the function and value of wetlands in your community
- Rather than draining or filling wetlands, seek compatible uses involving minimal wetland alteration, such as waterfowl production, fur harvest, hay and forage, and wild rice production
• Don’t start development projects in wetland areas
• Learn more about wetland restoration activities in your area; seek and support opportunities to restore degraded wetlands

School Projects

• Research how to build a backyard, school yard, or community wetland garden
• Research and build a rain garden to reduce stormwater pollution
• Design and build an erosion control project for steep areas and pathways
• Identify and report threatened wetland areas in your community
• Replant a threatened wetland area with native plants to attract wildlife back to the region
• Monitor wetland birds in an area

Wetland Resources

• America’s Wetland Resource Center, http://www.americaswetlandresources.com/
• Loyola University’s Center for Environmental Communication, http://www.loyno.edu/lucec/
### Types of Louisiana Wetlands

Louisiana’s 7,000 square miles of wetlands makes up 40% of the coastal wetlands of the continental United States. The following chart provides information about the types of wetlands in Louisiana.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Plants</th>
<th>Wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Natural Levees</strong></td>
<td>High grounds that formed at the edges of rivers; sandy soil</td>
<td>Hardwoods, such as live oaks grow on land above water level</td>
<td></td>
</tr>
<tr>
<td><strong>Bottom-land Hardwoods</strong></td>
<td>Areas that occasionally flood, but are usually dry</td>
<td>Hardwoods (hackberry, elm, maple, ash, honey locust, elderberry)</td>
<td>Variety of animals</td>
</tr>
<tr>
<td><strong>Swamp</strong></td>
<td>Any place holding water and having woody vegetation</td>
<td>Cypress and Tupelogum; moss and plants that can live on exposed tree roots or on trees</td>
<td></td>
</tr>
<tr>
<td><strong>Freshwater Marsh</strong></td>
<td>Any place holding water that has non-woody vegetation growing</td>
<td>Diverse plant species (cattail, water lilies, irises, duckweed, cutgrass, wild rice, bullwhip, bulltongue)</td>
<td>Diverse (alligators, snakes, turtles, mink, raccoons, otters, nutria, egrets, herons, ducks, bass, bluegills, grass shrimp, turtles, and many insects)</td>
</tr>
<tr>
<td><strong>Intermediate Marsh</strong></td>
<td>Mild salt content; mixture of plants found in freshwater and brackish marshes</td>
<td>Fewer species; freshwater plants – cattails, cut grass, and water lilies –mixed with 3’ tall wire grass</td>
<td>Less diverse (ducks and other water birds, snakes, alligators, a few turtles, muskrats, raccoons, nutria, and other fur-bearing mammals)</td>
</tr>
<tr>
<td><strong>Brackish Marsh</strong></td>
<td>Salty water</td>
<td>Mostly wire grass</td>
<td>Few animals, blue crabs, redfish, speckled trout, fiddler crabs, stly waterfowl;</td>
</tr>
<tr>
<td><strong>Salt Marsh</strong></td>
<td>Daily salt water tides</td>
<td>Oyster grass, black mangrove</td>
<td>Periwinkles (snails), ribbed mussels, fiddler crabs, oysters, clapper rails, seaside sparrow</td>
</tr>
</tbody>
</table>
## Soil: Earth’s Buried Treasure

**Wetlands Education**

**Level:** Grades 4-12

### Students will understand that

- Different types of soil have different capacities for retaining rainwater.
- If the soil in an area will not hold enough rainwater, flooding problems will ensue.
- Soil can be tested for its water-retaining capacity.
- Water affects both the biology and chemistry of soils.
- Wetland soils differ greatly from upland soils.

### Contents

- Soil: Contents, Experiments, Engineering
- Wetland Soils

### Soil Benchmarks

**Middle School Science**

**Earth and Space Science (Structure of the Earth)**

ESS-M-A4 investigating how soils are formed from weathered rock and decomposed organic material; (2, 3, 4)

**Science and the Environment**

SE-M-A2 demonstrating an understanding of how carrying capacity and limiting factors affect plant and animal populations; (1, 2, 3, 4, 5)

SE-M-A4 understanding that human actions can create risks and consequences in the environment; (1, 2, 3, 4, 5)

SE-M-A9 demonstrating relationships of characteristics of soil types to agricultural practices and productivity; (1, 2, 3, 4, 5)

SE-M-A10 identifying types of soil erosion and preventive measures. (1, 2, 3, 4, 5)

**Science as Inquiry (The Abilities Necessary to do Scientific Inquiry)**

SI-M-A1 identifying questions that can be used to design a scientific investigation; (1, 2, 3)

SI-M-A2 designing and conducting a scientific investigation; (1, 2, 3, 4, 5)

SI-M-A3 using mathematics and appropriate tools and techniques to gather, analyze, and interpret data; (1, 2, 3, 4, 5)

SI-M-A5 developing models and predictions using the relationships between data and explanations; (1, 2, 3, 4)

SI-M-A6 comparing alternative explanations and predictions; (1, 3, 4)

### Types of Louisiana Wetlands

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Plants</th>
<th>Wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>Levees: high grounds formed at the edges of rivers; sandy soil.</td>
<td>Hardwoods, such as live oaks grow on land above water level.</td>
<td>Variety of animals</td>
</tr>
<tr>
<td>Bottom-land</td>
<td>Hardwoods: areas that occasionally flood, but are usually dry.</td>
<td>Hardwoods (hackberry, elm, maple, ash, honey locust, elderberry)</td>
<td></td>
</tr>
<tr>
<td>Swamp</td>
<td>Any place holding water and having woody vegetation.</td>
<td>Cypress and Tupelo-gum; moss and plants that can live on exposed tree roots or on trees.</td>
<td></td>
</tr>
<tr>
<td>Freshwater</td>
<td>Marsh: any place holding water that has non-woody vegetation growing.</td>
<td>Diverse plant species (cattail, water lilies, irises, duckweed, cutgrass, wild rice, bullwhip, bulltongue)</td>
<td>Diverse (alligators, snakes, turtles, mink, raccoons, otters, nutria, egrets, herons, ducks, bass, bluegills, grass shrimp, turtles, and many insects)</td>
</tr>
<tr>
<td>Intermediate</td>
<td>Marsh: mild salt content; mixture of plants found in freshwater and brackish marshes.</td>
<td>Fewer species; freshwater plants – cattails, cut grass, and water lilies – mixed with 3' tall wire grass</td>
<td>Less diverse (ducks and other water birds, snakes, alligators, a few turtles, muskrats, raccoons, nutria, and other fur-bearing mammals)</td>
</tr>
<tr>
<td>Brackish</td>
<td>Marsh: salty water</td>
<td>Mostly wire grass</td>
<td>Few animals, blue crabs, redfish, speckled trout, fiddler crabs, stly waterfowl; Salt Marsh: daily salt water tides</td>
</tr>
</tbody>
</table>
OVERVIEW

Soil, like air and water, is one of the world's most important natural resources. It has many functions such as producing food for the world's population and recycling the air, water, and nutrients we need to live.

BACKGROUND

Soil Contents

The physical character of soils is determined by the balance of clay, silt, and sand particles and by the organic humus content of the soil.

- Soil is made up of a mixture of minerals – small grains, particles, and fragments that come from the rock deposits and sediments. This gives the soil its texture and determines whether the soil is sandy, loamy, or clayey.
- Soil contains organic matter from rotted and decomposed vegetation that is broken down by soil organisms.
- Soil contains varying amounts of water and air depending on the climate and the soil’s ability to hold water.

Soil Importance

- Soil is important for growing crops, plants, and trees
- Soil is home, or habitat, for the teeming millions of soil organisms
- Soil acts like a filter removing pollution from our drinking water and helping to regulate the flow of water through the landscape. Most rainwater ends up moving into the soil before it gets to plant roots,
- Soil forms a foundation for our buildings and roads. Type of soil determines the types of buildings that can be built
Importance of Soil Structure

Soil structure is the arrangement of soil particles into various aggregate sizes and shapes. Large spaces in soils are known as macro pores and are created by plant roots, burrowing creatures, and shrinkage caused by the drying of wet soil. These macro pores are usually continuous and form “highways” for air and water to travel deep into the soil. The loss of these “highways” reduces the ability of the soil to conduct water and air. Soil structure determines

- How porous the soil is (how easy it is for air and water to pass through the soil)
- The ease with which plant roots can penetrate and grow in the soil
- The rate of water absorption in the soil
- The erosion rate
- The amount of air in the soil
- The availability of soil micro-organisms
- The level of fertility
- Soil structure supports the growth of crops
- How well soil drains to prevent or support water-logging

Importance of Soil Water

Soil water is the amount of water present in the soil and available to plants.

- Soil nutrients are dissolved by water and this aids roots absorption
- Essential for plant metabolism e.g. transpiration, photosynthesis, translocation
- Helps to protect plants from high temperature or cold temperature
- Essential for seed germination
- Helps certain soil organisms to break down plant organic matter and release plant nutrients
- Helps plant cells retain water and prevents wilting and disease
- It is essential in the weathering of rocks in the soil
- It is essential in the cultivation and improvement of soil structure
- It promotes cooling effect on crops
- Water is needed for translocation of food substances in plants

Importance of Soil Air

The air found in soil is very different from the air found in the atmosphere. The air in soils is not exposed to moving air currents and is much more moist, or humid, than atmospheric air. Soil air tends to be very rich in carbon dioxide and poor in oxygen. Living organisms remove
oxygen, and carbon dioxide is left behind. This carbon dioxide leaks out of the soil, slowly replenishing the atmosphere's carbon dioxide supplies.

- It is essential for respiration in plants
- Soil organisms require air for respiration
- Excess air can kill anaerobic soil organisms thereby reducing such organisms
- It is important for photosynthesis
- It helps in the germination of seeds
- It determines the proportion of water in the soil
- It helps in the absorption of plant nutrients
- It is important for root development
- It is essential in the nitrogen and carbon cycles
- Oxygen is necessary for growth and development
- Carbon dioxide and sulphur dioxide react with water to form weak acids that aid weathering of rocks

SOIL EXPERIMENTS

1. **Experiment: Demonstrating the Air in Soils**
   
   Materials: a can of spray polyurethane and some soil clods.
   
   - Spray the clod and wait a minute or two before dropping the clod in a jar of water. Watch the bubbles. Air will bubble from some clods for up to 20 minutes or more.
   - Soil clods from surface soils from orchards, pastures, and lawns generally will have a high soil air content and will bubble longer.
   - Soil clods from subsoils, or soils from conventionally cultivated fields will generally have lower soil air content and will bubble less.

2. **Experiment: Particle Size and Sediment Demonstration**
   
   Materials: sand, silt, clay, 2 bottles with tops, water
   
   - Add clean sand to a plastic bottle filled with water.
   - Add silt and clay to a separate bottle filled with water.
   - Sand will settle rapidly.
   - Silt and clay will settle more slowly.
   - Shake the bottles and observe how long it takes for the particles to settle.
   - Observe the difference in the clarity of the water. The water is mostly clear in the bottle with the sand.
   - Note the sediment in suspension in the water of the silt and clay bottle.
3. **Experiment: Soil and Engineering**

**Scenario**
Your group is a team of consulting engineers for a new housing development. Many community residents are protesting the development. They are saying that the soil in that area will not hold the rain and there will be flooding problems for all houses in that area. Others believe this is just an excuse to delay and block the development.

**Task**
Your team will investigate the properties of the soil in the area. You will decide if the soil will support the development and if building can begin.

**Materials**
- Three soil samples: sand, agricultural soil (potting soil), and clay
- Water
- Three measuring cups
- Funnel
- Filter paper

**Procedure**
- Divide class into small groups, distributing materials to each group.
- Students should first test each type of soil in its dry state by measuring the same amount of each soil, in turn, into a funnel lined with filter paper, and then pouring a measured amount of water through it. They should use the same amount of water for each type of soil. The water that drains through each type of soil should be collected in another measuring cup and the amount recorded.
- Students should repeat the test using the same types of soil in their saturated states.
- Discuss which soil held the most water when dry and which saturated soil held the most water. Which type of soil would be most likely to cause flooding problems?

**Assessment**
- Have each student write a lab report describing the soil tests, including an explanation of how communities and developers would use such tests.
Lab Report

Name ___________________________

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Amount of Soil</th>
<th>Amount of Water Applied</th>
<th>Runoff Amount</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sand</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potting Soil</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clay</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Overview

Soils are one of the three characteristics that distinguish wetlands from upland areas. Because wetlands are wet some or all of the year, the biological, chemical, and physical character of the soil is altered. The presence of water creates an oxygen deficiency (anoxia) so most oxygen-dependent bacteria and insects cannot survive. As a result, decomposition of organic matter, such as fallen leaves and trees, happens very slowly and such particles accumulate in the soil. Organic-rich soil is usually very black. Water-saturated conditions may also affect the soil by reducing (removing oxygen) the mineral constituents, creating grayish or blue-gray colors.

Experiment: Investigate Wetland Soils

Materials

- Shovel or trowel
- Bucket
- Plastic wrap (to wrap soil blocks)
- Large baking pans, 3 per group of students or one per soil station
- Soils data sheet

Procedure

1. Preparation: For this activity, the teacher needs to bring both wetland and upland soil samples to the classroom. Alternatively, you could have each student or groups of students bring in their own soil samples. Before removing soil, make sure you know who owns the land, and secure permission to use the area.

Common Core Standards

Science

CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

CCSS.ELA-Literacy.RST.6-8.6 Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

CCSS.ELA-Literacy.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
2. **Soil Removal**: Once you have found a location from which to obtain the soil types, remove a block of soil approximately 10” square and 10” deep. Place the soil block in a bucket. Do the same in an adjacent upland area. Cover or wrap the soils to prevent moisture loss. Use the soil immediately to prevent altering the water and air conditions of the soil.

3. **In the classroom**, set up two soil lab stations or provide two soil samples per group of students. Place each soil block in a large, flat baking pan for ease of examination. Ask students to describe any differences they see (color, smell, texture, roots, insects) and record the information on the Soil Data Sheet. Discuss possible explanations for these differences using the background information in the Soil: Contents. Experiments, Engineering lesson (page 2) as a reference.

**Extension**

Ask students to perform a percolation test. Dig identical small soil pits in different locations—sandy soils, wetland soils, upland forest, school field. Fill the pits with the same amount of water. Time how long it takes each pit to drain the water.
Soil Removal: Once you have found a location from which to obtain the soil types, remove a block of soil approximately 10” square and 10” deep. Place the soil block in a bucket. Do the same in an adjacent upland area. Cover or wrap the soils to prevent moisture loss. Use the soil immediately to prevent altering the water and air conditions of the soil.

In the classroom, set up two soil lab stations or provide two soil samples per group of students. Place each soil block in a large, flat baking pan for ease of examination. Ask students to describe any differences they see (color, smell, texture, roots, insects) and record the information on the Soil Data Sheet. Discuss possible explanations for these differences using the background information in the Soil: Contents. Experiments, Engineering lesson (page 2) as a reference.

**Extension**

Ask students to perform a percolation test. Dig identical small soil pits in different locations—sandy soils, wetland soils, upland forest, school field. Fill the pits with the same amount of water. Time how long it takes each pit to drain the water.

<table>
<thead>
<tr>
<th>Soil Characteristics</th>
<th>Station 1</th>
<th>Station 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of soil layers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Color of the soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the soil have a smell?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Texture (fine, gritty)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the soil stain your fingers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Degree of wetness (wet, damp, dry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of living organisms (insects, earth worms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presence of organics (leaves, roots, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth of plant roots</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Experiment: Comparing Wetland and Upland Soil for Growing Plants

Materials

- 6 iris bulbs (available at garden shops)
- Two small glass fish bowls or transparent plastic containers
- Gravel
- Potting soil

Procedure

1. Place about 2-3 inches of gravel in the bottom of the fishbowls for drainage. Fill the bowls with potting soil, and place three bulbs in each so they are about 3/4 covered with the potting soil. Place the bowls by a window that has access to sunlight. It is important to maintain water levels in the two bowls at different, but consistent, heights. In the wetland bowl, keep water about 1/2 inch below the bulb. In the upland bowl, keep water just above the gravel.

2. As the bulbs sprout, pay attention to the rooting patterns. The wetland bulbs should grow a shallow network of fine roots; the upland bulbs will generate deeper taproots. Why are the bulbs growing differently? Discuss the ability of plants to adapt to different environmental conditions.

Adapted from World in Our Backyard, United States Environmental Protection Agency, http://www.epa.gov/
Lesson: Atchafalaya Wetland Food Webs
Grades four through six

Overview

All life is connected in a delicate balance. An ecosystem is an area where an organism finds the food, water, shelter, and space it needs to survive. Living things perform one of three functions that maintain the health of their ecosystem—they are either producers, consumers, or decomposers. The interrelationship among organisms in these three groups forms a food web.

Students will examine the wetlands food web to understand the importance and relationship of all forms of wetlands life and the significance of maintaining a healthy wetlands environment.

Key Questions

• What is the web of life?
• Why is it important to have diversity in a wetland ecosystem?

Objectives

Students will:
• explain the difference between food webs and food chains
• identify the source of energy for life in the food web
• describe the interrelationship and importance of all forms of wetland life
• gather evidence of who eats what in the wetlands ecosystem and create examples of food webs for the wetlands environment.

Procedure

1. Introduce Food Webs. Classroom Conversation:
   Eating food gives you the energy you need to live. This energy powers everything you do from playing a favorite sport to studying for a math test or goofing around with your friends. It helps you think, makes you grow, keeps your heart beating, and it keeps the blood circulating through your body. Without energy you could not live. The same goes for every living thing on earth. Microbes, beetles, mice, hawks, flowers, fish, trees, ducks, deer... if it’s alive, it needs energy.

Common Core Standards

Science

• CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
• CCSS.ELA-Literacy.RST.6-8.6 Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
• CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
• CCSS.ELA-Literacy.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
So, where does all this energy come from? How does it get passed around to all living things? Energy passes from one animal to another as they eat plants or one another. This flow of energy from one living thing to another is called a “food chain.” Let’s take a closer look...

2. Wetlands Webbing game (40 minutes)
   - Tell students that they are going to play a game.
   - Arrange students standing in a circle. Pass out one Wetlands Food Web game card to each student and instruct him/her to wear the cards around her/his neck. Explain that each card identifies the wearer as part of a wetlands habitat.
   - Demonstrate the concept of a food chain by passing the yarn to students to make simple food chains:
     - sun—clover—seeds—grasshopper—tree frog—hawk
     - algae—crawfish—raccoon
     - clover—rabbit—hawk
   - Food Web: The teacher takes a ball of yarn and hands it to the student who is wearing the ‘sun’ card. The sun asks, "Who depends on me"? One student (only one) who answers is handed the ball of string (the 'sun' still keeps hold of the end of the string). The teacher repeats the question as the chain progresses from producer to the end of the consumer line and the string is unfurled in one continuous strand to reach the end of the food chain. Build additional food chains until all wetland players are included in the web. Eventually all the players are connected or reconnected in a giant food web.
   - Discuss how each connection relies on previous and subsequent connections.
   - Now ask one student to sit down but to keep holding the string. (Perhaps a fish has been affected by pollution or the ducks have flown off after being disturbed.) When other students feel the string pull, they also sit down. Discuss what happens to the web of life once the connections have been broken.

3. Use the following materials to complete your examination of wetlands food webs.
   - Food Chains and Food Webs Student Reading
   - Producers and Consumers Graphic
   - Food Web Vocabulary
   - Wetlands Food Web Graphic Organizer
   - Wetlands Food Web Activity

Assessment

1. Participation in Wetlands Food Web game
2. Completion of Wetlands Food Web activity

Bibliography and Resources

FOOD CHAINS AND FOOD WEBS
Student Reading

A food chain describes the series of events that happen when one organism consumes another organism to survive.

Most food chains are interconnected. Animals typically consume a varied diet and, in turn, serve as food for a variety of other creatures that prey on them. These interconnections create food webs. Cows might be food for humans, bacteria, or flies. Each of those flies might be connected to frogs, microbes, or spiders. There are dozens of connections for every organism. When you draw all of those connecting lines, you get a web-like shape.

Producers are the beginning of a simple food chain. Producers are plants and vegetables. Plants are at the beginning of every food chain that involves the Sun. All energy comes from the Sun and plants are the ones who make food with that energy. They use the process of photosynthesis. Plants also make loads of other nutrients for other organisms to eat. Photosynthesis is only the beginning of a chain of energy conversions. (Examples: algae, duckweed, grass, etc.)

Consumers are the next link in a food chain. There are three levels of consumers. The levels start with the organisms that eat plants.

1. **Primary consumers** are first group of organisms the. They are the plant eaters of the chain; they will not eat animals. They are also called herbivores. A primary consumer might be a squirrel or it might be a deer. There are many types of animals that will eat the products of the photosynthesis process (plants). Examples are deer eating shrub leaves, rabbits eating carrots, or grasshoppers eating grass. When these animals eat these plant products, food energy and organic compounds are transferred from the plants to the animals.

2. **Secondary consumers** eat the primary consumers. Secondary consumers are also called carnivores. Carnivore means "meat eater." They are also called heterotrophs because they cannot make their own food and must depend on others. A mouse might be a primary...
consumer and a cat might be the secondary. Examples might include a cat eating a mouse, a fox eating a rabbit, a frog eating a grasshopper, or a bird eating a worm.

3. In some ecosystems, there is a third level of consumer called the tertiary consumer (that means higher level). These are consumers that eat the secondary and primary consumers. A tertiary consumer could be a wolf that eats the cat and the mouse. (Quarnary consumers eat

**Decomposers** make up the last links in the food chain. This chain of energy transferring from one species to another can continue several more times, but it eventually ends. It ends with the dead plants and animals that are broken down and used as food or nutrition by bacteria and fungi. Whenever something that was alive dies, the decomposers get it. There are more than 100,000 different types of decomposer organisms! Decomposers like bacteria and fungi break down nutrients in the dead "stuff" and return it to the soil. The producers can then use the nutrients and elements once it is in the soil. The decomposers complete the system, returning simpler nutrients to the soil so they can be used again by the plants.

The energy transformation chain starts all over again. This path of food consumption is called a food chain. The concept of food chains may seem simple, but in reality it is more complex. Think about how many different kinds of animals eat grass. How many different foods does the hawk eat? One doesn't find simple independent food chains in an ecosystem, but many interdependent and complex food chains that look more like a web and are therefore called food webs.

<table>
<thead>
<tr>
<th>Grass</th>
<th>Grasshopper</th>
<th>Toad</th>
<th>Snake</th>
<th>Hawk</th>
<th>Bacteria of decay</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Autotrophs (Producers)</td>
<td>Herbivores (Primary Consumers)</td>
<td>Carnivores (Secondary, tertiary, etc. consumers)</td>
<td></td>
<td>Decomposers</td>
<td></td>
</tr>
</tbody>
</table>

**Beyond the Facts**

The source of all food is the activity of autotrophs, mainly photosynthesis by plants. Each level of consumption in a food chain is called a trophic level. The table shown above gives one example of a food chain and the trophic levels represented in it.

Source: “Interesting facts about food chains” by Jacobo Bulaevsky
FOOD WEB VOCABULARY

1. **Producers.** Organisms, such as plants, that produce their own food are called autotrophs. They use the sun’s energy to make food through the process of photosynthesis. They are called producers because all of the species of the ecosystem depend on them.

2. **Consumers.** All the organisms that can not make their own food (and need producers) are called heterotrophs. Heterotrophs are called consumers because they depend on others, and they obtain food by eating other organisms.

There are three levels of consumers:

3. **Primary Consumers.** There are different levels of consumers. Those that feed directly from producers by eating plants or plant products are called primary consumers.

4. **Secondary Consumers.** Organisms that feed on primary consumers are called secondary consumers.

5. **Tertiary Consumers.** Those organisms that feed on secondary consumers are tertiary consumers.

Consumers are also classified depending on what they eat:

6. **Herbivores.** Herbivores are those that eat only plants or plant products. Examples are grasshoppers, mice, rabbits, deer, beavers, moose, cows, sheep, goats, and groundhogs.

7. **Carnivores.** Carnivores are those that eat only other animals. Examples of carnivores are foxes, frogs, snakes, hawks, and spiders.

8. **Omnivores.** Omnivores eat both plants (acting as primary consumers) and meat (acting as secondary or tertiary consumers). Examples of omnivores are:
   - Bears -- They eat insects, fish, moose, elk, deer, sheep as well as honey, grass, and sedges.
   - Turtles -- They eat snails, crayfish, crickets, earthworms, but also lettuce, small plants, and algae.
   - Squirrels -- They eat insects, moths, bird eggs and nestling birds and also seeds, fruits, acorns, and nuts.
   - Trophic Level. The last word that is worth mentioning in this section is trophic level, which corresponds to the different levels or steps in the food chain. In other words, the producers, the consumers, and the decomposers are the main trophic levels.

9. **Food Chain.** This path of food consumption is called a food chain.

10. **Food Web.** There are many interdependent and complex food chains in an ecosystem. These interconnected food chains look like a web and are therefore called food webs.
Decomposers

Decomposers like these fungi break down plant and animal matter into nutrients. Plants use the sun, water, and nutrients in the soil to grow.
### WETLANDS FOOD WEB GAME CARDS

<table>
<thead>
<tr>
<th>SUN</th>
<th>GRASSHOPPER</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Sun" /></td>
<td><img src="image" alt="Grasshopper" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DUCKWEED</th>
<th>MALLARD DUCK</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Duckweed" /></td>
<td><img src="image" alt="Mallard Duck" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RACCOON</th>
<th>MOSQUITO</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Raccoon" /></td>
<td><img src="image" alt="Mosquito" /></td>
</tr>
<tr>
<td>ALLIGATOR</td>
<td>PEOPLE</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td><img src="image1" alt="Alligator" /></td>
<td><img src="image2" alt="People" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TADPOLE</th>
<th>CLOVER</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Tadpole" /></td>
<td><img src="image4" alt="Clover" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRAGONFLY</th>
<th>CRAWFISH</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image5" alt="Dragonfly" /></td>
<td><img src="image6" alt="Crawfish" /></td>
</tr>
</tbody>
</table>

45
DIRECTIONS

NAME

_____________________

Draw food chains to create a wetlands food web
WETLANDS FOOD WEB

DIRECTIONS

Draw food chains to create a wetlands food web

NAME

_____________________

47
SUGGESTED FOOD WEB BOOKS

What Are Food Chains and Webs? (The Science of Living Things)
By Bobby Kalman
Crabtree Publishing 2009
Ages 4-8
ISBN-10: 0778776379
Learn all about food webs and food chains. Great pictures and diagrams help to explain the interaction between various living things and their food. Easy to read text covers herbivores, carnivores and omnivores and decomposers. Read about the difference in food chains from different parts of the world.

Who Eats What? Food Chains and Food Webs
By Patricia Lauber
Collins Publishing 1994
Ages 4-8
ISBN-10: 0064451305
This is another in the series of Let's-Read-and-Find-Out Science leveled readers. A great book to have in the primary grades for explaining food chains and webs.

Shark Snacks: Food Chains and Webs
by Richard Spilsbury
Heinemann-Raintree 2005
Ages young adult
ISBN-10: 1410919730
Take a look at a food web in the ocean. Detailed photos make this book fairly graphic and more appropriate for young adult readers.

Food Chains and Webs: What Are They And How Do They Work?
by Andrew Solway
Rourke Publishing 2007
Ages 9-12
ISBN-10: 1600446019
An investigation into food chains and food webs; Learn how the food energy moves from herbivores to carnivores and then on to decomposers.

Learning About Food Chains and Food Webs with Graphic Organizers
by Julie Fiedler
Powerkids Press 2006
Ages 9-12
ISBN-10: 1404234128
Teachers will find this one to be a great addition to their classroom for the cross curricular aspects of learning about food chains and food webs.

What Is an Herbivore? (Look, Listen, Learn)
by Bobbie Kalman
Crabtree Publishing 2007
Ages 4-8
ISBN-10: 0778766662
Great text and pictures explains the herbivore to young readers. Includes a CD.

What Is an Omnivore?
by Bobbie Kalman
Crabtree Publishing 2007
Ages 9-12
ISBN-10: 0778732967
This book can cross a variety of age groups as it studies the omnivore.

What Is a Carnivore?
by Bobbie Kalman
Crabtree Publishing 2007
Ages 9-12
ISBN-10: 0778732746
Find out about predators and prey. What skills and tools does a carnivore need to hunt other animals for food?

Decomposers (Nature's Food Chain)
By Megan Lappi
Weigl Publishers 2004
Ages 9-12
ISBN-10: 159036239X
Learn how decomposers fit in to the food chain and their contributions to our environment. Find out why we could not survive without them.
Water on the Move: The Water Cycle
Level: Grades 4-12

Note to Educators
Atchafalaya wetlands play an important function in the water cycle. They store water from rain and floods, releasing it back into the air and environment. Use these activities and experiments to help students understand the water cycle and the role wetlands play in it.

Definition: Water Cycle
The water cycle is a continuous cycle in which water changes from water vapor in the atmosphere to liquid water through condensation and precipitation and then back to water vapor through evaporation, transpiration, and respiration.

Vocabulary
- Solid
- Liquid
- Gas
- Water vapor
- Water cycle
- Condensation
- Evaporation
- Precipitation
- Transpiration
- Respiration
- Collection

Common Core Standards
Science
- CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- CCSS.ELA-Literacy.RST.6-8.6 Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
- CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- CCSS.ELA-Literacy.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
Water is a clear, odorless, tasteless liquid. Water is made of two hydrogen atoms and one oxygen atom. The hydrogen and oxygen atoms attract each other because they have different electrical charges. Each hydrogen atom (H) has a positive charge (+); each oxygen atom (O) has a negative charge (−). See Figure A.

When the hydrogen and oxygen atoms attract they form a water molecule. If you look at a water molecule under a powerful microscope, you will see that each molecule looks like Figure B.

Each water molecule is like a tiny magnet, with a negative charge on one side and a positive charge on the side where the hydrogen atoms attached. Like magnets, the negatively charged side of one water molecule attracts the positive side of another water molecule. See Figure C.

**The Three States of Water**

Water molecules are the only substance on Earth that exists in all three physical states of matter: solid, liquid, and gas.

In liquid form, water has no shape; it borrows the shape of the container it occupies. Name some types of containers that will hold water. What are their shapes?

<table>
<thead>
<tr>
<th>Container</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
LIQUID

As a liquid, water molecules move freely and form in small, loosely organized groups.

Figure D shows water molecules when water is in its liquid state.

SOLID

Water becomes a solid when the temperature drops below freezing 32°F or 0°C. What do we call frozen water?

In solid form, water molecules are connected in a distinct geometric pattern.

Figure E shows water molecules in a solid state.

VAPOR

When water is heated, it becomes a vapor, or gas, and escapes into the air. The more heat that is applied to water the faster it turns into a vapor. As a gas, water molecules arrange themselves in a very loose form with few molecules bonding together.

Figure F shows water molecules in vapor form.
The Water Cycle

The sun's energy is the driving force behind the water cycle. The sun heats up water on land and where it collects in the oceans, lakes, and seas as well as under the surface of the earth (groundwater). The water changes from liquid to water vapor in a process called evaporation (Figure A). The water vapor cools and, in a process called condensation (Figure B), forms droplets in the atmosphere. These droplets become clouds. The droplets (or ice crystals if it is cold enough) gather and then fall from the sky in a process called precipitation (Figure C). Precipitation falls in the form of rain, snow, sleet, and hail. This precipitation gathers in streams and rivers where it flows and becomes runoff. Runoff flows back into the oceans, seas, and lakes and collects under the surface of the earth as groundwater.
Draw the Water Cycle

NAME ____________________________

Directions

1. Draw and label the water cycle.
2. See the Water Cycle Checklist for items to include in your picture of the water cycle.
Water Cycle Experiment
Learn how the water cycle works
Grades 4-8

Name__________________________________________

Materials
- Jar (with large opening)
- Small plant
- Bottle cap containing a piece of ice
- Soil
- Sand
- Small rocks or pebbles

Directions
Gather the materials.
1. Place the pebbles, sand, soil, plant, and bottle cap in the jar as shown in the illustration.
2. Place the lid on the jar and tighten the lid.
3. Place the jar in a sunny location.
4. Use the Lab Journal to record your observations. For Observation 1, describe the conditions in the jar after you tighten the lid.

LAB JOURNAL

Observation 1
Day/Date__________ Time__________
Notes: (Describe the conditions in the jar and the physical state of the water)

Observation 2
Day/Date__________ Time__________
Notes: (Describe the conditions in the jar and the physical state of the water)

Observation 3
Day/Date__________ Time__________
Notes: (Describe the conditions in the jar and the physical state of the water)

Observation 4
Day/Date__________ Time__________
Notes: (Describe the conditions in the jar and the physical state of the water)

Use the results of your observations to explain what you learned about the water cycle.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Atchafalaya
NATIONAL HERITAGE ASSA
Water Cycle Crossword Puzzle

Across
3. Ice crystals that fall from the sky
6. Water that has been heated to a gas
9. Frozen rain
10. A large body of water that flows across the land
12. A large body of salt water
13. The process of changing from water vapor to water droplets

Down
1. Provides the energy that drives the water cycle
2. The process of water droplets or ice crystals falling from the sky
3. A small body of water that flows across the land
4. The process of water moving through the world by precipitation, evaporation, and condensation
5. The process of water turning into a vapor
7. These form in the sky when water vapor condenses into water droplets
8. A large body of fresh water
10. Water that flows in streams and rivers into the oceans and lakes
11. Water droplets that fall from the sky
Water Cycle Benchmarks

ELEMENTARY: GRADES 2-4
Grade 2
Science: Objects in the Sky
44. Give examples of how the Sun affects Earth’s processes (e.g., weather, water cycle) (ESS-E-B5)

Grade 3
Science: Earth and Space Science: Properties of Earth Materials
48. Identify examples of the processes of a water cycle (e.g., evaporation, condensation, precipitation, collection of runoff) (ESS-E-A3)

Grade 4
Science: Earth and Space Science: Properties of Earth Materials
58. Draw, label, and explain the components of a water cycle (ESS-E-A3)

Social Studies
Environment and Society
6. Identify ways in which people in the United States depend upon and modify the physical environment (G-1D-E1)

MIDDLE: GRADES 5-8
Grade 5
Science: Transformations of Energy
12. Identify the Sun as Earth’s primary energy source and give examples (e.g., photosynthesis, water cycle) to support that conclusion (PS-M-C3)
46. Identify and explain the interaction of the processes of the water cycle (ESS-M-C6) (ESS-M-A10)

Grade 8
Science: Earth and Space Science: Structure of Earth
23. Explain the processes of evaporation, condensation, precipitation, infiltration, transpiration, and sublimation as they relate to the water cycle (ESS-M-A10)
24. Investigate and explain how given factors affect the rate of water movement in the water cycle (e.g., climate, type of rock, ground cover) (ESS-M-A10)

HIGH: GRADES 9-12
Science: Earth Science—recommended for grades 9-12
Earth and Space Science: Energy in Earth’s System
(ESS-H-A1) Describe what happens to the solar energy received by Earth every day
(ESS-H-A1) Trace the flow of heat energy through the processes in the water cycle
Project and Field Guide for Students

(Invasive Species Awareness Project)

Families - Schools - Communities
What are Invasive Species?

Invasive species are species of plants, mammals, insects, fish, etc. that have been introduced into an environment in which they did not naturally evolve. Their introduction has been both accidental and deliberate, usually through lines of trade and transportation. From places like China, Brazil, and the South Pacific, these species are "introduced" to Louisiana where they have multiplied rapidly, causing problems for local environments and economies. In general, aggressive, non-native species have no enemies or controls to limit their spread.

Why Should We Care About Invasive Species?

Some introduced species can be beneficial, such as sugarcane and cotton, Louisiana's biggest crops. Others live harmlessly beside native Louisiana species, such as azaleas and crape myrtles, our favorite ornamentals. But other introduced species—called invasive species—cause environmental problems that are expensive to solve.

Invasive species threaten not only Louisiana's economy and environment, but also its unique cultural identity in America - one based on our bayous and backswamps, our rich history and famous cuisine, and our important industries.

Purple loosestrife, for example, was introduced from Europe in the 1800's as a medicinal herb and ornamental plant. It colonizes wetland areas, replacing native plants unable to compete for available sunlight, water, and nutrients. The loss of natural plants limits the variety of food and cover available to birds, insects, and mammals and may cause them to move or disappear from a region altogether.

A National Problem

While most invasive species were introduced to the United States, some are natives in one part of the country but serious pests in another part of the country. In addition, there are problem plants that are native but interfere with farming and other economic activities. Control costs and environmental damages can add up to millions of dollars per year.

Join the Project!

The Atchafalaya National Heritage invite families, community groups, and schools to join our investigation into the invasive species that threaten our natural species. The activities in this field guide will introduce you and your family, school, or community group to the invasive species that threaten the Louisiana environment, economy, and way of life.
What are Invasive Species?

Invasive species are species of plants, mammals, insects, fish, etc. that have been introduced into an environment in which they did not naturally evolve. Their introduction has been both accidental and deliberate, usually through lines of trade and transportation.

From places like China, Brazil, and the South Pacific, these species are "introduced" to Louisiana where they have multiplied rapidly, causing problems for local environments and economies. In general, aggressive, non-native species have no enemies or controls to limit their spread.

**Why Should We Care About Invasive Species?**

Some introduced species can be beneficial, such as sugarcane and cotton, Louisiana’s biggest crops. Others live harmlessly beside native Louisiana species, such as azaleas and crape myrtles, our favorite ornamentals. But other introduced species—called invasive species—cause environmental problems that are expensive to solve.

Invasive species threaten not only Louisiana’s economy and environment, but also its unique cultural identity in America - one based on our bayous and backswamps, our rich history and famous cuisine, and our important industries.

Purple loosestrife, for example, was introduced from Europe in the 1800’s as a medicinal herb and ornamental plant. It colonizes wetland areas, replacing native plants unable to compete for available sunlight, water, and nutrients.

The loss of natural plants limits the variety of food and cover available to birds, insects, and mammals and may cause them to move or disappear from a region altogether.

**A National Problem**

While most invasive species were introduced to the United States, some are natives in one part of the country but serious pests in another part of the country. In addition, there are problem plants that are native but interfere with farming and other economic activities.

Control costs and environmental damages can add up to millions of dollars per year.

**Join the Project!**

The Atchafalaya National Heritage invite families, community groups, and schools to join our investigation into the invasive species that threaten our natural species.

The activities in this field guide will introduce you and your family, school, or community group to the invasive species that threaten the Louisiana environment, economy, and way of life.
What You Can Do:

1. Explore

Visit CBR’s website, Louisiana’s Invasive Species, http://is.cbr.tulane.edu/index.html, to discover the invasive species that threaten Louisiana.

Complete the activities in this book to develop a personal field guide complete with important information and images, about Louisiana’s invasive species.

2. Investigate

Investigate the invasive species that live in your community. Plan a field trip to a nearby park or wildlife area to look for invasive plants. Investigate the ways in which communities try to solve the problems related to invasive species.

3. Make a Difference

- Stay Involved: join organizations, attend meetings and workshops
- Plan a home, school, or community invasive species project
- Attend a workshop or lecture. Visit www.lsm.crt.state.la.us to find Museum-sponsored lectures and workshops.
- Track endangered species (FrogWatch USA)
- Visit the CBR website, http://is.cbr.tulane.edu/solutions.html, to discover solutions to invasive species problems
- Investigate, join, and support local and state restoration projects
- Join or start a community clean-up project
- Support or start a school wetland or invasive species project
- Invite experts in the field to speak to your civic, social, religious, or economic organization
- Join the Conversation! Extraordinary ideas often come from ordinary conversation. Visit LSM’s Facebook page, www.facebook.com/LaStateMuseum, to find ways you can help and to record your thoughts

Project Investigation

Questions:

1. What types of invasive species cause problems for Louisiana?
2. What impact are they having on Louisiana?
3. What solutions do communities use to address the problems caused by invasive species?

Task:

1. Use the following Internet sites to identify Louisiana’s invasive species:
   - Center for Bioenvironmental Research http://is.cbr.tulane.edu/index.html,
   - Invasive and Exotic Species, http://www.invasive.org/
   - Invasivespecies.gov http://invasivespecies.org

2. Complete your Invasive Species Field Guide by recording your findings on the following pages.
### What types of invasive terrestrial plants threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

### Terrestrial Plants

Terrestrial plants are plants that grow on land.

#### What types of invasive terrestrial plants threaten Louisiana?

- **Common Name:**
- **Scientific Name:**
- **Pathway / Media:**
- **Reason for Introduction:**
- **Preferred Habitat:**
- **Ecological / Economic Damage:**

#### Task:

1. Use the following Internet sites to identify Louisiana’s invasive species:
   - Center for Bioenvironmental Research
   - Invasive and Exotic Species
   - Invasivespecies.gov

2. Complete your Invasive Species Field Guide by recording your findings on the following pages.

#### Project Investigation Questions:

1. What types of invasive species cause problems for Louisiana?
2. What impact are they having on Louisiana?
3. What solutions do communities use to address the problems caused by invasive species?
## Aquatic Plants

*Aquatic plants are plants that grow in water or in soil that is saturated with water.*

### What types of invasive aquatic plants threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>1</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>2</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>3</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>4</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

## Insects

The members of the class Insecta have segmented (having many parts) legs and bodies; adults usually have three pairs of legs and two pairs of wings.

### What types of invasive insects threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>1</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>2</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>3</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>4</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>
Insects
The members of the class Insecta have segmented (having many parts) legs and bodies; adults usually have three pairs of legs and two pairs of wings.

What types of invasive insects threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>1</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>2</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>3</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>4</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Waterborne Species

Waterborne species travel or live in water.

## What types of invasive waterborne species threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>1</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>2</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>3</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td>4</td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

## Mammals

Warm-blooded vertebrates (having a backbone), including humans, with a covering of hair on the skin and, in the female, milk-producing mammary glands for nourishing the young.

## What types of invasive mammals threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name:</th>
<th>Sketch or glue a picture here</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Name</td>
<td></td>
</tr>
<tr>
<td>Pathway / Media:</td>
<td></td>
</tr>
<tr>
<td>Reason for Introduction:</td>
<td></td>
</tr>
<tr>
<td>Preferred Habitat:</td>
<td></td>
</tr>
<tr>
<td>Ecological / Economic Damage:</td>
<td></td>
</tr>
</tbody>
</table>

---

### Louisiana's Invasive Species Word Scramble

**Directions:**

Unscramble the words to see the names of some of Louisiana's invasive species.

1. nianas rgeti  soqtiuom __________  __________  __________
2. ncxmeia  lobl  evilew __________  __________  __________
3. seechni   lowlat  erte __________  __________  __________
4. nogoc  sgars  __________  __________
5. ligalarot  edew  __________  __________
6. antig  vinalasi  __________  __________
7. ratew  yinthhac __________  __________
8. nisaa  macl  __________  __________
9. razeb  sulems  __________  __________
10. trailnaaus depotstyellj __________  __________  __________
11. utrain   __________
12. zukud   __________
13. riydlalh   __________

**Answers:**

66
Waterborne Species

Waterborne species travel or live in water. What types of invasive waterborne species threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Pathway / Media</th>
<th>Reason for Introduction</th>
<th>Preferred Habitat</th>
<th>Ecological / Economic Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mammals

Warm-blooded vertebrates (having a backbone), including humans, with a covering of hair on the skin and, in the female, milk-producing mammary glands for nourishing the young. What types of invasive mammals threaten Louisiana?

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Pathway / Media</th>
<th>Reason for Introduction</th>
<th>Preferred Habitat</th>
<th>Ecological / Economic Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Louisiana’s Invasive Species Word Scramble

Directions: Unscramble the words to see the names of some of Louisiana’s invasive species.

1. ianas rgeti soqtiuom __________ __________ __________
2. ncxmeia lobl evilew __________ __________ __________
3. seechni lowlat erte __________ __________ __________
4. nogoc sgars __________ __________
5. ligalarot edew __________ __________
6. antig vinalasi __________ __________
7. ratew yinthhac __________ __________
8. nisa macl __________ __________
9. razeb sulems __________ __________
10. trailnaaus depotstyellj __________ __________ __________
11. utrain __________
12. zukud __________
13. riydalh __________

Invasive Species Solutions

Species: _________________________
Solution:
_________________________________
_________________________________
_________________________________
_________________________________
_________________________________
_________________________________
Results:
_________________________________
_________________________________
_________________________________
_________________________________
_________________________________
_________________________________
**Do You Know Your Neighbors?**

Discover the invasive species that call your community “home”!

**Investigation**

After exploring the CBR website, investigate the invasive species that live in your community. Plan a field trip to a nearby park or wildlife area to look for invasive plants. For safety, never explore alone! Use your field journal as well as Internet and library resources to identify the mammals, insects, and waterborne species that live in your community.

**Materials**

- Field journal
- Pen or pencil
- Walking shoes

**Track Your Path!**

**Directions**

1. Use a map and or GPS device to trace your path. Mark your beginning and ending points as well as the location(s) where you observe invasive species,
2. Take pictures of the invasive species you observe and record notes for each picture, including date, time of day, location, and species.
3. Use your invasive species journal to identify the species.
4. Visually examine how each invasive species you see has affected the natural habitat.

---

**BASIC FIELD TRIP INFORMATION**

<table>
<thead>
<tr>
<th>Location</th>
<th>What area will you explore?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>Record the time of day (include a.m. or p.m.) you begin and end your field trip.</td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Explorers</td>
<td>Write the names of the people in your group.</td>
</tr>
</tbody>
</table>
### Invasive Species Field Notes and Observations

<table>
<thead>
<tr>
<th>Location</th>
<th>Field Notes</th>
<th>Photo Notes or Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Species Sighted:</strong> _______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What do you observe about the specimen and the surrounding environment?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write any questions you may have.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Field Notes</th>
<th>Photo Notes or Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Species Sighted:</strong> _______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What do you observe about the specimen and the surrounding environment?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write any questions you may have.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Field Notes</th>
<th>Photo Notes or Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Species Sighted:</strong> _______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What do you observe about the specimen and the surrounding environment?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write any questions you may have.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>Field Notes</th>
<th>Photo Notes or Sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Species Sighted:</strong> _______________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What do you observe about the specimen and the surrounding environment?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>_____________________________________________</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Write any questions you may have.</td>
<td></td>
</tr>
<tr>
<td>Location</td>
<td>Field Notes</td>
<td>Photo Notes or Sketch</td>
</tr>
<tr>
<td>----------</td>
<td>-------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coordinates (optional)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Field Notes

Species Sighted: _______________________________

What do you observe about the specimen and the surrounding environment?

_____________________________________

_____________________________________

_____________________________________

_____________________________________

Write any questions you may have.

_____________________________________

Photo Notes or Sketch

Location

GPS

Coordinates (optional)

Field Notes

Species Sighted: _______________________________

What do you observe about the specimen and the surrounding environment?

_____________________________________

_____________________________________

_____________________________________

_____________________________________

Write any questions you may have.

_____________________________________

Photo Notes or Sketch

Location

GPS

Coordinates (optional)

Field Notes

Species Sighted: _______________________________

What do you observe about the specimen and the surrounding environment?

_____________________________________

_____________________________________

_____________________________________

_____________________________________

Write any questions you may have.

_____________________________________
Make a Difference
Discover how one person can make a difference.

“Never doubt that a small group of thoughtful, committed individuals can change the world. Indeed, it's the only thing that ever has.”
—Margaret Mead

Start small and locally:

- Stay Involved: join organizations, attend meetings and workshops
- Plant a home, school, or community wetland garden or project
- Track endangered species
- Visit the CBR website, http://is.cbr.tulane.edu/solutions.html, to discover solutions to invasive species problems
- Investigate, join, and support local and state restoration projects
- Join or start a community clean-up project
- Support or start a school wetland or invasive species project
- Invite experts in the field to speak to your civic, social, religious, or economic organization
- Join the Conversation! Extraordinary ideas often come from ordinary conversation. Visit LSM’s Facebook page, Internet address, to find ways you can help and to record your thoughts

Start a Project:

- Develop an Internet-based Invasive Species Photo Gallery (Flicker, Picasa)
- Create an online book about invasive species (Mixbook.com, Smilebox.com)
- Submit an Invasive Species iReport of your field observation results
- Tweet about your invasive species observations
- Join/start a blog
- Create an invasive species graphic illustration or publication
Resources

- Louisiana State Museum
  http://lsm.crt.state.la.us

- Katrina and Beyond: Living with Hurricanes Facebook
  http://www.facebook.com/LaStateMuseum

- National Atlas: Invasive Species,
  www.nationalatlas.gov/articles/biology/a_invasive.html

- National Invasive Species Information Center
  www.invasivespeciesinfo.gov/unitedstates/la.shtml

- The Nature Conservancy
  http://www.nature.org/initiatives/invasivespecies/howwework/art21234.html

- Tulane/Xavier’s Center for Bioenvironmental Research (CBR)
  http://is.cbr.tulane.edu/index.html

- University of Rhode Island Graduate School of Oceanography interactive website,
  Hurricanes: Science and Society
  www.hurricanescience.org

- Invasive and Exotic Species,
  http://www.invasive.org/

- Invasivespecies.gov,
  http://invasivespecies.org

- National Geographic: HabitatsThe Basics,
  http://www.nationalgeographic.com/geography-action/habitats.html

- U.S. Fish and Wildlife Service: The Endangered Species Program,
  http://www.fws.gov/endangered/

Vocabulary

- **Arthropods**—Arthropods have jointed legs and a hard outer skeleton called an exoskeleton. They include groups such as the insects, arachnids such as spiders, crustaceans such as crabs and lobsters, centipedes, millipedes, and others.

- **Ecosystem**—A community of plants, animals and other organisms that are linked by energy and nutrient flows and that interact with each other and with the physical environment.

- **Insects**—Insects are arthropods that have three body regions: a head, a thorax, and an abdomen. They have one pair of antennae on the head and they have six legs that are attached to the thorax. Most insects have wings, though some do not.

- **Invasive species**—A species that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic harm, environmental harm, or harm to human health. Invasive species tend to grow rapidly and spread easily, and frequently out-compete native species for space and resources. An invasive species may be introduced or may spread outside its normal range through natural processes.

- **Native species**—A species that occurs naturally in an area (i.e. is not introduced.)

- **Species**—A group of organisms that differ from all other groups of organisms and that are capable of breeding and producing fertile offspring. This is the smallest unit of classification for plants and animals.

- **Vertebrates**—Animals with an internal skeleton made of bone are called vertebrates. Vertebrates include fish, amphibians, reptiles, birds, mammals, primates, rodents, and marsupials. Although vertebrates represent only a very small percentage of all animals, their size, and mobility often allow them to dominate their environment.
Classroom Suggestions

1. **Introduction.** Explain that every species has a native habitat. Occasionally, humans relocate a species, either through carelessness or with the intent of benefiting human beings, the species itself, and/or a new environment.

   Explain that students will work together to identify several "invasive" species, evaluate the effect their relocation has had on new environments, and discover ways communities try to solve the problems caused by invasive species.

2. **Investigate.** Ask students to work in small groups to search the Center for Bioenvironmental Research’s (CBR) *Louisiana’s Invasive Species* website, [http://is.cbr.tulane.edu/index.htm](http://is.cbr.tulane.edu/index.htm), for information about invasive species that endanger Louisiana’s environment and economy. Additional information sources are listed on page 15.

   Ask each group to research one of the five groups of invasive species that are identified by CBR. Make copies of the investigation sheets on pages 4-8 of this journal and distribute appropriate pages to each group.

   Ask students to research the types of solutions that communities use to address the invasive species problems. Which solutions are proving successful? Make copies of the Invasive Species Solutions graphic organizer on page 10. Ask students to use this graphic organizer to record their findings.

3. **Discuss.** Have students discuss in their groups what they have learned about the subject of relocated and invasive species. Ask students to emphasize the effects the movement of these species has had, or is having, on Louisiana’s environment and economy.

   Ask students to form an “Ask the Experts” panel to discuss and/or debate the solutions to Louisiana’s invasive species problems.

4. **Field Research.** As appropriate, ask students to explore their community or home/school neighborhood for examples of invasive species in their community.

   Review the invasive species field research overview on page 11 of this book. Make copies of the Invasive Species Field Guide and Observation Journal on pages 12 and 13. Ask students to use the field guide pages to record their observations and to take pictures or make sketches of the invasive species they observe.

5. **Present and Share.**

   Based on their field research, ask students to develop an invasive species photo gallery, online book, iReport, etc. about their field observations. Students can submit their results to the Museum via email at education@lsm.crt.state.la.us, can Tweet about their findings (visit the Museum at [http://twitter.com/#!/LaStateMuseum](http://twitter.com/#!/LaStateMuseum)), or submit their photos and iReports at [http://www.facebook.com/LaStateMuseum](http://www.facebook.com/LaStateMuseum).
Benchmarks and GLEs: Science

Grade 3
Science as Inquiry
5. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
8. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)

Organisms and Their Environments
35. Identify the components of a variety of habitats and describe how organisms in those habitats depend on each other (LS-E-C1)

Grade 4
Science as Inquiry
5. Use a variety of methods and materials and multiple trials to investigate ideas (observe, measure, accurately record data) (SI-E-A2)
8. Use a variety of appropriate formats to describe procedures and to express ideas about demonstrations or experiments (e.g., drawings, journals, reports, presentations, exhibitions, portfolios) (SI-E-A6)

Science and the Environment
48. Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population (SE-M-A2)
50. Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)
72. Predict and describe consequences of the removal of one component in a balanced ecosystem (e.g., consumer, herbivores, nonliving component) (SE-E-A2)

Grade 5
Science as Inquiry
7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
Science and the Environment
48. Determine the ability of an ecosystem to support a population (carrying capacity) by identifying the resources needed by that population (SE-M-A2)
50. Describe the consequences of several types of human activities on local ecosystems (e.g., polluting streams, regulating hunting, introducing nonnative species) (SE-M-A4)

Grade 7
Science as Inquiry
7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)

Populations and Ecosystems
27. Identify the various relationships among plants and animals (e.g., mutualistic, parasitic, producer/consumer) (LS-M-C4)
29. Predict the impact changes in a species’ population have on an ecosystem (LS-M-C4)

Adaptations of Organisms
31. Describe and evaluate the impact of introducing nonnative species into an ecosystem (LS-M-D1)
32. Describe changes that can occur in various ecosystems and relate the changes to the ability of an organism to survive (LS-M-D2)

Grade 8
Science as Inquiry
7. Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)

Earth and Space Systems
20. Describe how humans’ actions and natural processes have modified coastal regions in Louisiana and other locations (ESS-M-A8)

High School: Environmental Science
Ecological Systems and Interactions
14. Determine the effects of limiting factors on a population and describe the concept of carrying capacity (SE-H-A3)
9. Cite and explain examples of organisms’ adaptations to environmental pressures over time (SE-H-A8)
10. Analyze the effect of an invasive species on the biodiversity within ecosystems (SE-H-A9)
11. Explain why biodiversity is essential to the survival of organisms (SE-H-A9)

Resources and Resource Management
14. Analyze data to determine the effect of preservation practices compared to conservation practices for a sample species (SE-H-B2)

Common Core Standards: Science
- CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
- CCSS.ELA-Literacy.RST.6-8.6 Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
- CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
- CCSS.ELA-Literacy.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.