Rhythms of the Refuge: Educator's Guide

Red River National Wildlife Refuge Environmental Education Center

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To the Educator:

Thank you for choosing to bring your group to Red River National Wildlife Refuge. We are delighted you are taking the opportunity to enhance your group's classroom learning experiences!

The *Rhythms of the Refuge: Educator's Guide* is designed to assist your students' learning, discovery, and enjoyment of the environment. It contains information about the refuge's history and habitats, tips for organizing a field trip to the refuge, a variety of educational activities, and appendices with additional resource information.

As you look through the guide, you will see that it includes activities you can do with your class before coming to the refuge, while you are on the refuge, and after you leave the refuge. Obviously you will not be able to complete all, or even most of these activities in one field trip. Instead, select the activities that best meet the general objectives of your field trip. To help you decide which activities to select, there is a brief summary on the first page of each activity that includes:

- Methods used
- Learning objectives
- Materials needed
- Subjects covered
- Time required
- Appropriate setting (classroom or outdoors)
- Appropriate grade levels
- Vocabulary

Each activity can be modified to suit the needs of your students. For example, with younger students, you may want to simplify the background information and Student Pages. With older students, you may want to require that they make their observations using scientific techniques. Also, you may want to have them research relevant topics using the library, Internet, or other resources.

If this guide fulfills its purpose, your field trip will result in big grins, wind-blown hair, dirty hands, happy memories, and a new and better understanding of the refuge habitats and inhabitants. Enjoy your visit and please call the refuge staff if you have any questions (318)742-1219.

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CHAPTER 1
Red River National Wildlife Refuge

A. Conservation in the United States
   1. Federal Agencies
   2. State Agencies
   3. Local Agencies
   4. Non-governmental Organizations

B. The National Wildlife Refuge System

C. The History and Role of Red River National Wildlife Refuge

D. Map of Red River National Wildlife Refuge

E. Overview of Red River National Wildlife Refuge Habitats

F. Plants of the Refuge

G. Animals of the Refuge

A. CONSERVATION IN THE UNITED STATES

In the United States, there are a variety of groups involved in protecting the natural world. These groups include Federal agencies, State agencies, local agencies, and private or "non-governmental organizations." Each agency and group has a unique focus.

1. Federal Agencies:

United States Fish and Wildlife Service (Department of Interior) (www.fws.gov)

The U.S. Fish and Wildlife Service (Service) has the responsibility to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of people. In order to help fulfill these responsibilities, the Service has established programs which include the following:

Refuges (National Wildlife Refuge System): More than 540 National wildlife refuges (NWR) and more than 3,000 Waterfowl Production Areas (WPA) have been established in the United States. Over 95 million acres are included in the Refuge System; some of these lands and waters are wilderness areas. The Refuge System's mission is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future Americans.

Realty: This program supports the acquisition and management of Service lands. By utilizing money from the Migratory Bird Conservation Fund and the Land and Water Conservation Fund, Realty is involved in national planning and policy guidance for Service land acquisition.

Migratory Birds and State Programs: The Service is the lead Federal agency for managing migratory birds in the United States. The Service works to conserve migratory bird populations and their associated habitats in the United States and internationally. The Division of Federal Aid administers the use of money from Federal excise taxes on fishing and hunting equipment. This money is used by State wildlife agencies to acquire land, manage habitat, conduct research, provide wildlife-related recreation access, and carry out hunting and fishing safety training.

Fisheries and Habitat Conservation: The Service has the responsibility to conserve, restore, enhance, and manage the national fishery resources and

aquatic ecosystems. The fisheries program helps restore fish populations that have been depleted due to over-fishing, pollution, or other habitat damage. Over 80 National Fish Hatcheries exist in the United States to aid in fishery conservation.

Endangered Species: This program works to conserve and restore endangered and threatened species and the ecosystems upon which they depend. The Service identifies species as threatened or endangered, and develops recovery plans for those species as dictated by the Endangered Species Act.

International Affairs: Divisions within this program are involved in international conservation issues. This includes implementing domestic laws and international treaties to promote long-term conservation of natural resources, providing sound biological advice as to how to implement these laws and treaties, and providing international leadership on conservation issues.

Law Enforcement: This program involves investigating violations of national laws and international treaties related to wildlife, regulating wildlife trade, and helping Americans understand and obey wildlife protection laws.

External Affairs: External Affairs prepares legislative programs, reviews relevant legislation, and works with the media to provide information about the Service to the public. This program is also involved in training natural resource managers at the National Conservation Training Center in West Virginia. The Native American Liaison is another part of External Affairs that works with federally recognized tribes to identify areas where Federal and tribal conservation efforts will help to conserve fish, wildlife, plants, and their habitat.

National Park Service (Department of Interior) (www.nps.gov)

The National Park Service (NPS) is responsible for national parks and monuments; the park system covers over 80 million acres. Designated wilderness areas can be found within some of the national parks. The NPS works to preserve the scenery, natural objects, historical objects, and wildlife within the parks. In addition, the NPS provides for public enjoyment of the parks in such a way that the parks will remain for future generations.

Bureau of Land Management (Department of Interior) (www.blm.gov)

Approximately 270 million acres of land are administered by the Bureau of Land Management (BLM). Most of these lands are in the western states and Alaska. The BLM manages this land using the principle of multiple uses. Much of the BLM land is used for grazing and energy production. Also, some of the land is managed for recreation and/or wilderness.

U.S. Forest Service (Department of Agriculture) (www.fs.fed.us)

The national forest system includes over 191 million acres. The mission of the U.S. Forest Service (USFS) is to survey, inventory, protect, and manage the forests. As with the BLM, the USFS is guided by a multiple use policy. National forests are often logged, but other uses of Forest Service land include grazing, mining, recreation, and wilderness.

Environmental Protection Agency (www.epa.gov)

The Environmental Protection Agency (EPA) is an independent regulatory agency that administers a number of Federal laws including the Clean Air Act, Clean Water Act, Resources Conservation and Recovery Act (solid and hazardous wastes), and the Comprehensive Environmental Response, Compensation, and Liability Act ("Superfund"). Its mission is to protect human health and to safeguard the natural environment - air, water, and land - upon which life depends.

U.S. Geological Survey (www.usgs.gov)

The U.S. Geological Survey (USGS) conducts studies and surveys in order to describe and understand the biology and geology of the Earth. The information from these studies aids in the management of aquatic, biological, energy, and mineral resources.

2. State Agencies:

Within each state, agencies exist that manage natural resources, including: parks, fish and wildlife, water, air, geology, forestry, waste, mining, and soil. Generally, these agencies operate under a larger department, which is often called the DNR (Department/Division of Natural Resources).

State agencies often have similar goals to those of the Federal agencies. However, the State agencies are responsible for issues within the state. In general, State fish and wildlife agencies manage non-migratory species - it would be difficult or impossible for one state to be responsible for a species that travels long distances, crossing state and even national borders. In contrast, the U.S. Fish and Wildlife Service's emphasis is on migratory species, species identified by Federal law, as well as those species resident on a refuge.

Another example of the division between Federal and State authority relates to endangered and threatened species. Sometimes a plant or animal population is declining within a particular state, but it is stable in other areas of the nation. In that case, the organism could be listed as endangered or threatened within that state. State agencies would then develop a management and/or recovery plan for the organism. On the other hand, a plant or animal population could be declining throughout the nation.

Such an organism may be declared federally endangered or threatened. Then, the state is required to cooperate with associated Federal recovery programs.

In Louisiana, the Louisiana Department of Wildlife and Fisheries (LDWF) is the state agency which manages wildlife. The District II office of LDWF can be reached at (318) 343-4044.

The Louisiana Department of Environmental Quality (DEQ) office can be reached at (318) 362-5439. The LDWF and DEQ often work together investigating incidents where wildlife becomes sick or dies possibly as a result of environmental pollution (fish kill).

The Louisiana Office of Forestry can be reached at (318) 362-3141. They work with the LDWF on habitat projects.

The Office of Natural Resources Conservation is a regulatory agency for the oil and gas industry.

3. Local Agencies

Cypress Nature Study Center (318) 965-0007

Walter B. Jacobs Memorial Nature Park (318) 929-2806

Shreveport Green (318) 219-1888

Keep Bossier Beautiful (318) 213-2100

4. Non-Governmental Organizations:

A variety of organizations exist that are involved in conservation but are not government agencies. They may be local, state, national, or international groups. These groups are often called non-governmental organizations or NGOs. Examples of these groups include the National Wildlife Federation, National Audubon Society, World Wildlife Fund, The Nature Conservancy, and Ducks Unlimited. Each of these groups has a different mission and focus.

The Louisiana Nature Conservancy, Louisiana Wildlife Federation, Louisiana Wild Turkey Federation, Louisiana Native Plant Society, North East Louisiana Bird Club and the local chapters of Ducks Unlimited are active in conservation efforts in our area. The Sierra Club and Audubon Society have active chapters in Louisiana. Many national wildlife refuges have support or friends groups. Friends of Red River have been extremely active in promoting the development of Red River NWR facilities and educational program.

B. THE NATIONAL WILDLIFE REFUGE SYSTEM

U.S. Fish and Wildlife Service
National Wildlife Refuge System
1.800.344.WILD
http://refuges.fws.gov

The National Wildlife Refuge System is truly unique because it is the world's largest and most diverse collection of lands set aside specifically for wildlife. The National Wildlife Refuge System began in 1903, with the establishment of Pelican Island in Florida as a Federal Bird Reservation. Today, there are more than 552 national wildlife refuges (NWR), covering over 150 million acres. There is at least one refuge in every state, American Samoa, Puerto Rico, the Virgin Islands, the Johnson Atoll, the Midway Atoll, and several other Pacific islands.

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources of the United States for the benefit of present and future generations of Americans. Many refuges were established for special reasons, such as protecting a particular species. However, the purpose of these refuges usually broadens to include the conservation of the many other wildlife and plant species found in the refuge habitats.

In support of the Refuge System's mission, national wildlife refuges are managed by refuge staff using a variety of management tools. These tools vary according to the management goals, but can include prescribed burning, mowing, water management, hunting, agriculture, and grazing. These tools help to restore, maintain, and enhance fish, wildlife, and plant resources.

Most refuges are open to the public for wildlife-dependent recreation. Activities can include hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation. Also, many refuges now have accessible facilities. The availability of these recreational activities allows people to enjoy and appreciate national wildlife refuges and understand their importance to conservation.

The Blue Goose - the Symbol of National Wildlife Refuges

The Blue Goose is the symbol of the National Wildlife Refuge System, and can be found on national wildlife refuge boundary signs. If you see the Blue Goose, you know that you are near one of these important areas.

Rachel Carson was a biologist and chief editor for the U.S. Fish and Wildlife Service from 1939-1952. She wrote the following essay as an introduction to the series,

“Conservation in Action,” a collection of narratives about refuges and the Refuge System:

> *If you travel much in the wilder sections of our country, sooner or later you are likely to meet the sign of the flying goose - the emblem of the national wildlife refuges.*
>
> *You may meet it by the side of a road crossing miles of flat prairie in the middle West, or in the hot deserts of the Southwest. You may meet it by some mountain lake, or as you push your boat through the winding salty creeks of a coastal marsh.*
>
> *Wherever you meet this sign, respect it. It means that the land behind the sign has been dedicated by the American people to preserving, for themselves and their children, as much of our native wildlife as can be retained along with our modern civilization.*
>
> *Wild creatures, like men, must have a place to live. As civilization creates cities, builds highways, and drains marshes, it takes away, little by little, the land that is suitable for wildlife. And as their space for living dwindles, the wildlife populations themselves decline. Refuges resist this trend by saving some areas from encroachment, and by preserving in them, or restoring where necessary, the conditions that wild things need in order to live.*

C. THE HISTORY AND ROLE OF RED RIVER NATIONAL WILDLIFE REFUGE

Establishment of the refuge

The refuge was established on August 22, 2002, with the initial purchase of 1,377 acres in the Spanish Lake Lowlands Focus Area at a cost of one million dollars. Red River NWR is a unit of the North Louisiana National Refuge Complex. This Complex includes the D'Arbonne, Upper Ouachita, Black Bayou Lake, Handy Brake, and Red River NWRs and the Service's Louisiana Wetlands Management District.

The Red River NWR, stretching 120 miles along the Red River Valley from Colfax, Louisiana, near its southern boundary to the Arkansas state line, will play an important role regionally in fulfilling the goals of the Refuge System. Its proximity to a major metropolitan center will afford the public the ability to participate in educational opportunities that promote wildlife stewardship.

Historically, the Red River Valley was forested with bottomland hardwoods, cypress sloughs, and shrub swamps. After the Louisiana Purchase in 1803, early settlers began to clear these areas for farms and homesteads. This forest clearing rapidly accelerated in the 1960s and 1970s with the rise in soybean prices. During the last three decades, the Red River Valley was used extensively for agricultural production. The river itself was very turbid due to seasonal fluctuation and agricultural runoff. The resulting wildlife and fishery habitats were poor compared to those in other parts of the state.

Major influences on the land

The geologic history of refuge lands involved shifting stream beds and the deposition of alluvial (deposited by water) soils. Soil types and elevation coupled with a subtropical climate influenced the development of historical habitats such as bottomland hardwoods.

In the past 150 years humans have had more impact on the land than any other factor. Beginning before the Civil War much of the forest was removed for agriculture. Regular logging changed the remaining woodlands. Even today changes continue as refuge employees reforest the farm fields.

The role of the refuge in conservation at the following levels:

Local - Red River NWR protects and enhances valuable wetland habitat and the associated fish and wildlife. The refuge also provides environmental education and nature interpretation for students and other citizens of north Louisiana. It is a place where people can make connections with the natural world.

State - Red River NWR is one of 23 national wildlife refuges in Louisiana. The North Louisiana Refuges Complex (which includes Red River NWR), other national wildlife refuges and many state wildlife management areas provide critical wildlife habitat all across the state. Refuges are particularly important as corridors for wildlife travel. Travel corridors are especially important for large animals that range over many square miles. The Louisiana black bear, a threatened species in our state, inhabits several Louisiana refuges including two in the North Louisiana Refuges Complex. Refuges are among the few places in our state where the endangered red-cockaded woodpecker can still find suitable habitat (open pine stands with 70+ year old trees). National wildlife refuges in Louisiana provide extremely important wintering habitat for millions of duck and geese. The coastal refuges are also critical to neotropical migrants (birds that spend the nesting season somewhere in North America and fly to the tropics of Central and South America for the winter). They provide the last resting and feeding areas before migrating birds cross the Gulf of Mexico (500 miles non stop) when going south and the first place for birds to rest and feed on the return trip.

Regional - There are more national wildlife refuges in the southeast region than in any other region in the country. All these refuges are involved in the protection and management of wildlife habitat. They also provide sanctuaries and critical habitat for endangered /threatened species such as the red-cockaded woodpecker, West Indian manatee, many shore birds and birds of prey, turtles, mussels, fish.

National - There are over 552 national wildlife refuges protecting nearly 190 million acres for wildlife. Many refuges provide critical habitat for federally protected wildlife, including threatened and endangered species.

International - Red River and many other national wildlife refuges are key to the survival of neotropical migratory birds and waterfowl. These birds travel across international boundaries and the U.S. Fish and Wildlife Service works with other governments to insure their survival.

Management tools used on the refuge

Refuge management consists of habitat and public use activities. Habitat work includes: reforestation of former farm lands; active management of existing forests using prescribed burns, thinning and selective cutting for forest health; control of exotic species such as water hyacinth and Chinese tallow; and monitoring wildlife populations. Public use work involves managing hunting and fishing programs, providing environmental education and interpretation, law enforcement and facilities maintenance.

Public use opportunities on the refuge

Currently, public use is available on only two of the five refuge units. Portions of the Spanish Lake Lowlands Unit and Bayou Pierre Unit are open to hunting. Species hunted are ducks, geese, coot, quail, woodcock, squirrel, raccoon, opossum, feral hogs,

coyotes, beaver, and deer. Deer hunting is by archery only. The hunting seasons on the refuge are the same as the state seasons

Public uses on the refuge currently include wildlife observation and photography; recreational fishing in accordance with State of Louisiana regulations; recreational hunting of migratory birds and resident game in accordance with State of Louisiana regulations; and wildlife-dependent environmental education activities. At present, the primary wildlife-dependent public uses of the refuge include fishing, hunting, wildlife observation, and wildlife photography.

Fishing and boating on the Spanish Lake Lowlands and Bayou Pierre units are permitted year-round during daylight hours only. Licenses, limits, and boating safety requirements are the same as those adopted by the LDWF.

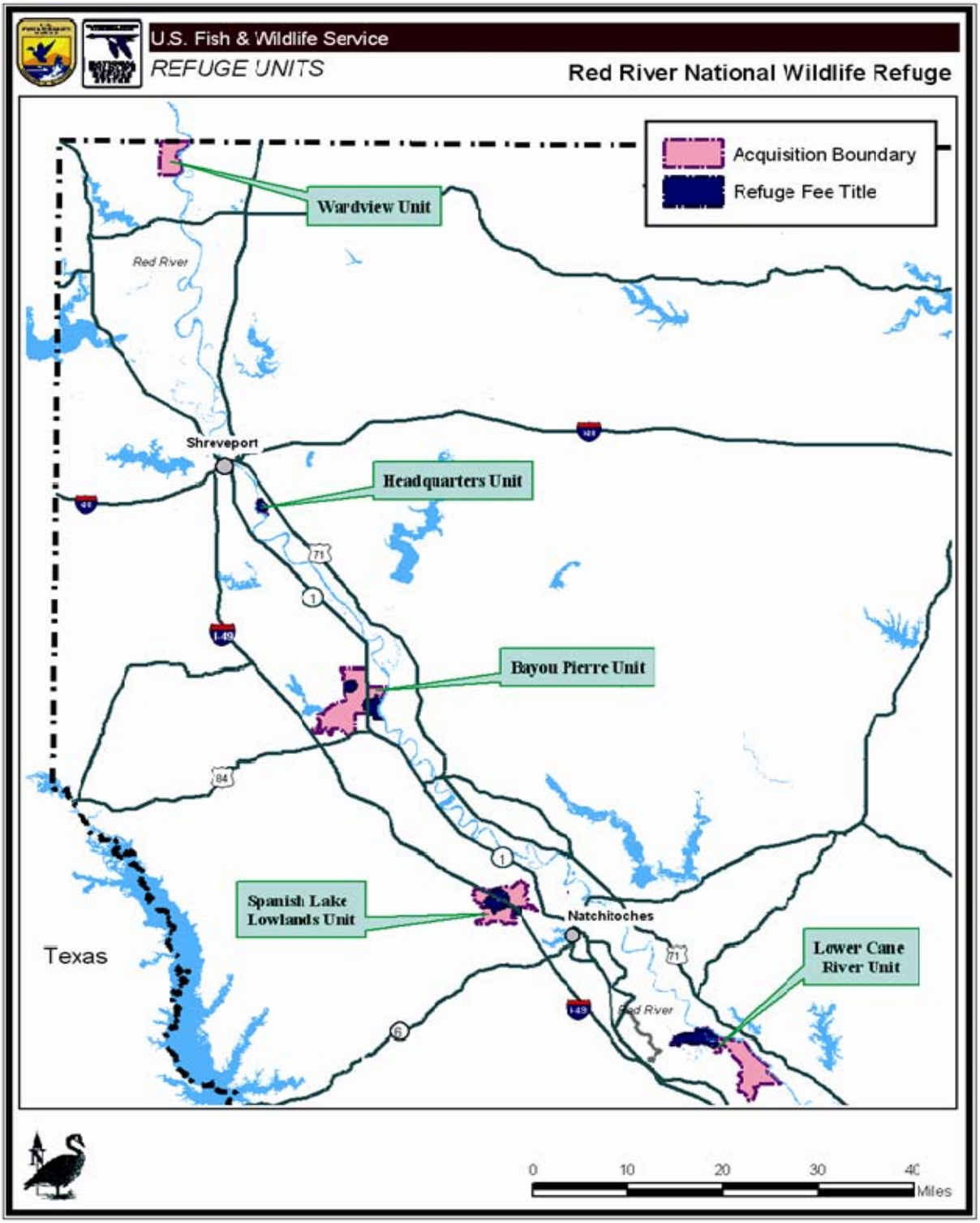
Cultural resources on the refuge

There are two 19th century cemeteries on the refuge. One is currently being maintained by a nearby church and the other is maintained by refuge staff.

Interesting and unique characteristics or facts about the refuge

Red River NWR is unique for our area because it is an urban refuge. With development all around, the refuge provides wildlife habitat in an increasingly populated area. The refuge is a wonderful place for families, school groups, youth groups and travelers. Here visitors can see an oxbow lake, the Red River and a host of birds and other wildlife. The nature trails winds through bottomland hard wood, grassland, and along the oxbow lake.

D. MAP OF RED RIVER NATIONAL WILDLIFE REFUGE



E. OVERVIEW OF RED RIVER NATIONAL WILDLIFE REFUGE HABITATS

Currently, the five units of the refuge include 5,653 acres of reforested bottomland hardwood forest; 5,295 acres of bottomland forest; 511acres of permanent water; 600 acres of moist soils; 1,245 acres of agricultural fields; 97 acres in a pecan orchard; and a 153 acre field that was grazed and currently invaded by wild plum and other invasives.

Prior to European settlement, the predominant habitat type throughout the area was bottomland hardwood forest. One goal of the refuge is to restore this once-dominant habitat type. The primary woody species in the lowest areas of bottomland hardwood forest are baldcypress, buttonbush, and swamp privet. Slightly higher on the floodplain are overcup oak, water hickory, Nuttall oak, persimmon, cedar elm, willow oak, and water locust. The understory largely consists of swamp privet, greenbrier, poison ivy, and buttonbush. Riparian habitats consist of black willow, cottonwood, and sycamore.

The cleared bottomlands have been replanted in species that would have originally inhabited the area, which include willow oak, water oak, overcup oak, Nuttall oak, shumard oak, cherrybark oak, sweet pecan, sycamore, sweetgum, green ash and baldcypress

Bottomland hardwood forests can be classified in this area into four primary habitat types:

Baldcypress– Water Tupelo
Overcup Oak– Water Hickory
Sweetgum– Willow Oak
Swamp Chestnut Oak– Cherrybark Oak

Baldcypress – Water Tupelo

Baldcypress and water tupelo together make up the majority of stocking in this forest type, which occurs in swamps, deep sloughs, and very low poorly drained flats. The sites are always very wet, and surface water stands well into or throughout the growing season. Soils are generally mucks, clays, or fine sand. Common trees associated with this type are black willow , water locust, overcup oak, green ash, and persimmon. Among the shrub species are swamp privet, buttonbush, and planartree. Woody vines include redvine. A variety of herbaceous plants will be commonly seen and take the form of flotants, emergents, and submergents. Frequently, a variety of mosses and lichens adorn the exposed tree trunks, and the crowns may be draped with Spanish moss.

Overcup Oak – Water Hickory

This type usually occurs in low, poorly drained flats and sloughs with tight clay or silty clay soils. These sites are the lowest within the first bottoms and are subject to late spring inundations. Overcup oak and water hickory together constitute the majority. Associates include willow oak, Nuttall oak, cedar elm, green ash, and water locust. Minor associates include black willow, persimmon and sweetgum. Common shrub species often associated include redvine, peppervine, trumpet-creeper, dewberry, and possibly greenbier. Panicums, asters, annual grasses, and cocklebur may occur in openings within the stand.

Sweetgum – Willow Oak

The low ridges in the broad slackwater areas of the first bottom are typically occupied by this forest type. Willow oak and sweetgum comprise the largest proportion of the stocking in stands of this type. A major associate on higher clay ridges and flats is Nuttall oak. Other trees associated with this forest type are sugarberry, green ash, overcup oak, water oak, water hickory, cedar elm, persimmon, and sometimes baldcypress. Common shrubs include swamp privet, American snowbell, possumhaw, hawthorn, and dull-leaf indigo. Woody vines occasionally present include greenbrier, peppervine, and redvine.

Swamp Chestnut Oak – Cherrybark Oak

This forest type occurs on the best, most mature, fine sandy loam soils on the highest of the first bottom ridges and hammocks, and on the second bottoms or terraces down from the ridges. These well-drained sites are seldom covered with standing water and only rarely overflow. Species composition of this habitat type varies widely, though cherrybark oak will most likely be much more common than swamp chestnut oak. Many other species contribute to a well-stocked stand: white oak, post oak, sweetgum, blackgum, hickory, willow oak; water oak, southern red oak, winged elm, sassafras, slippery elm, Shumard oak, black oak, black cherry, white ash, green ash, red maple, and loblolly and shortleaf pines. Common midstory plants include eastern redbud, flowering dogwood, American holly, red mulberry, American hornbeam, eastern hophornbeam, and witch-hazel. Shrub species usually include red buckeye, devil's walkingstick, sweetleaf, and *Viburnum* spp. Often included in this habitat type are grape vines, Alabama supplejack, Carolina jessamine, trumpet creeper, and greenbrier.

The four bottomland hardwood types described above are found only in remnants over most of the units of the refuge. It is the desire of refuge management to replicate these types where appropriate on the refuge. The cleared bottomlands have been reforested with species that originally inhabited the area, including willow oak, water oak, overcup oak, Nuttall oak, shumard oak, cherrybark oak, sweet pecan, sycamore, sweetgum, green ash and baldcypress. The outcome will be structurally diverse bottomland hardwood forest ecosystems that support a variety of forest-dependent wildlife species.

Moist-soil plant species vary depending on the timing of drawdowns and soil

disturbance, but usually consist of panic grass, sprangletop, millet, toothcup, coffeeweed, and a variety of sedges.

At Red River NWR, grain production is used to effectively manage moist-soil habitat. Rice, milo, and corn are the top choices as grain crops for ducks. Rice is particularly resistant to decomposition even under flooded conditions. Milo and corn also provide high energy resources for waterfowl and can generally be kept above the water surface.

WILDLIFE

Waterfowl

The West Gulf Coastal Plain and the Red River Valley are important ecoregions for migrating and wintering ducks and geese in North America. Red River NWR provides important foraging and resting (refuge) habitats within the Red River Valley for these waterfowl and serves an integral role in a large, cooperative planning and habitat management effort known as the North American Waterfowl Management Plan.

The refuge provides habitat for thousands of wintering waterfowl and year-round habitat for nesting wood ducks. The Red River is a historic migration corridor for migratory birds that use the Central and Mississippi flyways on their journey to the Gulf Coast. At least 14 species of migratory waterfowl use the refuge during some part of the year: mallard, gadwall, American widgeon, green-winged teal, blue-winged teal, northern shoveler, northern pintail, hooded merganser, ring-necked duck, canvasback, and lesser scaup. Other species that use the refuge less frequently include bufflehead, redhead, common merganser, red-breasted merganser, greater scaup, ruddy duck, common goldeneye, and American black duck. Wood ducks are year-round residents in Louisiana. Preferred habitats include forested wetlands, wooded and shrub swamps, tree-lined rivers, streams, sloughs, and beaver ponds. Wood ducks seek food in the form of acorns, other soft and hard mast, weed seeds, and invertebrates found in shallow flooded timber, shrub swamps and along stream banks. They loaf and roost in more secluded areas and dense shrub swamps.

Shorebirds

An appropriate disturbance rotation at the old rice fields and old fish ponds on the Bayou Pierre Unit will allow the refuge to hold water on a portion of the impoundments through the summer. High-quality habitat can be provided following a late summer drawdown, thus providing foraging habitat for wading birds in the summer and shorebird habitat during the peak of fall migration. This is all in addition to the benefits shorebird species will receive following the normal spring drawdown on the other units.

Neotropical Migratory Birds

More than 200 species of neotropical migratory birds use Red River NWR at various times of the year. Refuge habitats utilized include forested wetlands, scrub/shrub, open fields, sandbars, shallow flooded fields, and mudflats.

Water and Marsh Birds

The great blue heron, great egret, snowy egret, cattle egret, little blue heron, white ibis, green heron, yellow-crowned night-heron, black-crowned night-heron, American bittern, white-faced ibis, pied-billed grebe, common moorhen, purple gallinule, and sandhill crane use the refuge's sloughs, bayous, flooded timber, scrub/shrub, and open fields at different times of the year, depending upon the water levels. Roseate spoonbills, wood storks, and tricolored herons are seen irregularly, usually during post-breeding dispersal in late summer. Least bitterns most likely migrate through the refuge. Concentrations of double-crested cormorants use the refuge during winter. Anhingas are found along the river and associated oxbow lakes and sloughs during the summer. American white pelicans are sometimes seen in the open flooded fields in late summer and during migration. No major rookeries are known to occur on the refuge. Virginia rails and sora rails probably winter in appropriate habitat on the refuge. King rails may breed irregularly in the open fields if water levels are suitable. American coots are present year-round and are especially abundant in winter.

Mammals

Forty-four species of mammals are known or are likely to occur on the refuge, although an inventory has not been conducted. White-tailed deer are the only big game on the refuge.

Furbearers found on the refuge include: Virginia opossum, raccoon, striped skunk, river otter, beaver, mink, nutria, and muskrat. Gray fox, red fox, coyote, and bobcats are also present. Both eastern cottontail and swamp rabbits inhabit the refuge. Fox squirrels and gray squirrels are found on the refuge, with fox squirrels in the more open woods and gray squirrels inhabiting the small amount of dense forest.

Several species of bats are known or are likely to occur on the refuge. These include the Rafinesque's big-eared bat, southeastern myotis, big brown bat, eastern red bat, Seminole bat, evening bat, and during migration, the hoary bat.

Reptiles and Amphibians

More than 70 species of reptiles and amphibians are likely to occur on the refuge.

Fish

Red River NWR provides habitat for many species of freshwater fish (Appendix I). Important game species found in refuge waters include: bluegill, redear sunfish, longear

sunfish, white crappie, black crappie, largemouth bass, yellow bass, and white bass. Other species include: blue catfish, flathead catfish, channel catfish, smallmouth buffalo, bigmouth buffalo, black buffalo, freshwater drum, longnose gar, shortnose gar, alligator gar, spotted gar, bowfin, and carp.

Species of Concern

Priority bird species for conservation that may occur on or near the refuge include: cerulean warbler, Swainson's warbler, the recently delisted bald eagle, and endangered interior least tern, which nests on riverine sandbars. Other species of concern identified by the LDWF and others for the Upper West Gulf Coastal Plain that may occur on or near the refuge are the alligator snapping turtle, rusty blackbird, Rafinesque's big-eared bat, and southeastern myotis.

CHAPTER 2

Environmental Education at Red River National Wildlife Refuge

A. Defining Environmental Education

B. The Development of Understanding About the Environment

C. Guidelines for Learning in Environmental Education

D. General Objectives of the Rhythms of the Refuge Program

E. Basic Ecological Concepts

A. DEFINING ENVIRONMENTAL EDUCATION

Environmental education is a broad term, encompassing a variety of activities and concepts. A definition of environmental education that fits the mission of this program is:

> Environmental education attempts to advance awareness, knowledge, understanding, and appreciation of the functions of ecosystems and their management for fish, wildlife, and people.

From this definition, the goals of environmental education are:

> To foster a clear awareness and understanding of basic ecological concepts and the interrelationships between human activities and natural systems.
>
> To promote an awareness, understanding, and appreciation of the values of natural systems.
>
> To provide every person with opportunities to acquire the awareness, knowledge, values, attitudes, commitment, and skills needed to conserve and protect our fish and wildlife resources.

Because of its broad scope, environmental education provides an opportunity for an interdisciplinary approach to teaching and learning. It relates to a variety of traditional subjects, including science, social studies, history, geography, language arts, mathematics, art, civics/government, and economics. Approaches to learning about the environment are also highly variable, including everything from scientific investigation to creative writing.

B.THE DEVELOPMENT OF UNDERSTANDING ABOUT THE ENVIRONMENT

Environmental understanding develops as people are presented with opportunities to learn. As people learn about the environment, they often progress through different stages of understanding:

AWARENESS: Students acquire an awareness and sensitivity to the total environment and its interactions.

KNOWLEDGE: Students have a variety of experiences related to the environment. They acquire a basic understanding of the environment and its associated problems.

ATTITUDES: Students acquire a set a values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

SKILLS: Students acquire the tools for identifying and solving environmental problems.

PARTICIPATION: Students have an opportunity to be actively involved in all levels of working toward the resolution of environmental problems**.**

As an educator, knowledge of your students' experiences with the environment and their understanding of the environment can help you direct and focus your teaching.

C. GUIDELINES FOR LEARNING IN ENVIRONMENTAL EDUCATION

As in other areas of education, national standards for environmental education have been developed by the North American Association for Environmental Education (NAAEE). These standards are meant to provide educators with guidelines of how to help students attain environmental literacy. According to these guidelines, environmental literacy entails:

Questioning and Analysis Skills:

The ability to ask questions, speculate, hypothesize, seek information, and develop answers allows people to understand the world around them. In addition, individuals should be familiar with inquiry, and have the skills necessary for gathering, organizing, synthesizing, evaluating, and communicating information.

Knowledge of Environmental Processes and Systems:

Individuals should have an understanding of the systems and processes that make up the environment, including human influences. Knowledge is usually cross-disciplinary. Subcategories include the earth as a physical system, the living environment, humans and their societies, and environment and society.

Skills for Understanding and Addressing Environmental Issues:

Individuals should possess the ability to define, learn about, evaluate, and act on environmental issues. Subcategories include skills for analyzing and investigating environmental issues and decision-making and citizenship skills.

Personal and Civic Responsibility:

People should understand they can make a difference individually and as a member of a group. They are able to act on their conclusions about what needs to be done to ensure environmental quality.

The full guidelines have been published in *Excellence in Environmental Education - Guidelines for Learning (K-12).* They can be obtained by contacting:

NAAEE Publications and Membership Office
410 Tarvin Road
Rock Spring, GA 30739
(706)764-2976 (phone) (706) 764-2094 (fax) Web site: www.naaee.org

D. GENERAL OBJECTIVES OF THE *Rhythms of the Refuge* PROGRAM

Depending on the focus of your class field trip, your students will meet different general objectives. However, the following is a list of the general objectives of the *Rhythms of the Refuge: Educator's Guide*.

STUDENTS WILL BE ABLE TO:

4. Explain the role of the National Wildlife Refuge System in wildlife and habitat conservation.

5. Describe the unique contribution to conservation of Red River Wildlife Refuge in the local area, surrounding region, and National Wildlife Refuge System.

6. Describe and apply basic ecological concepts, such as energy flow, community, diversity, change, interrelationships, cycles, and adaptation.

7. Describe the components and functions of a given habitat by observing, counting, and describing the animals and plants in that habitat.

8. Use scientific methodology to explore the environment (ask questions, hypothesize, collect data, analyze data, form conclusions).

9. Make a land-use and/or land management decision in a role play situation and examine the consequences of this decision.

10. Show how individuals can affect the earth through their behaviors and attitudes by practicing a code of "environmental ethics" as described in the *Educator's Guide* and/or developed in the classroom.

E. BASIC ECOLOGICAL CONCEPTS

Ecology (from the Greek “oikos” meaning house) is the study of the relationships among living things and between living things and their environment. While there are many aspects of ecology, the following basic ecological concepts are essential to further understanding.

Because these are big concepts, we suggest you select one to several of them as the focus your field trip. Use these concepts to organize your field trip and select appropriate activities. The activities that can be used to illustrate these concepts are listed after each description.

Energy Flow:

The fundamental source of energy for the earth is the sun. As producers, plants capture this energy through the process of photosynthesis. This energy is subsequently transferred to plant-eating consumers. In turn, the plant-eating consumers (herbivores) are consumed by higher-level consumers called carnivores. As plants and animals die, their tissues are broken down by decomposers. The energy pathway from plants to herbivores to carnivores to decomposers is called a food chain.

As energy moves through a food chain, most of the energy is lost. As little as 10 percent of the energy at one level of the food chain flows to the next higher level. This explains why many plants are needed to support an herbivore, and many herbivores provide food for a relatively small number of carnivores.

Activities related to this concept:
- Pre-visit Activities C and E
- On-site Activities B, F, and G
- Post-visit Activities C and D

Cycles:

While energy flows through an ecosystem, matter cycles. The basic materials of life are used over and over again.

Soil Cycle: The soil helps to grow plants that in turn nourish animals. Eventually, the animals and plants die, and they are decomposed by a variety of microorganisms. The molecules that made up the plants and animals then return to the soil.

Water Cycle: Water is vital to life on Earth. The vast majority of the Earth’s water is found in the oceans. The earth’s water moves through a cycle powered by the heat of the sun. Water evaporates from the ocean, lakes, and rivers into the atmosphere, where it can condense and form clouds. This water then returns to the earth as

some form of precipitation. Some water is frozen in glaciers and icebergs. Water may also move through a living plant or animal.

Air Cycle: The elements and compounds that make up the earth's air are also used over an over again. The exchange of carbon dioxide and oxygen between plants and animals is essential to life as we know it.

Activities related to this concept:
Pre-visit Activities C, D, and G
On-site Activities B and D

Diversity:

The earth offers a wide variety of conditions in which plants and animals could live. In turn, living things are incredibly diverse. Variation at all levels (genetic, organismal, population, community, ecosystem, landscape) is essential for maintaining a healthy community and ensuring that plants and animals survive and reproduce on an ever-changing earth.

Activities related to this concept:
Pre-visit Activities C and D
On-site Activities A, B, D, E, and F
Post-visit Activities C and G

Communities:

A community is a group of different plant and animal species that occupy a particular area. Within each community, each plant and animal species has a particular role or job. The role an animal or plant fills in a community is called its niche.

Each animal and plant in a community must meet its needs. The place where an animal meets its needs is called its habitat. A habitat must provide the food, water, protection, and space that an organism needs. These habitat components must also be in the proper spatial arrangement (distance, accessibility, etc.) so that they are useable by the organism.

Activities related to this concept:
Pre-visit Activities D, E, and F
On-site Activities B, D, E, and F
Post-visit Activities C, F, and G

Interrelationships:

Interaction and interdependence exists between living and non-living things. For instance, living things depend on minerals and water for survival. Some organisms cooperate with one another, others compete. Nothing exists in isolation - a change in one strand of the food web affects the entire web of life.

Activities related to this concept:
Pre-visit Activities C, E, and G
On-site Activities B, D, F, and I
Post-visit Activities D and F

Change:

Change occurs all the time and at all scales in natural systems. At the geologic time scale, mountains rise and fall. Over hundreds of years, an open field may undergo successional changes and become a forest. Organisms are born, grow, and die. When living things die, they are broken down, decomposed, recycled, and used by other living things.

Activities related to this concept:
Pre-visit Activities C and F
On-site Activities D, G, H, and I
Post-visit Activities E, F, and G

Adaptations:

Every living thing has certain physical structures and behaviors that enable it to survive and reproduce successfully in its environment. Some organisms have become highly specialized to a particular environment. Other organisms are able to survive in a wider variety of habitats and are considered generalists.

Activities related to this concept:
Pre-visit Activities E and F
On-site Activities A, B, D, E, and H
Post-visit Activities C, E, F, and G

(*Earth Education* 1990)

Throughout your teaching of the above concepts, help your students understand how humans have been, are, and will continue to be an important factor affecting ecological processes. Because of our role in these processes, humans have a responsibility to all living things.

CHAPTER 3
Leading a Field Trip

A. Pre-trip Planning

1. General Tips

2. Checklist for Planning a Successful Field Trip

3. Contact Information for Red River National Wildlife Refuge

4. Group Management Tips

B. Rules of Respect on the Refuge

C. The Day of the Field Trip

1. Leaving the School

2. At the Refuge

3. Going Back to School

D. Post-trip Considerations

1. Wrap-ups

2. Evaluations

A. PRE-TRIP PLANNING

1. General Tips:

You may have a wealth of experience in organizing field trips and already be familiar with an effective planning process. However, the following tips may serve as a reminder or be helpful to those who are newer to field trip planning and preparation.

Careful planning can mean the difference between just a fun day outside and a meaningful learning experience. It is not just the educator who needs to be prepared for a field trip - students also need to plan and prepare.

During your planning, we suggest that you think of the Refuge as an outdoor classroom, a place where you can enhance your students' classroom learning experiences.

If the Refuge offers teacher training workshops or group leader orientation, plan to take advantage of this opportunity.

Clear the trip with the appropriate school administrative officials.

Follow the district procedures for field trip requests, bus reservations, insurance, substitutes, group leaders, permission slips, first aid, medication, special needs, and emergency preparedness.

Schedule a field trip date.

Check the school and community calendar and with school staff for conflicts. *Call the Refuge staff to reserve a trip date* (See p 41 for Refuge contact information). Also, discuss with the Refuge staff how you can best plan for inclement weather. Notify school staff of the field trip purpose, date, times, and location. Provide the other teachers in the building with a list of the students going on the field trip.

Review the *Rhythms of the Refuge: Educator's Guide*.

Look at the background information and activities in the *Rhythms of the Refuge: Educator's Guide* as an overview of what the Refuge and the guide has to offer. The guide is designed to assist you in teaching your students about ecological concepts in a fun and interactive manner. The activities are centered around what you can observe at Red River National Wildlife Refuge.

Become familiar with the site.

Just as you visit your classroom before a new school year begins, it is important you visit the Refuge before you bring your students. By taking the time to become more familiar with the Refuge lands and facilities, you will be better able to teach on the day of the trip. Note places where groups can gather and the

locations of rest room facilities, etc. If possible, take the time to meet the Refuge staff. It is also helpful to have the other group leaders visit the site before the field trip, if possible. Because the Refuge changes every season of the year, plan the "pre-field trip" visit in the same season as you plan to bring the students.

Determine the field trip general objectives.

To make the field trip effective, consider the following questions and plan accordingly:

- What are one or two understandings and/or ecological concepts that you would like the students to leave with at the end of the day? Review the Basic Ecological Concepts (See p 29), pick one to several of these concepts as a focus of the field trip.
- What would you like students to be able to do as a result of the field trip? What knowledge should the students gain? Are you trying to encourage a change in behavior or attitudes?

Planning the field trip general objectives does not mean you must develop and adhere to a strict field trip schedule. Instead, determine a few basic concepts, ideas, and/or skills that you want the students to learn from the field trip experience, and keep these in mind throughout the planning.

Get input and suggestions from the students.

Involve the students in planning the field trip. Allowing them to have input about the trip may increase their interest and excitement. The students may enrich the trip by providing you with new and creative ideas. Ask them, "What would you like to do, see, and learn at the Refuge?

Recruit adult group leaders.

Ask interested parents for their participation in the field trip by sending a letter home with the students. You may want to provide a summary of the field trip general objectives, as well as a summary of the responsibilities of the adult group leaders.

Select/modify/develop the lesson plans and activities that will help you meet the general objectives for the field trip.

With your overall general objectives in mind, select relevant activities from the *Rhythms of the Refuge: Educator's Guide*. The summary information on the first page of each activity will help you select appropriate activities.

As previously stated, there are more activities in the *Educator's Guide* than you can complete in one field trip. Ideally, you will be able to do several pre-visit activities, three to six on-site activities, and several post-visit activities. Including

pre- and post-visit activities will help students connect the field trip with classroom learning.

The field trip should not be a day where your students become overloaded with too many facts. Some detail makes the learning interesting, but as you know, students should see the relevance and larger meanings of what they are learning. Use information and activities that help illustrate these larger meanings.

If you want to modify some of the existing activities, resources to help with this process can be found in Appendix E. Add some of your own activities if you would like!

Develop your field trip schedule.

A field trip runs more smoothly when all participants know where they are supposed to be at what times. As you plan your itinerary, remember you will need to be flexible and adaptable. Inclement weather and delayed buses can require schedule adjustments. **All field trip leaders should have a copy of the trip schedule.**

Consider the following factors as you develop your field trip schedule:

- How old are your students?
- How much detail do you want to cover at each station?
- How experienced and knowledgeable are your other group leaders?
- Are the activities and concepts taught in them simple enough for the leaders to teach?
- How prepared are you to teach your group leaders?
- How many activities have you planned for each learning station?
- How much time will you have at the Refuge?
- How many rotations/stations do you want to have?
- Where and when can the students have rest room breaks and lunch/snack breaks?
- What are your options if there is bad weather?

When planning your schedule, allow some extra time for the introduction and closing of the field trip. For logistical reasons, buses may be late in the morning. Also, it may take a few minutes longer than expected to get groups back to a central location in the afternoon. Rotation times can vary from 20-60 minutes, depending on the level of detail and the number of activities you wish to cover at each station.

On your pre-field trip visit, keep track of how long it takes you to make transitions from location to location. In estimating how long these same transitions will take a school group, you may want to almost double the time it takes you to make these transitions.

You are welcome to call the Refuge staff and ask for suggestions and assistance with scheduling. We are happy to help!

Example schedule:

TIME	EVENT
8:15-8:30 am	Take attendance as students board buses
8:30-9:00 am	Travel to the Refuge
9:00-9:15 am	Bus arrives at the Refuge headquarters. Rest room break.
9:15-10:00 am	Welcome - presented by Refuge staff Group leaders receive orientation to the site
10:00-10:35 am	First Rotation
10:35-10:45 am	Switch groups (rest room break?)
10:45-11:20 am	Second Rotation
11:20-11:30 am	Switch groups
11:30-12:05 pm	Third Rotation
12:05-12:45 pm	Lunch/rest room break
12:45-12:55 pm	Switch groups
12:55-1:30 pm	Fourth Rotation
1:30-1:45 pm	Return to central location/rest room break
1:45-2:15 pm	Closing - presented by Refuge staff Group leaders clean equipment and buildings
2:15 pm	Board the bus

2: 15-2:45 pm	Travel to back school

Divide your students into small groups.
Before you arrive at the Refuge, you should divide your students into groups for the different rotations. Get input from other educators/group leaders about group composition. Sometimes separating friends is useful, sometimes it is not. Obtain name tags for students. It is fun to use plant or animal coded name tags to designate the groups. Name tags are helpful for both your group leaders and the Refuge staff.

Hold Group Leader Orientation or Distribute Group Leader Informational Letter.
We suggest you hold an orientation prior to the field trip so group leaders know their responsibilities and have an understanding of the trip schedule before the trip date. If a meeting is not possible, send out informational letters that explain group leader responsibilities and the field trip schedule. In the letter, remind group leaders of their responsibilities as well as what to bring on the trip (See Appendix F for example letter). Provide group leaders with a photocopy of the activity they will be facilitating. It is helpful if they know what they are doing before the day of the field trip. You may also want to mail them a photocopy of the Group Management Tips (See p 42).

Create bus rosters and assign group leaders to groups.

Make a detailed list of the materials you will need to bring.
A helpful item for each student is a clipboard or stiff notebook so he/she has a solid writing surface.

Send in the Pre-visit Planning Sheet to the Refuge (See Appendix F).
This should be received by the Refuge staff at least 2 weeks before the trip. On the Pre-visit Planning Sheet, note equipment that the Refuge staff can provide for you and submit requests for that equipment.

Make a list of the materials that students will need to bring on the field trip.
Include this list on a note home to the parents to ensure the students come with the necessary clothes and equipment (See Appendix F for example letter).

- Bag lunch with drink, no glass
- Plastic water bottle
- Comfortable clothes and closed-toe shoes that can get wet and dirty
- Change of clothes or shoes to keep on the bus
- Socks and long pants to protect against poison ivy/oak and insects
- Sun screen
- Insect repellant
- Hat
- Rain gear or jacket depending on the weather
- NO umbrellas (they have sharp points that can be dangerous)
- NO valuables that might get lost or damaged

Distribute Parent Letters/Permission Slips.
Give students their permission slips and a deadline for return of the slips. You may want to include a request for parent group leaders on the permission slips if you do not yet have enough group leaders (See Appendix F for example letter).

Plan activities that students can do on the bus and during transitions.
This will help you with group management issues. Some ideas for activities during these times can be found in Chapter 5 (General Refuge Activities). Choose activities that mesh well with the general objectives of your trip.

Do pre-visit activities.
You can divide students into their field trip groups for these activities to help group bonding and team strengthening. If possible, do a pre-visit activity outdoors so learning outside the classroom is not a novel experience on the day of the field trip.

Go over the safety procedures.
Students may be more attentive to safety and stewardship principles prior to the day of the field trip. Several of the pre-visit activities incorporate these principles into the learning. Allow time to discuss the reasons for safety procedures.

2. Checklist for Planning a Successful Field Trip:

- Clear the field trip with the appropriate school administrative officials.
- Schedule a field trip date. Consider alternative dates.
- Review the *Rhythms of the Refuge: Educator's Guide*.
- Become familiar with the site.
- Recruit adult group leaders. Emphasize that this will be a fun-filled learning experience.
- Arrange transportation.
- Select/modify/develop lesson plans and activities that fit into the curriculum and take advantage of students' interests. Design/adapt/photocopy the Student Pages for your students to use during the field trip (optional).
- Develop a field trip schedule. When planning your schedule, consider: small group divisions, distribution of equipment, travel time, timing of activities, and rainy day alternative activities.
- Divide students into small groups. Obtain group-coded name tags. This helps students to identify their groups and helps leaders and Refuge staff identify the students.
- Sign up adult leaders to attend an orientation, visit the Refuge with the group leaders, or arrange an informational meeting at your school.
- Send out an informational letter to group leaders. Provide activity information and group management tip sheet to adult group leaders at least TWO WEEKS before your field trip.
- Create bus roster and assign group leaders to groups.
- Make a detailed list of materials you will need to bring with you on the field trip.
- Send the Pre-visit Planning Sheet to the Refuge staff **at least two weeks prior to your visit.** This gives the Refuge staff the time to prepare equipment for your visit, if needed.
- Distribute parent letters and permission slips.

- Do pre-visit activities, if possible.

- Plan activities that students can do on the bus and during transitions.

- Remind students to dress properly. Ask students to bring a warm jacket and rain gear, and to wear clothes they will not mind getting dirty. Students should wear sturdy, closed-toe walking shoes. They should bring a backpack or other bag for carrying notebooks etc. A backpack is preferable because it will keep their hands free to do other things. You may want to have them bring a change of clothes and/or shoes.

- Don’t forget lunches! Bring a bag for collecting lunch garbage; the bag should be packed out to help encourage low-trash outings. Clean up the lunch area afterwards!

- Prepare students for the field trip. Let them know where they are going and the behavior expected of them. You may want to have the students participate in establishing their “own” list of expected behaviors.

- Designate an adult group leader to be responsible for collecting, cleaning, and returning the group’s equipment. All equipment must be cleaned according to the guidelines on your checkout list on the pre-visit planning sheet.

3. Contact Information for Red River National Wildlife Refuge

Contact person: Lisa Shook

Phone number: (318) 742-1219 or (318) 540-9877

E-mail address: lisa_shook@fws.gov

Fax number: (318) 742-1259

Refuge mailing address: 11372 Hwy 143, Farmerville, LA 71241 (complex office)

Location of the Refuge headquarters: 555 Sunflower Rd.

Amount of advance notice necessary for field trips: Two weeks notice is sufficient to get supplies ready, but the earlier you can schedule your trip, the better your chances of getting your first choice of dates.

4. Group Management Tips:

Learning in an outdoor classroom can be fun and exciting for educators and students alike. It offers unique learning opportunities for all. Here are a few suggestions for a successful experience:

Be prepared:
Read and prepare for your activity before the field trip. This will help you feel comfortable teaching it. If you are comfortable, your students will be too.

Have a focus:
Remember you cannot teach the students everything about any topic. Keep your main idea in mind when you are talking. What do you want the students to learn?

Enthusiasm:
Nothing is more contagious than enthusiasm. Sometimes students need a reminder that it is a good thing to be excited about learning. If you are talking about the plants and animals that live along the shore of a marsh, bend down to really show the kids the plants - get your hands dirty!

Demonstrate:
Demonstration is more effective than description. When you are explaining an activity, demonstrate it at the same time.

Speak with the group:
When you are outdoors talking with a group, you can help to make sure they hear you by facing them and talking clearly. Talk with them, not AT them. Try to speak at a volume that is loud enough for your students to hear you, but not so loud as to scare away wildlife. Let the students know they can ask questions. Also, place the kids so their backs are to the sun. If they have their backs to the sun, they will not need to squint to look at you and may pay more attention.

Eye contact:
As you speak, look around at all the students in the group. This will let them feel more connected to you, and you may be better able to tell if they are confused or daydreaming.

Stimulate imagination and critical thinking:
Delivering facts is only a small part of teaching. Getting students to think is the key to making this trip a memorable experience. Help students understand the relevance of what you are discussing, not all of its details. Discuss larger meanings.

Encourage curiosity:
Throughout the field trip, encourage students to ask questions and point out what they see. It is okay to say, “I don’t know” - do NOT feel like you need to know all of the answers to their questions. Encourage students to write down their questions and make some observations that may help them to answer their own questions back in the classroom.

Asking questions:
The students should not see you as the only source of knowledge. Let them ask AND answer questions. They will ask you questions; however, you can also ask them questions. This will encourage critical thinking and participation in the activity.

When you ask questions, give the group approximately 5 seconds to think before you give them the answer or before you call on someone. This will allow students time to think more deeply about your question and consider several alternative answers.

Teachable moments:
Take advantage of unplanned things around you. For example, if you are talking about the water cycle, and someone spots a coyote in the distance, stop, watch, and then discuss the coyote. You can either work the coyote into the discussion or forget the water cycle for a moment. Resume your discussion when the coyote moves on. These are teachable moments that an outdoor classroom can offer – take advantage of them!

Trail management:
Think of creative ways to hold your group’s attention as you are moving from site to site. Use the General Refuge Activities in Chapter 5 for ideas.

Educator assistance:
If you have a question, ask an available educator or the Refuge staff. If you need an additional activity to fill some time, get some ideas from someone else.

B. THE RULES OF RESPECT AT THE REFUGE

Before your group visits the Refuge, have a discussion about what kind of behavior they think is appropriate on the field trip. As a class, brainstorm a list of rules and discuss it. Such a discussion can make students more likely to be courteous while on the Refuge because they have “designed” the rules.

Remind the students - the Refuge is different than a playground. It is protected as are the plants and animals that live there. The students can play an important role in protecting the Refuge.

It may also help to remind the students that they will be visiting the home of many plants and animals. They should act like polite guests. (Also see: Pre-visit Activity 4A: What is a national wildlife refuge?

Below is a list of the basic behaviors that students and all visitors should follow while on the Refuge:

THE OUTDOORS IS A PLACE FOR LEARNING, JUST LIKE THE CLASSROOM.
Follow directions and be respectful of others, including the plants, animals, and people!

HIKE ONLY ON ESTABLISHED TRAILS.
By staying on the designated trails, students will not harm the plants and animals. This will allow others to enjoy the plants and animals too!

TAKE ONLY MEMORIES, LEAVE ONLY FOOTPRINTS.
All of the plants and animals on the Refuge are protected. Collecting flowers, rocks, or any other natural objects is not allowed. Students can take pictures, drawings, rubbings, and memories.

REPLACE WHAT YOU PICK UP.
If students want to pick up a stick or a rock to look at it, they should put it back where and how they found it. Help students relate to this by asking them how they would feel if someone came into their room and turned their bed upside-down or emptied their closet.

WALK AND TALK QUIETLY.
The students will see and hear more if they are moving quietly. They will also disturb less wildlife. Silence can allow you to listen to nature.

NEVER RUN OR CHASE ANY ANIMALS YOU SEE. YOU COULD INJURE THE ANIMAL OR YOURSELF.
Chasing an animal forces it to burn energy that it needs for survival. Also, the animals are protected by law. Be respectful and quiet when watching an animal. Remember, seeing the animal is part of the reason you are there.

CLEAN UP YOUR TRASH.
Do not leave trash anywhere on the Refuge. Pick up litter that you see. Recycle at designated places. Help keep the Refuge clean!

STAY WITH YOUR GROUP.
For safety reasons, students should stay with their group at all times.

TOUCH AND TASTE ONLY IF GIVEN PERMISSION.
Some plants are poisonous. Students should only taste something if they are directed by an adult to do so.

DO NOT DO EXTRA "EXPERIMENTS" - YOU COULD CAUSE INJURY.
Just as in the classroom, some students have the tendency to design their own "experiments" that can be dangerous to themselves and/or harmful to plants and animals. Out of respect for the plants and animals on the Refuge, students should follow the directions given by their leader.

CLEAN EQUIPMENT.
Return things how you found them.

ENJOY YOURSELVES!
This is your National Wildlife Refuge!

C. THE DAY OF THE FIELD TRIP

1. Leaving the School:

Orientation meeting.
Hold a meeting with all parent group leaders (and other educators, if possible) before school to fill them in on the schedule details, answer any questions, and discuss any last minute changes. Assign the group leaders to their groups, and provide them with a list of their students. Give them specific jobs for the trip, as needed. Make sure the group leaders know they have the authority to redirect inappropriate student behavior and make decisions if an educator is busy or unavailable. You may want to give them the Group Management Tips handout, if you have not already done so (See p 38-39).

Bring supplies to the loading area.
Ask the students to help you bring the necessary materials to the bus loading area (water jugs, first aid kit, activity materials, etc.). Make sure students have their medications, including inhalers. You may have to carry the medications, depending on school policy.

Take roll as students load the buses.
Assign educators to check off students' names as they actually load the bus. Use this opportunity to check whether each student has the required supplies, clothing, lunch, permission slips, etc. before they load the bus.

Bring a camera/video camera.
Record the day's events so you can show the administration and future classes the benefits of this field trip.

Bring a cellular phone.
Give the number of the cell phone to the office. Leave the phone on all day. If possible turn the ringer off so as to not disturb the outdoor experience.

2. At the Refuge:

Check in at the Visitor Center upon arrival.

Even if you are not going to have the Refuge staff provide an introduction upon arrival, let the Refuge staff know you are on the Refuge. This allows the Refuge staff to inform you of any last minute changes or other information (Ex: wildlife that has been spotted recently, closed roads, etc.). Stop at the rest room before going out onto the Refuge.

Safety precautions.
Remind students of appropriate behaviors. Remind students to stay where they are if they get lost.

Buddy system.
Have students look out for each other on the trip. Never let students go to the rest rooms without a buddy.

Go over the itinerary on arrival.
Discuss the itinerary with the students so they know what to expect.

Refuge equipment.
If you borrow any of the Refuge staff's educational equipment, count and return it in the same condition you found it. You may want to assign an adult to be in charge of this at the end of the day.

Check out with Refuge staff on leaving.

3. Going Back to School:

Have students and group leaders fill out evaluations.
On the way back to school, have the students and group leaders fill out evaluations of the trip (See Appendix G). While they are on the bus, the day will still be fresh in their mind. If possible, provide the Refuge staff with copies of these evaluations.

Talk with any students, group leaders, and educators who have specific comments or questions about the field trip.

Have fun!
Expect Murphy's Law to work overtime.
Have fun anyway!

D. POST-TRIP CONSIDERATIONS

1. Wrap-ups:

Post-visit activities.
A field trip that occurs in isolation will not be as effective as a field trip that is integrated with classroom experiences. Use the post-visit activities (See Chapter 7) to help students synthesize their learning.

Discuss student questions and comments.
Let students research the answers to any questions they had about what they saw and experienced at the Refuge.

Assess student learning.
Use some of the extensions/adaptations and assessment ideas listed after each activity description.

2. Evaluations:

Educator evaluations.
Provide the Refuge staff with feedback by filling out the Educator Field Trip Evaluation. Tell us what you liked and what you would change about your field trip. This will help us to help you and other classes on future trips (See Appendix G).

Other Feedback.
If appropriate, send the Refuge staff the feedback from the students, group leaders, and other educators. What did they like? What would they change? (See Appendix G). This is important information to the Refuge staff.

CHAPTER 4
Pre-visit Activities

A. What is a National Wildlife Refuge?

B. What is Special about Red River National Wildlife Refuge?

C. The Web of Life

D. Habitats: Survey and Compare

E. How Many Bears Can Live in This Forest?

F. Migration Headache

G. Wetland Metaphors

Pre-visit Activity A: What is a National Wildlife Refuge?

Adapted with permission from *Partners for Education: A Teacher's Guide to Using National Parks as Classrooms* – "What is a National Park?"

Method: This lesson is designed to introduce students to national wildlife refuges. Students will work in small groups, and each group will learn about a specific refuge. Students will also learn about the mission of the National Wildlife Refuge System and the role of individual refuges in the Refuge System.

Objectives: Students will be able to

- Explain the mission of the National Wildlife Refuge System
- Explain the importance of the National Wildlife Refuge System for wildlife, especially migratory water birds
- Name at least two refuges and describe resources that they protect
- Describe a basic code of conduct appropriate on a refuge

Materials:

- Copies of Student Page - "National Wildlife Refuge Expert's Notes"
- Map of the United States of America
- Push pins to mark locations of refuges on the map
- Brochures from national wildlife refuges (1 for every 3 students)
- National Wildlife Refuges - A Visitor's Guide brochure

Subjects: Social Studies, Civics, Science

Time: 2 45-minute sessions or 1.5 hours

Setting: Classroom

Grade Level: 4-12

Skills: Brainstorming, cooperating, interpreting photographs, using maps, oral communication, reading for details, formulating questions

Vocabulary: big game, climate, conservation, ecosystem, habitats, management, recreation, resources, species, waterfowl, wetland, wildlife

Background information:

Origins of National Wildlife Refuge System:

The National Wildlife Refuge System began in 1903, when President Theodore Roosevelt established 3-acre Pelican Island in Florida as a Federal Bird Reservation. This was the *first* Federal land set aside specifically to protect wildlife. However, the foundations for protecting wildlife and land resources began long before this date.
In the mid-1800's, certain groups became more aware of the importance of fish, wildlife, and land resources. Scientists began to see evidence of depleted natural resources, as did hunters and fishers. These groups began to lobby Congress for protection of the nation's resources. Interest increased in saving our nation's wild lands.

From its modest beginnings in Florida, the National Wildlife Refuge System has continued to grow. In 1912, the National Elk Refuge (Wyoming) was established; it was the first unit to be called a "refuge."

The passage of the Migratory Bird Hunting and Conservation Stamp Act ("Duck Stamp" Act) in 1934 helped provide the money needed to buy land for refuges. Under this act, duck hunters are required to buy the Federal duck stamp, thereby supporting the Refuge System. The act also opened up parts of the Refuge System for hunting. In the same year, the passage of the Fish and Wildlife Coordination Act authorized Federal water resource agencies to acquire land in order to protect and enhance fish and wildlife.

Influential People:

Several people were influential in the development of the Refuge System. A committee formed by President Franklin Roosevelt in 1934 had great impact. The members of the committee were Aldo Leopold, J.N. "Ding" Darling, and Thomas Beck. This committee advised the President on the needs of waterfowl. In 1935, J. Clark Salyer II was sent around the nation to select new refuge areas. Many of these new refuges provided habitat for waterfowl. Salyer is considered by most to be "the father of the Refuge System." For 31 years, he oversaw refuge administration and management and defended the integrity of refuges and the wildlife that used them.

1960's-1990's:

In the early 1960's, United States citizens were becoming more interested in outdoor recreation. The Refuge Recreation Act (1962) opened up refuges for more recreational uses, including education. The major stipulation of this act was that recreation could not interfere with the primary goals of the refuge. Further legislation in the 1960's helped to establish guidelines for administration and management of refuges.

In 1997, Congress passed the National Wildlife Refuge System Improvement Act, which provided clarification of the Refuge System's mission. As established by the act, the mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources of the United States for the benefit of present and future generations of Americans.

Refuges Today and in the Future:

Refuges are unique because their primary purpose relates to the conservation and management of fish, wildlife, and plant resources. Almost a century after the first refuge was established, the Refuge System includes more than 540 refuges and encompasses more than 95 million acres. At least one refuge is found in every state, American Samoa, Puerto Rico, the Virgin Islands, the Johnson Atoll, Midway Atoll, and several other Pacific islands.

There is a wide diversity among refuges. Refuges are found in a variety of habitats and climates. The present Refuge System protects a variety of organisms, including insects, molluscs, plants, birds, fish, reptiles, amphibians, and mammals. Refuges also vary greatly in size. The smallest refuge is Mille Lacs National Wildlife Refuge (Minnesota) - it is only a half-acre in size. The Arctic NWR (Alaska) is one of the largest refuges - it covers 19.2 million acres. Some refuges are found adjacent to cities (Rocky Mountain Arsenal NWR - Denver, Colorado) while most are found some distance from a major city.

The National Wildlife Refuge System is a shining example of the value that Americans have placed on wildlife. Those who helped to found the Refuge System showed great foresight. It is a truly magnificent wildlife conservation program unique in the world.

Rachel Carson's Essay about National Wildlife Refuges:

If you travel much in the wilder sections of our country, sooner or later you are likely to meet the sign of the flying goose - the emblem of the national wildlife refuges.

You may meet it by the side of a road crossing miles of flat prairie in the middle West, or in the hot deserts of the Southwest. You may meet it by some mountain lake, or as you push your boat through the winding salty creeks of a coastal marsh.

Wherever you meet this sign, respect it. It means that the land behind the sign has been dedicated by the American people to preserving, for themselves and their children, as much of our native wildlife as can be retained along with our modern civilization.

Wild creatures, like men, must have a place to live. As civilization creates cities, builds highways, and drains marshes, it takes away, little by little, the land that is suitable for wildlife. And as their space for living dwindles, the wildlife populations themselves

decline. Refuges resist this trend by saving some areas from encroachment, and by preserving in them, or restoring where necessary, the conditions that wild things need in order to live.
(From the "Conservation in Action"series. The series was a collection of writings about individual refuges and the Refuge System)

Summary of Key Events:

1903: Beginning of the National Wildlife Refuge System - President Theodore Roosevelt established Pelican Island (Florida) as the first bird sanctuary. During his term, he created 51 bird reservations and 4 big game preserves.

1918: The Migratory Bird Treaty Act between the U.S. and Great Britain (for Canada) became the foundation for future legislation that would greatly expand the Refuge System.

1934: President Franklin D. Roosevelt convened a committee to determine how to save waterfowl during the Dust Bowl era. Conservationist Aldo Leopold, cartoonist J.N. "Ding" Darling, and publisher Thomas Beck suggested a "Duck Stamp" act to raise funds for acquiring wetland habitat. Congress passed the Migratory Bird Hunting and Conservation Stamp Act ("Duck Stamp" Act).

1935-1936: "Ding" Darling, head of the U.S. Biological Survey (the predecessor of the U.S. Fish and Wildlife Service) sent biologist J. Clark Salyer II to locate prime wetlands nationwide. The 600,000 acres that were eventually purchased became more than 50 refuges, including Red Rock Lakes (Montana) for trumpeter swans and Agassiz (Minnesota) for waterfowl.

1940: The U.S. Fish and Wildlife Service was formed as a part of the Department of the Interior.

1966: The National Wildlife Refuge System Act was passed. It included measures to preserve ecosystems for endangered species, perpetuate migratory bird species, preserve natural diversity, and create public appreciation for wildlife protection.

1980: Alaska National Interest Lands Conservation Act adds almost 54 million acres to the Refuge System in that state.

1997: National Wildlife Refuge Improvement Act legally establishes the conservation of fish, wildlife, and plants as the mission of the Refuge System. The Act also gives priority to certain wildlife-dependent recreational uses on refuges so long as they are compatible with the purpose of the refuge and the mission of the Refuge System. These uses are hunting, fishing, wildlife observation, wildlife photography, environmental education, and interpretation.

Suggested Procedure:

1. Explain to the class that they will be visiting a national wildlife refuge on their field trip. On the trip, they will have the chance to explore the refuge and participate in activities. The purpose of this lesson is to discover what refuges are and why they exist.

2. Ask the whole group to brainstorm what they think of when they hear “national wildlife refuge.” Record students’ answers on an overhead or on the board.

3. Discuss the history of the Refuge System.

4. Organize the class into cooperative groups of 2-3 students. If the activities that you plan to do on your field trip require group work, you may wish to use this activity to establish the groups for the trip. Ask the students to think of a name for their group.

   Suggested tasks for students working in cooperative groups:

   TIME KEEPER - makes sure the group finishes their task in the allotted time

   RECORDER - records the group’s ideas or writes the group’s answers to specific questions

   REPORTER - presents the group’s findings to the class

   MATERIALS MANAGER - is responsible for any materials that the group needs

   FACILITATOR - makes sure everyone in the group participates in the activity and feels that they are part of the process

1. Give each group a brochure from a National Wildlife Refuge and one copy of the Student Page “National Wildlife Refuge Expert’s Notes” (p 57). Each brochure contains a variety of information about a particular refuge.

   The refuges selected for this activity are all located in the central region of the United States. When the students map the locations of their refuge, they will begin to see that some refuges play an important role in the migration of water birds. Such refuges provide resting and eating areas along migration routes.

   If the reading level in the brochures is too high for your students, consider trying one of the following suggestions:

- Place emphasis on the photographs in small group work and read parts of the brochures to the whole class later.
- Place one of your strongest readers in each group
- Lead the activity with the whole class rather than using small groups
- Invite students from a higher grade to do the activity with your class - place at least one older student in each group

1. Make learning about the different refuges fun by challenging your students. Tell them that each group's assignment is to become experts on a refuge and report their discoveries to the class. Part of their task during the group presentation is to demonstrate their expertise to the class. They need to be convincing experts. Explain that the Student Page you will give them will help get them started, but they will need to seek out other information in their brochure. If possible, provide them with props (hats, shirts, etc.) to help them get into their roles.

2. Have each group report on "their" refuge, display the refuge's brochure, and place a marker on the map of the United States where the refuge is located.

3. After the groups have presented their information, ask them if they notice a pattern on the map related to the locations of the refuges. The refuges picked for this lesson are all in the central area of the United States and illustrate a "pathway" for migratory birds (called the Central Flyway). Discuss this as one of the values of the refuges. You may also want to remind the students that these refuges are just a few examples of the approximately 540 refuges. Show them the map included in the National Wildlife Refuges - A Visitor's Guide brochure to give them a more full understanding of the Refuge System.

4. Ask the class if there is anything they would like to add or delete from the list they developed concerning what they think of when they think of a refuge.

5. Ask the students to make inferences as to what they think the purpose of the National Wildlife Refuge System is, based on what they know and what they have learned from the brochures. As a class, try to brainstorm a mission statement for the Refuge System.

6. Copy the National Wildlife Refuge System's mission statement onto the board or an overhead (See Background Information). Have the students compare the two statements and discuss the mission of the National Wildlife Refuge System.

7. Explain to the class that even though the National Wildlife Refuge System was established to protect our nation's plants and animals, the U.S. Fish and Wildlife Service cannot do this job alone. The plants and animals that every refuge protects are threatened in some way. Environmental degradation, such as water and air pollution, loss of habitat, exotic plant and animal species, and other problems, affect natural

resources. Vandalism, acid rain, adjacent development, and other problems also affect natural resources.

8. Explain that the Refuge System belongs to us all. It is everyone's responsibility to learn about and care for the refuges.

9. Refer to Rachel Carson's essay and discuss what the quote means (See Background Information). Ask the students to imagine they are on a talk show and the interviewer asks them to answer the question, "What do you think of the national wildlife refuges?" Have them record their own responses.

10. Close the session by having the students brainstorm a code of conduct for how they should behave when they visit the Refuge on their trip. Use "The Rules of Respect on the Refuge" (Chapter 3 Section C) as a reference. Explain that because refuges are protected, Federal law prohibits removing anything from the Refuge. Use the motto: "Take only memories, leave only footprints."

Extensions/Adaptations:

- As a class, make a time line illustrating the history of the National Wildlife Refuge System using the brochures and background information. Add important dates in U.S. history to the time line. Research other refuges near you and add them to the time line as well. Have the students find out if any refuges were established in the year they were born, or during other years significant to them.

- If your class has computer access to the Internet, have the students visit the National Wildlife Refuge System's home page (http://refuges.fws.gov) or go to the home pages of individual refuges (accessible through the National Wildlife Refuge System's home page). They can download pictures and information from the Web or send email questions to refuges.

Assessment Ideas: Student Page - "National Wildlife Refuge Expert's Notes"

NATIONAL WILDLIFE REFUGE EXPERT'S NOTES

GROUP NAME:_____

GROUP MEMBERS:

You and your group are about to become EXPERTS on a national wildlife refuge. The challenge is that you will not be able to visit this refuge in order to see the area first-hand. All you have been given is the brochure from that refuge.

You will be presenting what you know to your classmates, and you will need to show them exactly what you know! You need to make your classmates believe that you know everything there is to know about this refuge.

When speaking to the class, you will be able to use your notes, so use this worksheet to write down information that an expert would know about the refuge. The questions listed below will help get you started, but you will find that there are other interesting tidbits of information you want to write down and share with the class to prove to them that you know lots about this refuge.

1. BASIC INFORMATION:

a. What is the refuge's name?

b. How long ago was the refuge established?

c. In what town and state is the refuge located? (Be ready to place a marker on a map to show where the refuge is located.)

2. What kinds of plants and animals are found on this refuge?

3. What activities can people do on this refuge?

4. What are three things that make this refuge special?

5. What are two reasons this refuge should be preserved and protected for future generations?

OTHER INFORMATION ABOUT THE REFUGE:

Pre-visit Activity B: What is Special About Red River National Wildlife Refuge?

Method: Students will learn about Red River National Wildlife Refuge (NWR) by reading the brochure, searching the web site, and using field guides to research species that are found on the Refuge.

Objectives: Students will be able to

- Explain why Red River NWR was established
- Use brochures and the Internet to learn about the Refuge
- Describe several species that they may see at Red River NWR
- Use a field guide to identify a given organism

Materials:

- Copies of Student Page - "What is Special About Red River National Wildlife Refuge?"
- Red River NWR brochures (1 brochure for every 3 students)
- Rulers (1 for every three students)
- Species lists from Red River NWR
- Field guides (At least 1 field guide for every three students)
- Internet access (1 computer for every 3 students)

Subjects: Science, Computers**,** Geography

Time: 60-90 minutes

Setting: Classroom

Grade Level: 3-12

Skills: Reading, researching, classification, identification, Internet use, discussion, map reading

Vocabulary: field guide, habitat, map scale, map symbol

Background information:

Information about Red River National Wildlife Refuge is available from a variety of resources, including the Refuge brochures and website. Using the Refuge brochures, students can quickly obtain basic information about the plants and animals, habitats, recreation opportunities, regulations, and history of the Refuge. Exploring the Refuge website provides another opportunity to learn about the Refuge. Often, students will also be able to learn about current events on the Refuge from the website. Using the Internet to learn about the Refuge also provides an opportunity to practice computer skills.

Understanding how to use a field guide is an important skill for learning about the natural world. Field guides vary in organization – the organization is usually explained in the opening pages of the field guide. For example, some wildflower guides are arranged by flower petal color. In contrast, many bird field guides are arranged into family groups.

Some field guides are organized as a dichotomous keys. With this system, students examine an “unknown” plant or animal, and read a description which requires them to make a choice between two possibilities. For example, if a student is looking at a tree, they may read the following descriptions:

1a. Leaves needle-like or scale-like, mostly evergreen; seeds in cones, not enclosed in a fruit (conifers)

1b. Leaves broad and annually deciduous; seed enclosed in a fruit

The student must select the correct description by examining the tree, and continue through sets of descriptions until they have identified the species.

If you want your students to learn how to use dichotomous keys, you may want to have them practice making a key using a familiar object. You could have them construct a dichotomous key of shoes. In this case, the first level of the dichotomous key might distinguish shoes with laces from shoes without laces. Students should continue to make the key until every shoe is distinguished from every other shoe. After students have constructed their own dichotomous key, the basic concept should be more straightforward.

Suggested Procedure:

1. Set up three stations: Refuge Brochures, Field Guides, and Refuge Web Page.

2. Divide your class into three groups of approximately equal size. Explain to the students that they are going to be learning about Red River National Wildlife Refuge by examining the Refuge brochure and web page. They will also be using field guides to learn about some of the plant and animal species that live at Red River National Wildlife Refuge. During this activity, they will answer questions about the Refuge on the Student Page - “What is Special about Red River National Wildlife Refuge?”

3. Refuge Brochure Station: (Materials: brochures and rulers) Red River National Wildlife Refuge brochure covers a variety of topics, including:

a. History of the Refuge
b. Basic geography of the Refuge
c. Wildlife management tools on the Refuge
d. Refuge regulations

This station is mostly self-explanatory. Students need to use the materials to answer the questions provided on the Student Page.

4. Field Guide Station: (Materials: field guides, species lists of plants and animals found on the Refuge) Try to provide guides for a variety of organisms, including plants, birds, mammals, animal signs/tracking, amphibians, reptiles, insects, and aquatic invertebrates (provide as many as possible). Try to have several bird field guides because birds are often the most visible wildlife during a field trip. Also, try to include several different plant field guides.

   NOTE: Try to bring these field guides on the trip because the students will already be somewhat familiar how to use them.

5. Refuge Web Site Station: You may want to provide the students with the web address of the U.S. Fish and Wildlife Service and/or the web address of Red River National Wildlife Refuge so they will not waste time searching for the web page.

   - U.S. Fish and Wildlife Service: http://www.fws.gov
   - Red River National Wildlife Refuge: http://www.fws.gov/northlouisiana/RedRiver/

   NOTE: In some cases, it may not be possible to use computers for this activity. If computer access is not possible, print and photocopy the relevant pages from the Refuge website beforehand so students can at least get a general idea of the information they can obtain from the website.

6. Bring the class back together. Go over the following points to help students prepare for the field trip.

a. What did they learn about the Refuge? (Example: Why was Red River National Wildlife Refuge created?)
b. How was the information in the brochures different from the information on the Refuge website?
c. How is a field guide used?
d. What are some of the plant and animal species they expect to see at the Refuge? In what habitats do they expect to see these species?
e. Make a list of the students' predictions of both the species they expect to see and the habitat in which they expect to see them. Distribute a copy of this list to the students so they can keep track of what they actually see on the Refuge and in what habitats they see these species. After the trip, make comparisons between the students' predictions and what was actually seen. What did they see? Where did they see it? Were the species seen in the predicted habitats? Why were there differences between the predictions and results?

Extensions/Adaptations:

- Have students research another refuge in the state. Compare and contrast the two refuges.

Assessment Ideas:

- Have students make brochures or posters for Red River National Wildlife Refuge using the information they learned. Include information about the history of the Refuge, a picture/drawing and natural history description of one of the plants or animals found on the Refuge, recreational activities that are allowed on the Refuge, etc.

- Give the students pictures (or actual specimens, if available) of different plants and animals. Have them identify the organism and describe its natural history by using the appropriate field guide.

WHAT IS SPECIAL ABOUT RED RIVER NATIONAL WILDLIFE REFUGE?

NAMES:

Brochure Station:

1. **Finding Red River National Wildlife Refuge (RRNWR):** Look at the map that shows where Red River NWR is found

a. Draw the outline of the state where Red River NWR is found:

b. Draw and label the location of Red River NWR on your state map.

c. What town is closest to Red River NWR? _____ Draw and label the town on your own map.

d. How many miles is the closest town from Red River National Wildlife Refuge? (Use the map scale to answer this question)

_____

2. **Map of Red River National Wildlife Refuge:** Look at the map that shows the different areas of the refuge.

a. What is the scale of the map? _____

b. What is the distance from the most southern point of the Refuge to the most northern point of the Refuge? (Use the map scale) _____

c. What is the map symbol for the Refuge boundary? _____ Draw your own map of the Refuge, using the symbol for the Refuge boundary.

d. What is the map symbol for nature trails? _____ Draw the nature trail(s) on your map.

e. Draw and label the location of the Refuge headquarters on your map.

f. What do you see on the brochure map that you would like to see on the field trip? _____ Draw and label it on your own map.

Field Guide Station:

1. Look at the lists of plants and animals that are found on Red River National Wildlife Refuge. Select four of these plants and animals to learn about. Write their names below:

_____

_____

_____

_____

2. Use the field guides to look up each of these plants or animals. Fill in information about each plant or animal in the boxes below:

Name of plant or animal: Draw it or describe what it looks like: In what kind of habitat will you find it? (Pond, forest, prairie, etc.)
Name of plant or animal: Draw it or describe what it looks like: In what kind of habitat will you find it? (Pond, forest, prairie, etc.)

Name of plant or animal: Draw it or describe what it looks like: In what kind of habitat will you find it? (Pond, forest, prairie, etc.)
Name of plant or animal: Draw it or describe what it looks like: In what kind of habitat will you find it? (Pond, forest, prairie, etc.)

Internet Station:

Web address: _____

1. The National Wildlife Refuge System is part of what agency? The U.S.

   _____

2. How many refuges are in this state? _____
3. What are the names of the other refuges in this state?

4. Why AND when was Red River NWR established?

5. What are some animals and plants that you might see on the Refuge? In what habitats will you see these animals and plants?

I predict that I will see:	I will see this plant or animal in this habitat:
_____	_____
_____	_____
_____	_____
_____	_____

BONUS QUESTION: What is the “Blue Goose”?

Pre-visit Activity C: The Web of Life

Adapted with permission from *WOW! The Wonders of Wetlands* ("Marsh Market"), 1995. Published by Environmental Concern Inc., St. Michaels, MD (410) 745-9620

Method: Students construct a web of living and nonliving components of an ecosystem.

Objectives: Students will be able to

- Explain how the living and nonliving parts of the natural world are connected to each other directly and indirectly
- Describe two connections that their particular plant, animal, or physical component has with the web of life

Materials:

- Ball of yarn
- Cards with pictures of plants, animals, and physical aspects of the environment (sun, air, etc.)

Subjects: Science (ecology, biology)

Time: 40 minutes

Setting: Classroom

Grade Level: 2-8

Skills: Analysis, application, discussion, visualization, problem solving

Vocabulary: algae, bacteria, carnivore, consumer, decomposer, ecosystem, environment, food chain, food web, fungi, herbivore, nutrients, omnivore, producer, species

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Background Information:

The plants, animals, and physical environment of an ecosystem are interconnected and interdependent. Some relationships are direct, and simple to understand. For example, a deer has a direct relationship with the plants it consumes. Indirect relationships are less obvious. A mountain lion consume deer, but it also has an indirect relationship with plants because without plants, the deer could not live. Because of these direct and indirect relationships, a change in one part of an ecosystem can bring changes in other parts of an ecosystem. All of these connections can together be thought of as a web of life.

Beyond understanding simply that organisms are connected with one another and their physical environment, it can be helpful to discuss their relationships more specifically. Food chains are often used to illustrate some of these relationships. An example of such a food chain is:

grass ⇨ grasshopper ⇨ sparrow ⇨ hawk

The various levels of the food chain can be defined in the following way:

Producer: an organism that produces its own food (Example: algae, plants, some bacteria)

Consumer: an organism that ingests other organisms or organic matter

Herbivore: an organism that feeds chiefly on plants (sometimes called a primary consumer) (Example: grasshopper)

Carnivore: a flesh-eating organism (Example: sparrow, hawk)

Omnivore: an organism that eats both plants and animals (Example: raccoon)

Decomposer: any of the various organisms that feed on and break down organic substances (such as dead plants and animals). Decomposers are involved at every level of the food chain and play an integral role in the recycling of nutrients. (Ex: bacteria, fungi)

Expanding this food chain into a food web is simple. A grasshopper can be eaten by a number of other organisms. It may eat several types of grass. A hawk will eat multiple *species* of animals, not just one species of sparrow. Omnivores, by definition, eat a variety of organisms. In addition, decomposers play an essential role in all parts of any ecosystem, by returning the organic matter of dead plants and animals to an inorganic form that can again be taken up by plants.

A food web can be further expanded into a web of life by considering the role of air, water, and nutrients. While often less obvious, these components play an essential role in the ecosystem. For instance, without nutrients, plants may not grow well, and may not be as nourishing for herbivores.

In the end, it is clear that the web of life has many connections between organisms and their environment. Direct and indirect connections between the components make for the incredible complexity of an ecosystem.

Suggested Procedure:

1. Photocopy the Web of Life cards on p 72 these plants and animals are found on the Refuge, as are the basic components of the physical environment (sun, air, etc.).

2. Divide the students into groups of 10-15 students. Ask each group of students to stand facing one another in a circle. Hand each student one of the cards, and give them a moment to read the information on the card. Each student's card should be placed where other students can see it.

3. Begin the "webbing" by handing the ball of yarn to one of the students in the circle. Students will pass the yarn, and explain their relationship with the player to whom they are going to pass the yarn. For example, I am a RED-TAILED HAWK, and I breathe AIR. The HAWK then tosses or rolls the yarn to the student holding the AIR card.

   Relationships can be direct or indirect. For example, a HAWK depends on RABBITS for food, but it also depends on PLANTS because the RABBITS eat the PLANTS. If a student receives the yarn a second time, he/she should pass it to a student that he/she has not already tossed it to.

   NOTE: For young children, this activity works better when the students are seated and the yarn is rolled between the players.

4. Once the webbing is complete, have the students shift so the web is taut. Have students discuss how sometimes a plant or animal's role in the web may change, or disappear entirely (Ex: pollution, habitat loss, etc.). How will this affect the web as a whole?

5. Have a player "die" due to pollution, habitat loss, etc. - that player should hold up his/her hand with the yarn. When other players feel a tug in the yarn, they should hold up their hands as well. This illustrates how everyone in the web is affected, directly or indirectly, by the loss of one member. After all members have been affected, reverse the process. Ask the students how the damage can be healed. Show the recovery by having the students put their hands back down.

6. Discuss the meaning of the activity with the class:

a. Are any of the parts of the web more important to the survival of the whole than the others?

b. Are you surprised some of the plants, animals or physical elements you had considered unimportant are actually essential to the survival of the web?

7. When you are done with your discussion, have everyone place their yarn carefully on the floor. Have one of the students roll up the yarn.

Extensions/Adaptations:

- When students are passing the yarn, have them name their “role” in the ecosystem (Ex: carnivore, decomposer, producer, etc.) This reinforces the meanings of these words.

- Have students research the food habits and predators of their animals, the needs of their plants, or the importance of their physical components. Students can include this information on the back side of their cards.

Assessment Ideas:

- Have students identify the animals, plants, and physical components in another food web and describe their role (carnivore, herbivore, omnivore, etc.)

- Have students write the name of their plant, animal or physical component at the center of a page, and draw a web of life that shows the connections of their element with the other organisms and physical components of the ecosystem.

WEB OF LIFE CARDS

Customize: Develop 15-20 cards with the names of plants and animals found on the refuge, and short descriptions of where that animal or plant lives, what it eats, and what eats it. Include a variety of plants and animals, including insects, bacteria, reptiles, mammals, and birds to show the diversity of life found on the refuge. Some example cards of the physical components of an ecosystem have already been completed.

SUN The sun provides the energy so plants can grow. Without the sun, most plants and animals would not be able to live.	**WATER** Plants and animals need water to survive. Some animals and plants need more water than others. Some plants and animals can only live in water.
AIR Air provides oxygen for the animals to breathe. Air provides the carbon dioxide plants need to make their own food.	Mosquito larva Live in fresh water and are eaten by many other animals including other insects, large and small fish.
Bluegill Sunfish	Largemouth Bass

Great Blue Heron	Bull Frog

Pre-visit Activity D: Habitats: Survey and Compare

Method: Students conduct a simplified wildlife survey on the school grounds using transect lines and point surveys (explained below). This survey is then repeated at the Refuge (or in a different habitat type on the school grounds). Students use their data to compare and contrast the two areas for their suitability as wildlife habitat.

Objectives: Students will be able to

- Define "habitat" and "carrying capacity" and explain their importance to wildlife
- Observe and count wildlife in an area using a transect line and a point survey
- Compare and contrast two habitats using class data

Materials:

- Copies of the Student Page - "Wildlife Survey Report"
- 2 stakes/flags for each transect line (1 transect line for 2 students)
- 1 string for each transect line (5 meters long if possible)

Subjects: Science and Mathematics

Time: 2 50-minute sessions

Setting: Outdoors and classroom

Grade Level: 3-12

Skills: Analysis, classification, comparison, computation, discussion, evaluation, observation, synthesis, scientific investigation

Vocabulary: adaptations, carrying capacity, climate, environment, habitat, generalist, predator, prey, season, specialist, species, wildlife management

Background Information:

Habitat can be thought of as an animal's home, or address. It is the arrangement of food, water, protection, and space that is suitable for an animal's needs. Habitat is the type of surroundings in which a particular animal is generally found. For example, a red-tailed hawk is often found in somewhat open habitat. However, a red-tailed hawk also needs trees or other tall objects (Ex: telephone poles) on which to perch. In addition, there must be enough prey in the area for them to survive.

What constitutes “good” or “bad” habitat? It depends on the animal and its particular adaptations. “Good” habitat for a polar bear is not good habitat for an animal that is adapted to warmer climates. Some animals can adapt to a variety of conditions; they are considered generalists. For example, a pigeon could be considered a generalist. Other animals have specific requirements that can only be met in a particular type of environment (specialists). The black-footed ferret is a specialist; it lives only in prairie dog towns and feeds almost exclusively on prairie dogs.

Another concept related to habitat is carrying capacity. This is a term that is often used in wildlife management. In its most basic form, carrying capacity is the number of animals of any given species that a particular habitat can support. High quality habitat has a higher carrying capacity than low quality habitat. Also, carrying capacity of an environment can vary from year to year or from season to season. For example, during a bad winter with cold temperatures and lots of snow, a particular habitat will not support as many animals as during a mild winter.

When biologists want to sample the wildlife that lives in an area, they can employ a variety of methods. One method is the line transect. In this method, the observer walks a line and records the individuals observed from that line. This procedure is then repeated along different transect lines. The number of animals observed along the transect line gives the biologist an index of the population for that habitat. In other words, the biologist can calculate how many individuals were observed per distance traveled, individuals observed per unit time of observation, or individuals caught per trap per unit time. This type of sampling method is used in bird counts, small mammal trapping, and road kill counts.

Another method for sampling wildlife is the point survey. The biologist stands at an observation point for a pre-determined period of time, and records the individuals seen during that time. This procedure is repeated at different observation points. As with the line transect, the point survey method provides an index of a population in a habitat, such as the number of animals seen per hour of observation. This method is often used in bird counts.

These sampling methods can be used to compare habitats. The abundance or scarcity of wildlife can indicate the carrying capacity of that habitat. Another indicator of habitat quality is the type of animals that are found in an area. For instance, the presence of predators means there is be enough quantity and quality food for the predator to survive. Also, some animal species are more sensitive to disturbance, and their presence can indicate a high quality habitat.

NOTE: The sampling techniques used in this activity have been simplified, but will allow students to experience the process of wildlife sampling.

Suggested Procedure:

1. PREPARATION:

a. Habitat Selection: Determine what type of habitat comparison you want your students to make. Do you want them to compare an urban habitat with a less disturbed habitat? Do you want them to compare different types of habitats, such as grasslands versus woodlands? Depending on the type of habitat comparison you want your students to make, select a particular habitat (e.g. field, woodland) on the school grounds for the wildlife survey. Or, if you want to compare two habitats on the school grounds, select two different habitats on the school grounds.

b. Transect Lines: Before class, lay out transect lines (1 transect line per 2 students) in the selected habitat(s). This is important because the process of setting up the transect line can disturb wildlife. You need to allow the animals time to resume normal activities before the survey. Leave plenty of space between the transect lines so students do not disturb one another during the activity.

2. Before you take the class outside, explain the terms habitat, carrying capacity, and wildlife. Remind students wildlife includes: birds, fish, reptiles, mammals, amphibians, insects, spiders, and other invertebrates.

3. Tell the students they will be conducting wildlife surveys. For this survey, students should be looking for wildlife AND signs of wildlife (prints, nests, scat, broken nut shells, spider webs, scratches on bark, chew marks on grass, etc.). They will use their data to compare and contrast two habitats.

4. Ask the students to form hypotheses/predictions about which location (school grounds or the Refuge, or two different habitats on the school grounds) is likely to have:
   a. Greater/lesser diversity of wildlife and plants. WHY?
   b. Greater/lesser abundance of wildlife and plants. WHY?
   c. Hypothesize which species of animals they expect to see in the different locations.

   Remind students their hypotheses do NOT have to be correct.

5. Go outside with your students. Before they begin their wildlife survey, they should describe the habitat on their Wildlife Survey Report.

a. Line transects: In pairs, students walk the length of the transect line counting the wildlife and wildlife signs that they see within 2 meters (on either side) of the transect line. You may want to have each student focus on a particular side of the transect line. On their Wildlife Survey Report, students record the type of animals they see (to the best of their ability) and approximately where they saw it along the line. Students should work slowly and quietly so they observe more wildlife and wildlife signs. For older students, you may want to have them record the animal's estimated distance from the transect line.

b. Point counts: Students work individually to do the point survey. Students spread out from one another and pick an area on the school grounds that they have not already surveyed. After they have picked their observation point, they stand quietly for a few minutes to allow wildlife to resume their normal activities. They then record the wildlife and wildlife signs they observe. On their Wildlife Survey Report, students record the type of animals they see (to the best of their ability) and approximately where the animal was relative to their position. Have students observe for a predetermined period of time. Ten minutes is appropriate for many students. For older students, you may want to have them record the animal's distance from the observation point.

6. After the observations have been made, return indoors and have the students summarize their data. For the transect lines, students will work with their partner to calculate the number of organisms per transect line - you may want to have them do separate calculations for each animal group. Students can summarize the point survey data as individuals. For the point surveys, students can calculate the number of organisms per unit time. Again, you may want to have them do separate calculations for each animal group.

7. Summarize the class data by averaging the students' data. Discuss the differences between individual data and class averages. Keep this information for later discussions after you have visited the Refuge or surveyed a comparison habitat on the school grounds.

8. At the Refuge, repeat this procedure so you can make a comparison list of Refuge wildlife. Use the same length transect lines and same amount of observation time for the point counts as at school so the results are comparable.

9. Discuss:

a. What wildlife and wildlife signs did they see in each habitat? What did they learn about the habitats and associated wildlife from using line transects and point surveys?
b. What kinds of food, water, protection, and space are available at the two locations?
c. Which location is better habitat for a_____?
d. What could be some reasons for differences (and/or similarities) between what they found at the school and at the Refuge?

e. Is there a difference in the apparent carrying capacity for_____ between the two locations? What does this tell you about the quality of the environments?
f. How did their hypotheses compare to their results? What predictions were correct? What predictions were incorrect?
g. How would they conduct their survey differently next time? What would they do the same?

Extensions/Adaptations:

- Repeat the observations during different seasons. What changes do you notice?

- Have students make observations at or near your home as a third comparison.

Assessment Ideas:

- Provide students with a summary of a Wildlife Survey Report from a third habitat (can be hypothetical). How does this habitat compare with the one(s) they surveyed? What are the similarities? What are the differences?

- Have students write a report that summarizes the class results of the Wildlife Survey Report. Have them include a graph of how many of each kind of animal were found in each habitat.

WILDLIFE SURVEY REPORT

Observer Name:_____Date:_____Location:_____

My Hypotheses are:

Habitat description:

Line Transect:

Length of transect: _____

Draw where you saw each animal or animal sign along the transect line:

(Transect line)

Record the number of each kind of animal you see along the transect line:

Birds	Mammals	Insects	Reptiles and Amphibians	Fish and Shellfish	Other?

Total number of animals or animal signs observed: _____

Calculations: Calculate the number of animals per unit distance.

Point Survey:

Draw where you saw animals or animal signs during the point survey:

(Observer)

Record the number of each kind of animal you see during the point survey:

Birds	Mammals	Insects	Reptiles and Amphibians	Fish and Shellfish	Other?

Total number of animals or animal signs observed: _____

Calculations: Calculate the number of animals per unit of observation time.

Pre-Visit Activity E: How Many Bears Can Live in this Forest?

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Method: Students will become "bears" to look for one or more components of habitat during this physically involved activity.

Objectives: Students will be able to

- Define a limiting factor
- Describe how limiting factors affect animal populations

Materials:

- Five colors of construction paper (a couple sheets each of red, yellow, green, blue, and orange) or an equal amount of light poster board or colored tokens
- One black felt pen
- Envelopes (one per student)
- Pencils
- One blindfold
- Five sheets green construction paper (for extension)

Subjects: Science, mathematics

Time: 20-45 minutes or longer

Setting: Outdoors

Grade Level: 5-8

Skills: Analysis, computation, discussion, evaluation, generalization, kinesthetic concept development, listing, observation, psychomotor development

Vocabulary: cover, habitat, limiting factors, shelter

Background Information:

Black bears are the focus of this activity that illustrates the importance of suitable habitat for wildlife. The activity demonstrates the consequences for a population of bears if one or more habitat components is relatively scarce. When any element or factor in a habitat is inappropriate or exceeds the tolerance range for an animal or population, it directly affects the well-being of the animal(s) and may result in death or population reduction. This factor "limits" the animal or population. Limiting factors may include habitat components such as food, water, shelter, and appropriate space, as well as life history parameters such as disease, predation, and climatic conditions. Limiting factors also

may be related to human activity such as development, pollution, and hunting. Populations tend to increase in size until limited by one or more of these factors.

Black bear habitat limits black bear populations, especially through the influences of shelter, food supply, and the social tolerances or territoriality of the animal. Shelter or cover is a prime factor. Black bears need cover – for feeding, hiding, bedding, traveling, raising cubs, and denning. Wit limits of space, adult bears will kill young bears or run them out of the area. These young bears must keep moving around either until they die or until they find an area vacated by the death of an adult.

When food supplies are reduced by factors such as climatic fluctuations, competition becomes more intense. Some adult bears might temporarily move to seldom-used areas of their home range, sometimes many miles away. They must live on what food is available in the area. These individuals may become thin and in poor condition for winter hibernation or, in the case of young bears, be forced from the area by more aggressive adults.

All possible conditions are not covered by the design of this activity. However, by this simple illustration, it is possible for students quickly to grasp the essential nature of the concept of “limiting factors” – habitat components affecting the survival of an animal or restricting the numbers or range of an animal population.

Suggested Procedure:

1. Make up a set of 2" x 2" cards from colored construction paper. Use the chart below to determine how many cards of each color to make and what to write on each one.
   As shown on the chart, the color of the card determines the type of food it represents:

a. Orange – nuts (acorns, pecans, walnuts, hickory nuts)
b. Blue – berries and fruit (blackberries, elderberries, raspberries, wild cherries)
c. Yellow – insects (grub worms, larvae, ants, termites)
d. Red – meat (mice, rodents, peccaries, beaver, muskrats, young deer)
e. Green – plants (leaves, grasses, herbs)

The number on each card represents the number of pounds of food. For example, a card with the label M-4 represents four pounds of meat.

Number of Cards to Make

			(Number of Students in Group)						
Paper Color	**Label**	**Represents**	**10-15**	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**
Orange	N-20	Nuts, 20 lbs	2	3	3	4	5	6	7
Orange	N-10	Nuts, 10 lbs	8	13	17	21	25	29	33
Blue	B-20	Berries, 20 lbs	2	3	3	4	5	6	7
Blue	B-10	Berries, 10 lbs	8	13	17	21	25	29	33
Yellow	I-12	Insects, 12 lbs	2	3	3	4	5	6	7
Yellow	I-6	Insects, 6 lbs	8	13	17	21	25	29	33
Red	M-8	Meat, 8 lbs	2	3	3	4	5	6	7
Red	M-4	Meat, 4 lbs	8	13	17	21	25	29	33
Green	P-20	Plants, 20 lbs	2	3	3	4	5	6	7
Green	P-10	Plants, 10 lbs	8	13	17	21	25	29	33

1. The following estimates of total pounds of food needed for one bear in 10 days are used for this activity:

Nuts	20 pounds (25 percent)
Berries and Fruit	20 pounds (25 percent)
Insects	12 pounds (15 percent)
Meat	8 pounds (10 percent)
Plants	20 pounds (25 percent)
	80 pounds (100 percent)

NOTE: These figures represent the food of a typical black bear in Arizona. The components of an actual bear's diet will vary between areas, seasons, and years. For example, a bear in the State of Alaska would likely eat more meat (fish) and fewer nuts than a bear in Arizona. One similarity among black bears everywhere is that the majority of their diet is normally made up of vegetative material.

If the table is followed when making the food cards, there should be less than 80 pounds of food per student, so that there is not actually enough food in the area for all the "bears" to survive.

2. It is also possible to include “water” as a habitat component by making additional squares from light blue paper. To calculate how many water cards to make, multiply the number of students by 1.25 (round to the nearest whole number). For example, for a group of 20 students, make 20 x 1.25 = 25 water cards. Divide the water squares into five equal piles (or roughly equal) and mark each group with one of the following letters: R, L, ST, SP, and M. These letters represent all the places where a bear could find water: rivers, lakes, streams, springs, and marshes.

3. In a fairly large open area (e.g. 50' x 50'), scatter the colored pieces of paper.

4. Do not tell the students what the colors, initials, and numbers on the pieces of paper represent. Tell them only that the pieces of paper represent various kinds of bear food. Since bears are omnivores, they like a wide assortment of food, and the students should gather different colored squares to represent a variety of food.

5. Have each student write their name on an envelope. This will represent the student’s “den site” and should be left on the ground (perhaps anchored with a rock) at the starting line on the perimeter of the field area.

6. Have the students line up on the starting line, leaving their envelopes between their feet on the ground. Give them the following instructions: *“You are now black bears. All bears are not alike, just as you and I are not exactly alike. Among you is a young male bear who has not yet found his own territory. Last week he met up with a larger male bear in the big bear’s territory, and before he could get away, he was hurt. He has a broken leg (Assign one student as the injured bear. He must hunt by hopping on one leg.) Another bear is a young female who investigated a porcupine too closely and was blinded by the quills. (Assign one student as the blind bear. She must hunt blindfolded.) The third special bear is a mother bear with two fairly small cubs. She must gather twice as much food as the other bears. (Assign one student as the mother bear.)*

7. Students must walk into the “forest.” Bears do not run down their food; they gather it. When students find a colored square, they should pick it up (one at a time) and return it to their “den” before picking up another colored square. (Bears would not actually return to their den to eat; they would eat food as they find it.)

8. When all the colored squares have been picked up, the food gathering is over. Have students pick up their den envelopes containing the food they gathered and return to class.

9. Explain what the colors and numbers represent. Each color is a kind of food and the numbers represent pounds of food eaten. Ask each student to add up the total number of pounds of food they gathered - whether it is nuts, meat, insects, berries, or plant material. Have each student write the total weight on the outside of their envelope.

10. Using a chalkboard, list “blind,” “injured,” and “mother.” Ask the blind bear how much food she acquired. Write the amount after the word “blind.” Ask the injured bear and the mother bear how much they acquired and record the information. Ask each of the other students how much food they found; record each response on the chalkboard. Tell the students each bear needs 80 pounds to survive.

a. Which bears survived? Is there enough to feed all the bears?

b. How many pounds did the blind bear collect? Will she survive?

c. What about the mother bear? Did she get twice the amount needed to survive? What will happen to her cubs? Will she feed her cubs first or herself? Why? What would happen to her if she fed the cubs first? What if she ate first? If the cubs die, can she have more cubs in the future, and perhaps richer, years? (The mother bear will eat first and the cubs will get whatever, if any, is left. The mother must survive; she is the hope for a continued bear population. She can have more cubs in her life; only one needs to survive in order for the population to remain static.)

11. If the water squares are included, each student should have picked up at least one square representing a water source or they do not survive. Water can be a limiting factor and is an essential component of habitat.

12. Ask each student to record how many pounds of each of the five categories of food they gathered. Ask each student next to convert these numbers into percentages of the total poundage of food each gathered. Provide the students with the background information about black bears so that they can compare their percentages with what are typical percentages eaten by black bears in Arizona. Ask each student to guess how healthy their bears would be. How do the bears’ requirements for a diet seem to compare with the needs of humans for a balanced and nutritious diet?

13. Ask the students to arrive at a class total for all the pounds of food they gathered as bears. Divide the total by the 80 pounds needed by an individual bear (approximately) in order to survive in a ten-day period. How many bears could the habitat support? Why then did only __ bears survive when your class did this activity? Is that realistic? What percentage of the bears survived? What percentage would have survived had the food been evenly divided? In each case, what percentage would not survive?

14. Ask the students to determine the amount of food tokens that must be added in order to support all of the bears in this activity. If sufficient food were available for all of the bears would the population likely increase the following year? Have the students support their answers. Other than food, what factors, natural or human-related, might also limit the growth of the bear population? How would each of these factors affect the bear population? Could the bear population increase indefinitely if unlimited food were available? Why or why not?

15. Based on their discussion, ask the students to try to define the term limiting factor. Have them suggest examples of limiting factors, cultural and natural, that would be likely to actually influence the survival of other animals and their populations.

Extensions/Adaptations:

1. Cut paper or poster board into 2" x 2" squares. Make five squares per student. For example, with a class of 30 students, you would make 150 squares. Divide all the squares into five equal piles and mark the cards in each pile with one of these letters: B, T, D, H, and F. These represent B = bedding sites, T = travel ways, D = dens, H = hiding cover, and F = feeding sites. For the purposes of this activity, these are defined as follows:

a. Bedding Sites: Black bears are usually active in early morning and late evening, and bedded most of the rest of the day and night. Bedding sites are usually in areas of dense vegetation, steep topography, and/or large trees where the bears feel secure.

b. Travel Ways: Bears require corridors of cover (made up of thick vegetation and/or steep topography) to enable them to travel between areas of food, water, and shelter within their home range.

c. Dens: Black bears use dens as shelter for hibernation from November to April in each year. Bears have been found denning in hollow logs, caves, holes dug into hillsides, under buildings, on top of the ground, and even in culvert pipes. Bears often prepare and may use more than one den, and may change dens during the winter because of disturbance or if the den leaks. Bears seldom re-use dens from one year to the next.

d. Hiding Cover: Black bears evolved as animals that escape danger from predators and other bears by hiding in thick cover.

e. Feeding Sites: Bears often will use areas with less cover than hiding areas or bedding sites for feeding. Feeding sites are, however, often found close to thick hiding cover to allow the bear to quickly escape danger if necessary.

NOTE: This information is based on actual research data from a study in Arizona. These components may vary slightly in different parts of North America.

2. In a fairly large open area (e.g. 50' x 50'), scatter the colored pieces of paper.

3. Have the students line up along one side of the area. Tell them that they are to become “bears” for the purposes of this activity. Review the concept of habitat - that a bear would need shelter, food, water, and space in a suitable arrangement in order to survive. Do not tell the students what the letters on the squares represent. Tell them only that they represent one element or component of bear habitat.

4. Direct the students to move as individual “bears” into the area. Each bear must pick up as many of the components of habitat as possible. Some competitive activity is acceptable as long as it is under control. Bears are territorial. Remember that if bears

fight, which they seldom do, they can become injured and unable to successfully meet their needs for survival.

5. When the students have picked up all of the squares of paper in the area, have them return to the classroom or be seated in any comfortable area. Ask the students to separate their squares of paper into piles according to the letter on each. Using a chalkboard or large pad for a visual reference, ask the students to predict what the letters on the green cards represent - giving them the clue that each is an element of cover or shelter for a black bear. What kinds of shelter would a bear need? What do these initials represent? Record how many bears acquired at least one of each kind of shelter. How many got only four kinds? Three? Two? How many got only one kind of shelter? For the purposes of this activity, only those bears with at least one of each kind of necessary shelter can survive through one year.

6. Shelter is a very important part of a bear's habitat. A bear needs shelter in which to search for food and water. Bears also need shelter for traveling through their home range, and shelter for bedding, hiding, and denning. Ask students why a den is important. (The bear could live from April through October but would not have a secure place to hibernate and might not survive the winter.) Ask the students what would happen if a bear did not have travel ways? (Without travel ways, home ranges become fragmented and bears are not able to reach needed food, water, or other shelter. Without suitable habitat, bears move into marginal habitats and get into trouble with people.)

7. In this activity, how many bears survived? What was a limiting factor for this population of bears? (Shelter.) What other things possibly could become limiting factors? (Water and space or territory are two examples.) Could food be a limiting factor for bears? (Yes, however bears are omnivores and can utilize many sources of food.)

8. Ask the students to summarize what they have learned about the importance of suitable habitat for bears' survival. How are the bears' habitat needs similar to and different from the needs of other animals?

Assessment Ideas:

- Define: limiting factor
- Describe some of the factors that may limit the survival of an animal.
- What might be the consequences to the individual animal and to its population if one of these limiting factors were no longer limiting?

NOTE: The complete *Project WILD K-12 Education Activity Guide* can be obtained by attending a Project WILD workshop. Please contact your State Coordinator for more information by going to the Project WILD website at www.projectwild.org.

Pre-Visit Activity F: Migration Headache

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Method: Students portray migrating water birds traveling between nesting habitats and wintering grounds.

Objectives: Students will be able to

! List limiting factors affecting habitats and populations of migrating water birds
! Predict the effects of such limiting factors
! Describe the effects of habitat loss and degradation on populations of migrating water birds

! Make inferences about the importance of suitable habitat for migrating birds

Materials:

! Large playing field or gymnasium
! Two bases (paper plates or carpet squares, for example) for every 2-3 students

Subjects: Science, Environmental Education, Expressive Arts

Time: 45 minutes

Setting: Outdoors or large indoor area

Grade level: 5-8

Skills: Analysis, classification, comparing similarities and differences, discussion, evaluation, generalization, hypothesizing, inference, interpretation, kinesthetic concept development, listing, observation, prediction, psychomotor development, synthesis

Vocabulary: habitat, limiting factors, migration, shorebirds, water birds, waterfowl, wetlands

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Background Information:

Migration:

Birds that migrate depend not just on having one suitable habitat, but two and often three habitats. For example, some birds nest and raise their young in the northern limits of their ranges. The same birds may also require suitable habitats in the southern limits of their range to live during winter. Because migrating birds travel hundreds or thousands of miles between nesting and wintering grounds, resting and feeding sites (known as stopovers) are crucial.

A variety of remarkable migrating shorebirds and waterfowl inhabit the skies and waters of the United States. Many migrating birds – ducks, geese, cranes, herons, rails, terns,

and plovers, for example – require wetlands in their breeding, stopover, and wintering grounds. Without wetlands, dozens of species of water birds face loss of necessary habitat.

Over the last 150 years, water bird populations have been threatened by the alteration of habitats and direct mortality of birds. Numerous populations of water birds have declined, some significantly. The disappearance and degradation of wetlands are major threats to the survival of migratory water birds. Destruction of wetland habitats reduces the quantity of suitable nesting, feeding, and resting areas. Alteration of wetland habitats often reduces the quality of habitats, making them unsuitable for water birds. Wetland habitats, usually found in low, fertile plains along watercourses, were historically prized for conversion to farmland and settlements. Agriculture and development, both residential and industrial, have reduced the number and quality of natural wetlands.

Direct mortality of water birds occurs in various ways. The migration routes of North American water birds are well known. Before the passage of regulations regarding the hunting of water birds, market hunters of the 19th century and the very early 20th century decimated the flocks by taking advantage of the vast numbers of water birds that concentrated at strategic points along these routes. Pollution, through insecticides and herbicides for example, has also taken a toll. The birds ingest the poisons through the food chain, sometimes with lethal effects. In some cases, pesticides also kill the birds' food, reducing their food supply.

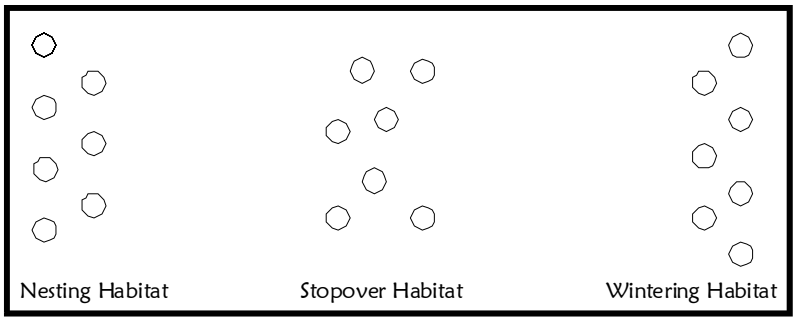
Many international, Federal, State, and private groups recognize the importance of wetland habitats to wildlife preservation. In the early 1900s, several laws and treaties were enacted and signed that regulated the hunting of water birds, as well as protecting the habitat on which they depended. Laws that conserve and enhance wetland habitats have slowed the alteration of the habitats. The Clean Water Act of 1977 and the Farm Bill of 1985 are two major pieces of such legislation. In addition, techniques have been developed to build new wetlands as well as enhance the quality of existing wetlands. The U.S. Fish and Wildlife Service (Service) has the principal legal responsibility in the United States for managing migratory wildlife at the Federal level. State wildlife agencies share some responsibilities with the Service in conserving migratory water birds.

The effects of natural occurrences and human management efforts during the 1990s have produced mixed results. The North American Waterfowl Management Plan, coordinated by the Service, has worked through private/public partnerships to conserve and enhance waterfowl habitat in Canada and the United States. This effort, aided by several years of plentiful rain and snow, have allowed populations of many species of waterfowl (ducks, geese, swans) to rebound from near record lows in the 1980s and early 1990s to near historic high numbers. On the other hand, shorebirds like plovers, terns, and the red knot continue to suffer losses because of habitat loss and alteration along coastal regions.

In this activity, each student (assuming a class of 30) represents thousands, if not tens of thousands, of water birds. Thus, occasional losses to predation and other events of relatively minor magnitude during the course of migration are not emphasized in the simulation. The major purpose of this activity is for students to dynamically experience some of the important factors that affect habitat quality and the associated survival of migratory water bird populations.

Suggested Procedure:

1. Select a large playing area about 70 feet in length. Place an equal number of bases in three areas on the playing field as shown below:



Choose the number of bases so that there is one base for each two or three students at each of the three areas on the field. Designate one of the end areas the “wintering habitat,” the other end the “nesting habitat,” and the area in the middle as “stopover habitat.”

2. Explain to the students that they are water birds and will migrate between these three areas at your signal. Tell the students that the bases represent wetlands. These wetlands provide suitable habitat for water birds. At the end of each migration, the students will have to have one foot on a base in order to be allowed to continue (survive). Tell the students that only two (or three as decided in Step 1) water birds can occupy a habitat (base) at one time. If they can’t find a habitat that isn’t “filled,” that means they have not found any suitable habitat. The “pass away,” and have to move, at least temporarily, to the sidelines. During migration, the students may want to “flap their wings,” moving their arms like birds in flight.

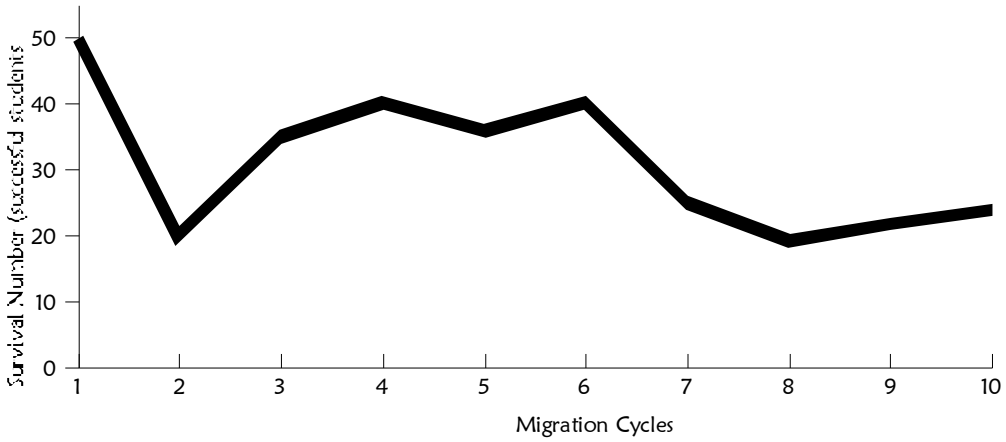
3. Explain to the students that many factors limit the survival of populations of migrating water birds. Some involve changes in the wintering, stopover, and nesting habitats. There will be periods of time where food, water, protection, and space are suitably arranged to meet the habitat requirements of the birds. There will be other times when the habitat is stressed, with many factors limiting the potential for the birds’ survival.

4. Begin the activity with all the students at the wintering habitat. Announce the start of the first migration. Have the students migrate slowly until they become familiar with the process. Then they can speed up. On the first try, all the birds will successfully migrate to the stopover habitat.

5. Explain that most water birds need these areas to rest and eat before continuing the migratory journey. Then have them migrate from the stopover habitat to the nesting habitat. Explain that there has been no loss in the area of available high-quality habitat. Thus, a successful nesting season is at hand.

6. Before the students migrate back "south," remove one base from the stopover habitat. Explain that a developer has received a permit to drain a wetland to build a mall. Repeat the instruction to migrate and send the birds to the stopover habitat. Have the students who could not find available habitat stand on the sideline. Tell the students that these birds died as a result of habitat loss. Remind any "deceased" birds that they will have a chance to get back into the activity. They can come back as surviving hatchlings when favorable conditions prevail and there is habitat available on the nesting ground.

NOTE: the migrations can be graphed as shown below:



Continue the migrations by reading the Habitat Scenarios below. Educators may want to appoint two students as monitors to remove and add bases (habitats) as required in the Habitat Scenarios.

HABITAT SCENARIOS: These scenarios can be used during the activity to assist educators with the factors that may reduce or enhance a wetland habitat.

A marsh has been dredged to allow a marina to be built. Remove one stopover habitat.	A landowner has agreed to re-flood fields after harvesting, increasing acreage for wintering birds. Add one wintering habitat.
A joint Federal/State wetland restoration project involved removing drain tiles, allowing former wetland to flood and return to its natural state. Add one stopover habitat.	A large increase in the number of mink and raccoons has reduced the value of a marsh nesting area. Remove one nesting habitat.
Wintering habitat is reduced by the conversion of bottomland hardwood forests to cropland. Remove one wintering habitat.	New legislation restricts motorboat traffic on a number of lakes and large marshes, reducing the human disturbance to wildlife. Add one wintering habitat.
Several years of sufficient rain and snow has replenished the water supply, thus increasing the food supply. Add one nesting habitat.	A timber company has agreed to preserve a forested wetland in exchange for tax credits. Add one stopover habitat.
Soil subsidence and salt water intrusion have caused the loss of coastal marsh. Remove two wintering habitats.	A new National Wildlife Refuge has been established in the prairie pothole region. Add one nesting habitat.

8. After the activity, ask the students to identify factors that caused water bird populations to decline or increase. What are the short- and long-term effects of the decline or increase? Which factors are human-caused? Which are natural? What factors reduced or enhanced the quality of the habitat? What are the benefits and liabilities related to these factors for the community?

Extensions/Adaptations:

1. Research a species of water bird. Conduct this activity again with each student representing a specific kind of water bird.

2. Explore the major factors affecting habitat loss and alteration, or gain and restoration, in your area. Research the causes for long-term habitat loss, as well as any major efforts underway to prevent these increasing losses.

3. Using a map, plot the major migratory routes of North American birds.

4. Visit a national wildlife refuge, State wildlife area, bird observatory, private sanctuary, seashore, or other habitat for migratory water birds.

5. What other animals migrate? How are the problems they face similar to those of migratory birds?

6. There are national laws and international treaties protecting migratory species. Find out about some of these. What is their history? Are they effective? Are there problems enforcing them? What migrating species, if any, are unprotected by such laws?

7. Find out how wetlands have changed or remained the same in your community throughout the last 100 years. Are there wetland regulations or zoning laws in your community?

Assessment Ideas:

1. Name two human activities and two environmental factors that might interfere with water bird migration. For each activity and factor, describe the possible effects on the water birds.

2. Distinguish between effects on individual birds and effects on populations of birds. Indicate if an effect is short-term or long-term.

3. Why is suitable habitat important for migrating water birds? Include in your response a description of the different kinds of habitat that are needed by migrating water birds.

4. Is habitat loss a greater threat to the survival of migrating populations than for stationary populations of wildlife? Explain your answer.

NOTE: The complete *Project WILD Aquatic Education Activity Guide* can be obtained by attending a Project WILD workshop. Please contact your State Coordinator for more information by going to the Project WILD website at www.projectwild.org.

Migratory Birds that Utilize Red River National Wildlife Refuge

Supplementary Habitat Scenarios

Listed below are additional descriptions of factors that can affect migratory water bird populations on the wintering, stopover, and nesting habitats.

A large condominium development has been built on a drained marsh that was prime duck wintering habitat. Remove one wintering habitat.	Acid rain has reduced the number of invertebrates needed by female waterfowl during nesting. Remove two nesting habitats.
A large oil spill from a supertanker has severely damaged a number of salt marshes that were prime wintering areas. Remove three wintering habitats.	A number of dry years has reduced the number of prairie potholes along the migration route. Remove two stopover habitats.
A canal was constructed to remove boat traffic from a river that was used by a large number of waterfowl years ago. It is returning to its natural state. Add one wintering habitat.	A partnership project between the U. S. Fish and Wildlife Service and Ducks Unlimited resulted in improved waterfowl habitat along the Canadian border. Add one nesting habitat
A national wildlife refuge has been acquired along the migration route. The refuge includes several wetlands that will have decreased human disturbance. Add one stopover habitat along the migration routes.	Water in a man-made marsh has been drawn down to speed decomposition and consolidate the bottom. Remove one nesting habitat for a season and then add two the next year because of greatly improved nesting habitat.
A large freshwater marsh has been restored by releasing water from the Mississippi River back into delta areas that had been drained after the river was leveed. Add two wintering habitats.	Prime duck habitat has been severely damaged by the use of the marsh as an irrigation pond. Remove one nesting habitat.
A coastal resort town has annexed a nearby area containing a wetland, which it has drained to build a tourist hotel. Remove one wintering habitat.	A number of consecutive dry years have occurred resulting in a number of small wetlands drying up. Remove one wintering habitat.
	(Adapted from *Educator's Guide to St. Marks National Wildlife Refuge*)

Pre-visit Activity G: Wetland Metaphors

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Method: Students are presented with a selection of objects for investigation as metaphors for the natural functions of wetlands.

Objectives: Students will be able to

- Describe the characteristics of wetlands
- Evaluate the importance of wetlands to wildlife and humans

Materials:

- Large pillowcase, bag or box
- Sponge
- Small pillow
- Soap
- Eggbeater or mixer
- Small doll cradle
- Sieve or strainer
- Paper coffee filter
- Antacid tablets
- Small box of cereal

Subjects: Environmental Education, Language Arts

Time: One or two 30-60 minute sessions

Setting: Classroom or outdoors

Grade Level: 5-8

Skills: Analysis, application, comparing similarities and differences, generalization, inference, interpretation, listing, public speaking, recognition, reporting, synthesis, visualization

Vocabulary: bogs, environment, habitat, lagoons, marsh, prairie potholes, swamps, wet meadows, wetland, wildlife

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Background Information:

Wetlands are many different things to many different people. Some people have never heard or thought about wetlands. Others are working actively to protect wetlands because of their importance.

Wetlands include freshwater and saltwater marshes, wet meadows, swamps**,** lagoons, bogs, and prairie potholes. All wetlands, whether coastal or inland, provide special

habitats that serve areas far beyond their boundaries. Wetlands are uniquely important to plants, animals, humans, and the total environment.
Because of the abundance of food, vegetative cover (shelter), and water found there, most wetlands are rich with diverse wildlife species.

Coastal and inland marshes, for example, provide breeding, resting, and wintering habitats for thousands of migratory birds – including ducks, geese, swans, cranes, and shorebirds. Many species of fish that are important for commercial and personal use by humans reproduce and spend part, or all, of their life cycles in fertile wetlands adjacent to larger, more open bodies of water. These fish species include bass, salmon, walleye, perch, and pickerel. A wide variety of reptiles, amphibians, insects, and crustaceans, also breed and live in wetlands. Frogs and toads, turtles of all kinds, salamanders, snakes, dragonflies, water striders, clams, and crayfish flourish in wetland habitats. Many mammals – from muskrats and beaver to white-tail deer and moose – also depend on wetland areas.

Wetlands are often referred to as “nurseries” because they provide critical breeding and rearing habitats for countless numbers and kinds of wildlife.

Wetlands also have the unique ability to purify the environment. They act as natural filtering systems and have been shown to be extremely effective. For example, they can trap and neutralize sewage waste, allow silt to settle, and promote the decomposition of many toxic substances.

The importance of vegetation associated with wetlands cannot be overlooked. Plants absorb nutrients and help cycle them through food webs. Plants also help keep nutrient concentrations from reaching toxic levels. Plants slow down water flow, causing silt to settle out. Through photosynthesis, plants add oxygen to the system and provide food to other life forms.

Of great importance to humans are the flood control characteristics of wetlands. When runoff from rains and spring thaws is high, wetland areas absorb excess water thereby helping it gradually drain away down streams and rivers and through the soil. Acting as buffers, healthy wetlands reduce flooding and erosion. In drier periods, wetlands hold precious moisture after open bodies of water have disappeared.

The many activities that take place in wetlands make them among the most productive ecosystems in the world.

As remarkable and resilient as wetlands are, these unique areas have limits. Their destruction and/or abuse can have devastating effects on wildlife, humans, and overall environmental quality.

Wetland habitats are being converted to other uses (agriculture, roadways, housing developments) or otherwise being altered (drained for pest control or polluted) at the rate of about a half million acres per year. And although many wetlands are protected by Federal and State laws, there still appears to be a significant need to create a greater understanding of the importance of wetlands as ecosystems and as wildlife habitat.

Many of the major attributes of wetlands can be explored through the use of metaphors. To use a metaphor is to apply a word or phrase to an object or concept that it does not literally denote, in order to suggest a comparison between the two. A metaphor represents a concept or idea through another concept or idea. “A tree is a home” and “Books are windows of thought” are two examples. In this activity, a variety of everyday objects are used to represent the natural functions of wetlands. For example:

OBJECT:	**METAPHORIC FUNCTION:**
Absorbs excess water caused by runoff; retains moisture for a time even if standing water dries up (e.g., sponge placed in a small puddle of water absorbs water until saturated, then stays wet after standing water has evaporated)	
Pillow/Bed	A resting place for migratory birds
Mixer/Egg Beater	Mixes nutrients and oxygen into the water
Cradle	Provides a nursery that protects and feeds young wildlife
Sieve/Strainer	Strains silt, debris, etc. from the water
Filter	Filters smaller impurities from the water
Antacid	Neutralizes toxic substances
Cereal	Provides nutrient-rich foods
Soap	Helps cleanse the environment

The major purpose of this activity is for student to develop an appreciation and understanding of wetlands through the power of metaphor linking the characteristics and natural functions of wetlands to the familiar realm of everyday life.

Suggested Procedure:

1. Prepare a “Mystery Metaphor Container” (pillowcase, bag, or box). It should be possible for students to put their hands into the container and pull out an object without being able to see inside the container. Educators may want to collect as many as one metaphoric object per student, but at least have enough for one per group of four students. Put the container aside to use later.

2. Discuss the variety of wetlands found in your local area, state, country, etc. Then invite the students to sit quietly and close their eyes. Ask them to picture a wetland. Have them “examine” what it looks like. Have them “look” carefully at the plants and animals, including insects and small creatures. What does the air “feel” like? How does it “smell?”

3. Invite the students to tell what they imagined. Compile a list of their offerings. Encourage discussion and mutual sharing.

4. With their lists as a point of reference, help the students identify which plants and animals are most likely to be found in a wetland. If possible, have them classify the plants and animals according to the kind of wetland in which they would be found. State or Federal wildlife officials and representatives of private conservation or nature-related organizations can be helpful.

5. Next provide the students with background information to serve as an overview of the basic ecological activities that characterize the wetland habitat. For example, educators might include the following

a. Sponge effect – absorbs runoff
b. Filter effect – takes out silt, toxins, wastes, etc.
c. Nutrient control – absorbs nutrients from fertilizers and other sources that may cause contamination downstream
d. Natural nursery – provides protection and nourishment for newborn wildlife

Suggest that these activities and many more that they could probably think of are taking place in wetlands all the time.

6. Bring out the “Mystery Metaphor Container.” Tell the students that everything in the container has something to do with a wetland. Have the students divide into groups of four. Announce that when it is their turn, a representative of each group will draw an object from the container. Then, as a group, they must figure out how the object could represent what a wetland is or does.

7. Have the designated student reach into the container and withdraw one object. When each group has an object, ask them to work as a team to describe the relationships

between the metaphoric object and the wetland. Encourage the students to build on each other's ideas. You can also assist by strengthening their connections.

NOTE: Allow the students time to discuss their ideas with each other before doing so in front of the entire class.

8. Ask each group to report their ideas to the class.

9. Following the discussion and review of the functions represented by each metaphor, ask the students to summarize the major roles that wetlands perform in contributing to habitat for wildlife.

a. List the ways in which ways in which wetlands are important to humans.
b. Why do humans convert wetlands to other uses?
c. Ask the students if their own attitudes about wetlands are different now. If yes, how? If not, why not?

10. For the final part of this activity, encourage the students' understanding of how the wetlands' condition depends on each of us. Many kinds of wildlife depend upon wetlands. Our own well-being requires wetland ecosystems. Strengthen the students' understanding of how humans are connected to wetlands. Recreation, aesthetics, utilitarian uses, environmental quality, and nature study are but a few of the connections we each have with wetlands.

Extensions/Adaptations:

1. Visit a wetland to verify the appropriateness of the metaphors explored in the classroom. Identify and discuss any limitations to the appropriateness of these metaphors. Identify what seem to be the most compelling attributes of the metaphors in helping you understand the characteristics and nature of the wetland. Expand yon your understanding of these metaphors. Identify new and appropriate metaphors.

2. Investigate local, county, State, and Federal regulations and laws that govern uses of wetlands.

Assessment Ideas:

1. Explain why wetlands are called one of the world's most productive ecosystems.

2. Wetlands are important to a range or organisms in the animal kingdom, from zooplankton to humans. Select five species of animals and describe how wetlands are important to each.

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CHAPTER 5
General Refuge Activities

A. Quick Activities

B. Trivia Questions

C. Refuge Bingo

D. Auto Tour/Nature Trail

General Refuge Activity A: Quick Activities

Adapted from *Salt Marsh Manual: An Educator's Guide*, *A Guide to Environmental Education for National Wildlife Refuges and Fish Hatcheries in the Southeast Region*

These activities can be used any time during your field trip. They are good attention getters and require no background information. They are useable on the bus, at a gathering area, or whenever a pause in the action could cause chaos! The questions can be copied or written on index cards ahead of time and given to group leaders.

Short Observations:

- Find a bird and watch it as you count to 25. Describe what you noticed about the bird's color, flight, size, or other characteristics.
- Stop! Close your eyes and listen. Describe the sounds that you hear in 30 seconds.
- Do you see tracks in the mud? Can you guess who made them? Which way were they traveling? Follow the trail.
- Find an insect and watch it as you count to 25. Describe what you noticed about the insect - how many legs does it have? Can it fly? Is it eating? What is it eating? Anything else?

Find Something:

- Find three human-made things around you. What are the positive and negative aspects for each object?
- Find two to five things that have been changed by an animal. Find two to five things that have been changed by humans. Any connections?
- Find two animals or an animal and a plant that have a relationship with one another. (Owl-mouse, heron-fish, duck-wild millet, minnow-algae)
- Find the largest and the smallest animal, plant, flower, bird, crab, stone, shell, etc. Find different things that are the same size.
- Find a bird that: walks on its own stilts, dives to get its food, or uses the mud flats as a supermarket.

Do Something:

- Do you see any litter? If it is safe to do so, pick it up.
- Move the way an animal moves.
- Write two sentences about something (animal, plant, cloud) you see right now.
- Compare the colors of animals with their surroundings. What do you notice?
- Push a pencil point into the soil with the open palm of your hand. Measure the distance it has gone into the soil when your hand begins to hurt. Try the measurement in different areas. If you were a burrowing animal, where would you like to live? Why?
- Predator/prey: Choose one student to be the prey. He/she is blindfolded and set in the center of a large circle formed by the other students (predators). One at a time, the leader points to a predator, who then tries to sneak up quietly and touch the prey. The prey has to use its ears to listen for predators and point to the predator when it is heard. Let several children try and switch roles.

Pretend/Imagine:

- Pretend you are 1 inch tall and live in the marsh. What would you like to eat? Who would like to eat you? Where would you hide?
- Let's pretend it suddenly started to rain hard right now. Where would you go if you were a _____ (rabbit, squirrel, bird, fish, butterfly, etc.)
- Pretend it is 500 years ago. What do you think this land looked like? What lived here? Did people live here? What do you imagine was the same? What do you imagine was different?
- Pretend it is 500 years in the future. What do you think the land will look like? What will live here? Will people live here? What do you imagine will be the same? What do you imagine will be different?

General Refuge Activity B: Trivia Questions

These questions can be used any time during your field trip. They are good attention getters and require no background information. They are useable on the bus, at the gathering area, or whenever a pause in the action could cause chaos! The questions can be copied or written on index cards ahead of time and given to group leaders.

Easier:

- Name three animals that can be found in a wetland.
- Name one thing that feathers help birds to do. (fly, stay warm, attract a mate)
- Mammals are one group of animals that has backbones. What are others? (fish, reptiles, birds, amphibians)
- True or False: Mammals are the only group of animals that are warm-blooded. (False: birds are warm-blooded)
- True or False: Herbivores eat dead animals. (False - herbivores eat plants)
- True or False: Plants provide protection for animals. (True)
- True or False: Pine needles are leaves. (true)
- Name three things for which an insect can use its legs. (walking, jumping, swimming climbing, making noise, catching prey, crawling)
- What is camouflage? (ability of an animal to blend in with its surroundings)
- List three places an insect might live. (almost anywhere)
- What is a decomposer? (an organism that helps break down dead tissue and turns it into soil)
- What are some ways animals use wetlands? (food, water, protection, nesting sites, stopover during migration)
- What are two good things insects do for people? (provide honey and silk, pollinate crops, decompose dead animals and plants)
- What animal (other than humans) builds dams on the water? (beaver)

- Name three ways different birds use their feet. (swimming, climbing, running, perching, grasping, scratching)

- What does endangered mean? (an animal or plant that is in danger of going extinct)

Intermediate:

- Name two ways that birds use their beaks (eating, preening, nest building)

- What are two types of animals that undergo metamorphosis? (insects and amphibians)

- How many legs do most insects have? (most adults have six, some larvae have none)

- Which large bird feeds on fish that it catches in a huge pouch underneath its bill? (pelican)

- True or False: Many bats can fly, swim, and walk. (True)

- What are deciduous trees? (trees that lose their leaves each year)

- True or False: Wetlands can help reduce flooding. (True: wetlands act like giant, shallow bowls. Water flowing into these bowls naturally loses speed as it collects and spreads out)

- Where do green plants get their food? (from photosynthesis. Carbon dioxide, water, and sunlight are necessary ingredients for plants to make food)

- Why are decomposers important? (they recycle the nutrients from dead plants and animals)

- Name two characteristics that birds have in common with reptiles. (partially hollow bones, scales, similar skull and ear bones, lay eggs)

- What is the most important problem facing wildlife today? (habitat destruction and degradation)

- Name the five major components of habitat. (food, water, protection, space, all must be in appropriate arrangement)

- List three ways different mammals escape predators. (flee, fight, play dead, live in a group, smell bad, display sharp quills or other protective features)

- What do omnivores eat? (plants and animals)
- Name one reason why birds sing. (stake out a territory, defend a mate)

More Difficult:

- What are two ways mammals can avoid harsh living conditions or reduced food supplies? (migrate, hibernate or estivate, store food, change their diets)
- True or False: If it hadn't been for glaciers, many of the wetlands in North America would not be here today. (True: the glaciers that once covered much of North America gouged out basins that later formed wetlands)
- What are the three main body parts of an insect (head, thorax, abdomen)
- What do most butterflies eat? (nectar from flowers)
- Are national wildlife refuges located randomly? (No, they are located primarily along the Pacific, Central, Mississippi, and Atlantic flyways.)
- What are the stages of complete insect metamorphosis? (egg - larvae - pupa - adult)
- Name two beneficial insects. (ladybug beetle, praying mantid, honey bee)
- MAKE UP MORE OF YOUR OWN!

General Refuge Activity C: Refuge Bingo

This bingo sheet can be used in a variety of ways. One way is a means of introducing the students to some of the plant and animal life they may see while on the Refuge. Another is to use the sheets as a contest within small groups to determine who sees what first. Use your imagination!

Find a bird soaring high in the sky. Draw it.	Draw one of the plants that floats on the water in a wetland.	Draw a plant that is growing along the shore of a wetland.	Listen for a bird that is singing. Write what it sounds like.	Find evidence of an animal. What is the evidence?
Find an insect sitting on a plant. Draw it.	Name an important plant that lives in a wetland.	Name one type of wetland on this Refuge.	Name one of the management tools used on the Refuge.	Draw one of the mud creatures that you find in the mud along the shore of a wetland.
Find a bird walking or standing in the wetland. Draw it.	Name one of the functions of a wetland.	Draw or write about the most interesting thing you have seen today.	Draw a duck that you see.	Draw an insect that floats on the water.
Find animal tracks and draw them.	Find an animal that is hiding in the shrubs. What color is the animal?	Draw a bird that is feeding.	Find a fish in the wetland. How big is it?	Find an American kestrel. Draw its beak.
Find a reptile or amphibian. What is it?	Find a bird that dives under the water to feed.	Find a bird with a long skinny beak. Draw the beak.	Find a bird sitting in a tree. Draw its feet.	Find a butterfly. What colors is it?

General Refuge Activity D: Nature Trail

As you walk the Nature Trail use the interpretive brochure to learn more about the plants, wildlife and habitats on refuges in north Louisiana**.**

CHAPTER 6
On-site Activities

A. Adaptations Everywhere

B. A Habitat Expedition!

C. Start a Nature Journal

D. Plant Diversity

E. Create a Class Field Guide

F. Wetland Inventory

G. No Trash Lunch

H. What Should We Do with this Land?

I. Manage a Refuge!

On-site Activity A: Adaptations Everywhere

Method: Students will work in pairs to observe wildlife (birds, mammals, amphibians, reptiles, insects, etc.) using binoculars, spotting scopes, and magnifying glasses. They will observe what the organisms are doing. They will then use the concept of adaptation to explain the appearance and behaviors of the organisms.

This is a good orientation activity when your group arrives at the Refuge. It heightens students' attention to their surroundings, and gets them focused on the purpose of the field trip.

Objectives: Students will be able to

- Define and apply the term adaptation
- Use binoculars and spotting scopes correctly
- Use their field guides to identify organisms

Materials:

- Copies of Student Page - "Adaptations Everywhere"
- Binoculars
- Spotting scopes (if possible)
- Magnifying glasses
- Field guides

Subjects: Science

Time: 40-50 minutes

Setting: Outdoors

Grade Level: 1-8

Skills: Gathering information, organizing information, interpreting information, identification, concept application

Vocabulary: adaptation, amphibians, behavior, crustaceans, environment, habitat, hibernate, invertebrate, larvae, marsh, raptor, species, submerged vegetation

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Background Information:

An adaptation is defined as:

- An adjustment to environmental conditions
- A modification of an organism or its parts that helps the plant or animal survive and reproduce

Adaptations equip an animal or plant for survival within a particular environment or set of environments. An adaptation can relate to the behavior, anatomy, and/or physiology of

an organism. Consequently, an adaptation could be viewed as a “tool” a plant or animal possesses that helps it survive and reproduce.

Some examples of adaptations are:

- Birds that swim often have webbed feet that they use as paddles in order to move through the water (Ex: ducks).
- The strong feet and sharp talons of a raptor (hawk, eagle, falcon, accipiter, owl) help it to catch and kill prey.
- The porcupine’s quills protect it from other animals.
- Different shorebird species have bills of different size and shape depending on their diets. For example, the American avocet has an upward-curved bill it swings back and forth in the water to stir up the bottom mud. It then snatches exposed insects and crustaceans. A dunlin uses its short beak to feel for small worms and insect larvae just below the mud’s surface.
- The ability of cacti to store water helps them survive in arid climates.
- In order to survive unfavorable environmental conditions, some animals hibernate.

The very fact that an adaptation helps an organism to survive under certain environmental conditions means an adaptation is also a limitation. For example, a plant that is adapted to wet tropical conditions cannot survive in a desert.

Some organisms seem to be highly adapted to their particular environment, while others are found in a variety of environments. An organism that is adapted to a specific and narrow set of conditions is considered a specialist. Other organisms are able to live in a variety of environments and are called generalists.

Example of a specialist: The snail kite lives in freshwater marshes in warm climates. Its diet is almost exclusively apple snails (genus *Pomacea*). The kite’s beak is long and pointed; this helps it to extract the snail from its shell. Apple snails are most abundant in alkaline (basic) waters that have a good supply of submerged vegetation and dissolved oxygen.

Example of a generalist: The red-tailed hawk is found in almost all of North America. The red-tailed hawk has a wide tolerance for different habitats. Its diet includes birds, reptiles, amphibians, invertebrates, and small mammals.

Suggested Procedure:

1. Explain the adaptation concept. Tell students they will be using observation tools to learn about the animals in this immediate area.

2. Show or review with the students how to use a spotting scope and binoculars.

3. Divide the students up into teams of two. Make sure each pair has a spotting scope, binoculars, or magnifying glass. Provide each pair with a field guide appropriate for what they will be able to observe with their observation tool.

4. Explain to the students that they will be taking turns observing and recording with their partner. The students on each team should sit or stand back-to-back. (This will force the students to look in opposite directions.)

a. The student with the spotting scope, binoculars, or magnifying glass should locate a particular animal with their observation tool.

b. The observer should then describe the behavior and appearance of their animal to their partner WITHOUT TELLING THEM WHAT ANIMAL TYPE/SPECIES THEY ARE OBSERVING. For example, if they are describing a mallard, they might tell their partner that the animal is swimming in the water, has feathers on its body, webbed feet, a green head, etc. The observer should make at least 5 observations. The recorder should write these descriptions on the Student Page - “Adaptations Everywhere.”

c. When the observer thinks he/she has sufficiently described the animal (or the animal has moved away), the observer and recorder should turn to face one another. They should then read through the descriptions and discuss why they think the listed aspects of appearance and behavior help an animal survive. For example, a mallard’s webbed feet help it to swim. Older students may take this farther and explain that webbed feet help a mallard to swim – this allows them to find food in another habitat under the water.

d. Having discussed the animal’s adaptations, they can use what they have learned to try to identify the species using a field guide. If they identify it, they can write their answer in the margin of the Student Page.

5. Allow all the students to observe something through the spotting scopes, binoculars, and magnifying glasses. This illustrates that adaptations are found everywhere and in all shapes and sizes.

6. Bring the students back together. Have each team describe to the group the adaptations of one of the animals they observed. The other students should try to guess the animal from the descriptions of its adaptations.

Extensions/Adaptations:

1. Have students “design” a creature that is perfectly adapted for a certain habitat or is adapted to live in many different habitats. The creature could be a mammal, bird, fish, plant, insect, amphibian, reptile, or a new “type” of organism. Have them draw the creature or build a model of it.

2. Describe the behavior and appearance of different animals to the students. Ask them to try to describe the characteristics of the habitat in which the animal lives. How is the animal adapted to that habitat?

Assessment Ideas:

1. Have students write their own definition of the term adaptation and give examples of adaptations (animal or plant) that they have seen on the Refuge.

2. Point out an animal to the students. Have them make basic observations and identify it using their field guides.

ADAPTATIONS EVERYWHERE

Recorder: Observer:

Appearance	Behavior
Describe what the animal looks like:	Describe what the animal is doing:
How do you think this helps the animal survive and reproduce?	How do you think this helps the animal survive and reproduce?

Recorder: Observer:

Appearance	Behavior
Describe what the animal looks like:	Describe what the animal is doing:
How do you think this helps the animal survive and reproduce?	How do you think this helps the animal survive and reproduce?

On-site Activity B: A Habitat Expedition!

Adapted from *Salt Marsh Manual: An Educator's Guide*.

Method: Students will explore a habitat and learn about the organisms that live in that habitat (plants and animals). This activity is flexible and will work in a variety of habitats.

Objectives: Students will be able to

- Describe several of the organisms that live in a particular habitat
- Describe/explain several of the adaptations of the organisms that live in a particular habitat
- Draw a basic food chain and/or web using at least 3 of the organisms that live in a particular habitat

Materials:

- Copies of Student Page "Expedition Data Sheets" (1 set per group)
- 1 magnifying glass per group
- Appropriate field guides or identification sheets

Subjects: Science

Time: 40-60 minutes

Setting: Outdoors

Grade Level: 4-8

Skills: Investigation, observation, cooperation, questioning, synthesizing, describing

Vocabulary: ecosystem, habitat

Background information:

The Red River National Wildlife Refuge has different habitats or ecosystems within its boundaries. (See p 17 for overview of Red River NWR habitats) Each habitat can be studied by investigating only a small section of it. The plants and animals observed represent some of the living organisms one would expect to see in that habitat.

Suggested Procedure:

1. Tell the students they are going on an expedition to explore an unknown territory. They will be on an expedition team with three members:

a. A zoologist: a scientist who studies animals
b. A botanist: a scientist who studies plants
c. An earth scientist: a scientist who studies the earth and its processes

2. Divide the students into groups of three and hand out the Expedition Data Sheets. Discuss the responsibilities of each expedition member by having one student read each role description aloud (found at the top of the Expedition Data Sheets).
3. Give the students area boundaries. Remind them of the “Rules of Respect on the Refuge,” if appropriate.

4. Students should write their answers to all of the questions on their Expedition Data Sheet so they can share at the end of the activity.

5. Point out the tools that the students have to help them explore their territory. The magnifying glasses will allow them to see plants and small animals in greater detail.

6. Remind the students where they should return to after they have completed their expedition, and send them out to explore. Allow 15-25 minutes for the expedition.

7. When the students have returned from their expedition, allow each expedition team to discuss their findings.

8. After the expedition teams have discussed their findings, have them form “specialist teams” so that the botanists, earth scientists, and zoologists can meet with one another. Specialist teams should summarize their findings for the habitat. Each “specialist team” should then elect one (or more) spokesperson to summarize their findings to the other specialist teams. Use the specialist presentations as an opportunity to help students form conclusions about the general characteristics and inhabitants of the habitat.

9. After each specialist group has presented its findings, gather the whole group into a circle. Ask each student to share something he/she learned or saw:

a. What was the most interesting?
b. How many different plants or animals did you find?
c. What did you learn about the physical components of the area?

Extensions/Adaptations:

Repeat this procedure in different habitats as time allows to compare the diversity and complexity of different habitats.

Assessment Ideas:

Have students develop a brochure that would make an ecotourist want to come visit this habitat. The brochure should include the findings of the zoologist, botanist, and earth scientist on the expedition team. It should include descriptions of the adaptations of at least one plant and animal found in this habitat. It should also include an illustration of a food web of the habitat.

THE ROLE OF THE EARTH SCIENTIST

(Scientist who studies the earth and its processes)

1. Describe how the land looks. (Is it flat or hilly? Are there cliffs in the area? Is it open fields, forest, etc.?)
2. Describe the climate. (What would a typical spring, summer, fall, and winter would be like here? Is it mostly sunny or cloudy? How cold and hot would it be? Would it be windy or calm?)
3. Describe the soil. (Is it coarse, medium, or fine? Is the soil moist or dry? Warm or cold? What can live in this soil?)

EXPEDITION DATA SHEET - Earth Scientist

1. Describe the area:

2. CLIMATE: For a typical year, describe what you think it would be like in this area in the following seasons. (Would it be windy? Wet? Dry? Cold? Hot?)

a. Spring _____
b. Summer _____
c. Fall _____
d. Winter_____

3. SOIL (Circle your choice)

Texture: Coarse Medium Fine
Soil Moisture: Wet Moist Damp
The soil is Cooler Warmer than the air.
Soil color:_____
Are layers visible?_____

Bonus Question: What does this habitat have to offer plants and animals? Does it have areas that provide food, water, and shelter? (Answer this question when you meet with the other earth scientists after the habitat expedition.)

THE ROLE OF THE BOTANIST

(Scientist who studies plants)

1. Describe the plants in this habitat. Are they fuzzy, smooth, salty, etc.
2. Describe the size, color, and shape of the leaves and flowers.
3. What makes them different from each other?
4. How have they adapted to get enough water?

EXPEDITION DATA SHEET – Botanist

1. How do plants get their food?

2. Draw and describe the plants growing in your study area. Record the features of the plant - size, color, shape of leaves and flowers (fuzzy, smooth, woody, waxy, etc).

3. Where could plants find water and shelter in this area?

Bonus question: How do you think the features you described above help the plants to live in this habitat? (Answer this question when you meet with the other botanists after the habitat expedition.)

THE ROLE OF THE ZOOLOGIST

(Scientist who studies animals)

1. Describe animals you find by color, size, shape, and body parts.
2. Look for signs of animals who live here (scat, tracks, holes, webs, etc.)
3. Name all animals that appear to live here.
   A. Describe the food chain for each animal, what do they eat? What eats them?
   B. Where do the animals find water and protection?

EXPEDITION DATA SHEET – Zoologist

1. Draw and describe the animals you found in your study area. Record special features you observe (color, size, shape, specialized mouth parts, camouflage, protective parts like horns or quills).

2. Draw and describe any animal signs found in your study area (scats, tracks, holes, webs, etc.).

3. Where could animals find food, water, and shelter in this area?

Bonus Question: Draw a food chain for one of the animals you described above. (Answer this question when you meet with the other zoologists after the habitat expedition.)

On-site Activity C: Start a Nature Journal

Method: Students will sit quietly in an area, making observations and inferences that connect to their learning. They will record these observations and inferences as an introduction to keeping a nature journal.

Objectives: Students will be able to

- Record their observations and experiences at the Refuge
- Share their experiences with other students in their group

Materials:

- Copies of the Student Page "Nature Journal Ideas"
- Paper and pencil
- Optional: markers, colored pencils, crayons

Subjects: Science, Art, Language Arts, Social Studies (Depends on student's chosen activity)

Time: 30-50 minutes

Setting: Outdoors

Grade Level: 1-12

Skills: Reflection, writing, drawing, observation, mapping, poetry

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Background Information:

Through the ages, scientists, authors, poets, explorers, and many others have kept journals to record their observations and experiences. As learning tools, journals can serve a broad spectrum of purposes. Some journals contain objective information on things such as scientific experiments, weather, wildlife behavior, and seasonal changes. Some journals are entirely personal. A journal can include both personal expressions and objective observations. Keeping a nature journal can be a powerful experience because it helps the observers slow down, carefully take note of their surroundings, and make first-hand observations of nature.

Journals can be started using a few simple tools: several sheets of loose leaf paper, a hard writing surface, and a writing utensil. Some basic information that is often included in a nature journal includes date, time, place, and weather (temperature, wind speed and direction, description of the clouds, etc.). Still, there does not need to be a set format as to how this information is recorded in a nature journal; the writer can develop their own style.

Having recorded some basic information about the area, a student can choose something more specific to study. While in the field, students should be encouraged to record information without using field guides or other textbooks because this encourages them to improve their own observation skills. Back in the classroom, students can refer to their journal entries to research and find more information about what they observed.

Beyond its value as a learning tool, keeping a journal also allows time for reflection and relaxation. Rather than rushing through an area, students have personal time in a natural area. This can help students feel more connected to the land.

After students have completed their journal entries, providing an opportunity to share their observations with others in their group can further increase learning. Sharing provides students with the opportunity to show what they saw and learned. It can help students see the diversity of observations that can be made in nature. It can also help them draw connections in their learning.

Suggested Procedure:

1. Give the students the Student Page - “Nature Journal Ideas,” along with the paper and writing utensil of their choice, and tell them they will have 15-20 minutes to sit quietly by themselves to observe their surroundings. Send them off into the natural area. You may want to give them boundaries of where to go, but also give them adequate space to spread out from one another.

2. Bring the group back together. Have the students sit in a circle on the ground. Allow students to share their experiences as they are comfortable. If each student is asked to share only one entry that they put in their journal, they can choose the one with which they are comfortable.

Extensions/Adaptations:

1. Have students repeat this activity at a location near their home (or in their home) How does the location influence their discoveries and reactions?

2. Continue this activity over a whole week, month, semester, or year as a homework assignment.

NATURE JOURNAL IDEAS

(Select one or more of these to try)

Use all of your senses to describe in words and pictures your habitat to someone who has never been to this place before.

Make a pencil rubbing of some objects in your plot (leaves, bark, seeds, etc.. Find as many textures as you can.

Find as many living organisms or signs of living things as you can. Describe or sketch each insect, plant, bird, or other animal you see.

Draw a picture of your plot from several perspectives. What would it look like if you were a bird flying over? What would a mole notice (underground)? How would it look to an ant? Think of other perspectives too.

Draw or describe the life cycle of something in your habitat (tree, rock, soil, bird, beetle...)

Look for signs of wildlife such as droppings, marks on trees, nests, holes in the ground, etc. Describe or sketch these wildlife signs. Make an educated guess about what animal made that sign.

Make a scale map of your plot, including as many living and non-living things as you can.

Look for signs of wildlife such as droppings, marks on trees, nests, holes in the ground, etc. Make a hypothesis about what animal made that sign.

Write a poem in the shape of something in your habitat (like a tree, rock, stream...) or just write a poem.

Write a short story or children's story from the point of view of some animal or plant. Write about what it might be like to live in this habitat. Include some problems to be solved, develop your characters using real behaviors of those animals, include descriptions within the story of things you notice in your habitat.

COME UP WITH SOME IDEAS OF YOUR OWN!

On-site Activity D: Plant Diversity

Adapted from *Educator's Guide to the St. Marks Refuge* - "Plant Discovery"

Method: Students will look at plants in open water, at the water's edge, and in the uplands and study the differences between the plants in these different habitats.

Objective: Students will be able to

- Describe at least one difference between plants that live in different habitats
- Explain two reasons for plant diversity

Materials:

- Copies of the Student Page - "Plant Diversity"
- Pencils, clipboard
- Hip boots (optional)

Subjects: Science

Time: 30-40 minutes

Setting: Outdoors

Grade Level: 3-6

Skills: Observation, collection, organization of information, scientific investigation

Vocabulary: diversity, emergent plant, floating plant, submerged plant

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Background Information:

The diversity of plant life exists partly because environmental conditions differ from habitat to habitat and change throughout the year. One of the major factors influencing plant adaptations is the amount of water available in a particular area. This can easily be seen by comparing the structures of plants that grow in open water, at the water's edge, and in the uplands.

- OPEN WATER: These plants must survive very wet conditions and have a mechanism for either floating above the water to get sunlight (sometimes called floating plants), or being able to survive in the water column below the surface (sometimes called submerged plants), using diluted sunlight. For example, water lilies grow on the surface, and elodea grow below the surface.

- WATER'S EDGE: The dominant plants are those that can keep their roots wet during the high water time of the year, and then survive dry conditions when the water in

the pond is low. At least part of the plant is above water level (sometimes called emergent plants). Cattails are an example of plants found in this zone.

- UPLANDS: These plants must suck up moisture from the ground through their roots, and then give off water vapor through their leaves (transpiration). They must be able to stand upright without the support of surrounding water. Some of these plants have woody, not soft, trunks and branches.

Suggested Procedure:

1. Tell the students they are going to go on a discovery walk to learn about plant diversity. They will be looking at the conditions in which plants live and how their structural adaptations help them to live there. Help the students brainstorm a list of some of the different conditions in which a plant could live (e.g. moisture levels, wind conditions, temperature, oxygen levels, amount of sunlight, nutrient levels, etc.).

2. Divide the students into teams of 2-3. Give each team a copy of the Student Page. Have them answer the questions on the first page.

3. Send the students to investigate the plants in the different habitats. Remind them to carefully record their observations.

4. After students have visited the sites, bring the group back together. Discuss the environmental conditions found in each area. Help them to draw the connections between the structure of the plants and the conditions in which they grow. How does this tie in with plant diversity? Do not get caught up in identifying plants - focus on plant adaptations.

Extensions/Adaptations:

1. Repeat this activity along another transition zone, such as a meadow - forest edge - forest.

2. If your group has been working on plant identification, have students examine features of the plants that they think might aid in identifying the plant. Have the students key out a few of the plants using a guide.
3. Make the exploration more quantitative by having the students walk (and wade) a transect line that goes through the different habitats and count the plants touching the transect line, noting their basic characteristics.

Assessment Ideas:

1. Student Page - “Plant Diversity”

2. Have students use photographs to compare/contrast the structural adaptations of plants that live in other habitats (for example: tundra, rain forest, desert).

PLANT DIVERSITY

Before you go look at the plants, answer the following questions about where the plants live:

	Open Water	Pond Edge	Upland
SOIL: Is the soil in this area usually wet, usually dry, or sometimes wet and sometimes dry?			
SUNLIGHT: How much sunlight can a plant get in this area?			
DESIGN A PLANT: Design and draw a picture of a plant that could survive in these conditions. Label 2 of the adaptations that would help your plant survive in this area.			

Now, begin exploring, and record your observations:

	Open Water	Pond Edge	Upland
How many different types of plants do you see? (Are there lots or few?)			
Draw or describe the most numerous plant in this area. (How tall is it? What shape are its leaves? Does it have woody stems?)			
How tall are the tallest plants in this area? How tall is the shortest plant in this area?			

Other observations?

Conclusions:

How did the plants that you designed compare with the plants you actually saw in each area? What was the same? What was different?

Open Water:

Pond Edge:

Uplands:

Why do you think the plants in each area are different from the other areas?

On-site Activity E: Create a Class Field Guide

Adapted with permission from *WOW! The Wonders of Wetlands*, ("Wet 'n' Wild") 1995. Published by Environmental Concern Inc., St. Michaels, MD (410) 745-9620

Method: Students will carefully observe the wildlife (birds, mammals, insects, reptiles, amphibians, fish, shellfish, etc.) and plants that they see on their field trip. They will use their observations and drawings to compile a class field guide from the trip.

Objectives: Students will be able to

- Observe and describe plants and animals that they see outdoors
- List the characteristics of a plant or animal that should be studied when trying to describe/identify a plant or animal

Materials:

- Copies of the Student Page - "Class Field Guide"
- Pencils, pens, clipboards
- Colored pencils, felt-tip pens, or crayons (back at classroom)
- Published field guides

Subjects: Science, Art, Language Arts

Time: 5-20 minutes outdoors, 30-40 minutes in the classroom to complete the field guide

Setting: Outdoors and Classroom

Grade Level: 1-12

Skills: Gathering information, organizing information, interpreting information, drawing, writing

Vocabulary: adaptation, behavior, habitat

Background Information:

The adaptations a plant or animal has are the tools (anatomy, behaviors, physiology, etc.) that allow it to survive and reproduce in its natural habitat. A plant or animal's habitat provides it with the food, water, protection, and space that it needs to survive and reproduce. Some organisms can live in a wide variety of habitats, while others have more specific needs (generalists versus specialists).

Numerous published field guides are available to help people identify and learn the natural history of everything from birds to mushrooms to rocks. These guides can be valuable aids for learning about the outdoors. However, it can also be helpful for students to sharpen their own observation skills and learn the natural history of the plants and animals at the Refuge by making their own class field guide.

By carefully observing a plant or animal and noting the habitat in which it is found, a person can learn about the natural history of the organism. What are the dominant features of the habitat in which it lives? In what part of the habitat is the plant growing? How is the animal using its habitat? How does the animal forage for food?

Making a sketch of the organism can also be helpful. Observations include the color, size, and shape of the plant or animal. A particular part of the animal or plant's body, such as the bill, or legs may help in identification. The flower structure is important in plant identification.

Suggested Procedure:

1. Before the field trip, tell the students they will be observing plants and wildlife while on the trip in order to make a class field guide. You may want to let them look at field guides prior to the trip so they can see an example of the kind of information that field guides include.

   Let them know they can include a variety of organisms in the class field guide - birds, plants, mammals, reptiles, insects, worms amphibians, fish, shellfish, microscopic organisms (if you do pond sampling), etc.

2. Brainstorm with the students the characteristics and behaviors that they should be looking for when they are observing their plant or animal. If students come up with ideas that are not on the class field guide sheet, you can add the ideas to the back of the sheet.

3. At the Refuge, remind students that they cannot collect anything at the Refuge; they must make their observations where they see the animal, plant, etc. Out of respect for the plants and animals, they should quietly observe them and not try to pick them up.

4. Within a specific boundary you establish, allow each student to select their observation spot. Allow some distance between each student.

5. Ask students to jot notes down about their subject. Items to consider are:

a. Appearance: Color? Size (Compare the plant or animal to something else, e.g. bigger than a crow, smaller than a Canada goose)? Shape? Where are its eyes, ears, mouth?
b. Location: What are the characteristics of the habitat in which it is found? Wet/dry? South facing? What kinds of vegetation are found here? Etc.
c. Movement: Does it move? How does it move? Does it move quickly? Slowly?
d. Behavior: What is it doing? Remind students that plants can be "doing" invisible things (i.e. photosynthesis)

e. Sketch the organism.
f. Diagram the location. Students should show both the habitat in which the organism is found and the habitats surrounding the organism. For example, in what part of the pond was it found?

6. After the field trip, have the students complete their field guide pages. Have them use a published field guide or other references to learn more about the specific needs of the species for nesting, protection, etc. This natural history information should be included in the class field guide pages. You may want to have them work on their field guide page as homework on the day of the field trip.

7. Compile the class field guide. If you only have one copy, keep it in the classroom so students can look at it during free periods. You may want to photocopy it so students have their own copies.

Extensions/Adaptations:

1. Key out the organisms from the class field guide.

2. Discuss the challenges involved in identifying some species and understanding their habitat needs.

3. Compare the students' guide to a published guide so they can see what additional information is included in published field guides.

Suggested Assessments:

1. Student Page - "Class Field Guide"

2. Have students explain the importance of an animal's or plant's habitat to its survival.

3. Describe a particular habitat to the students. Have them design an organism that is adapted to this habitat.

Sketch of Plant or Animal AND its habitat:

CLASS FIELD GUIDE

Name of plant or animal:

Description of plant or animal:

Important characteristics of the habitat:

What is the animal or plant doing?

BACK AT SCHOOL:
Look up this species in a published field guide. Describe what this species needs in its habitat to survive and reproduce.

On-site Activity F: Wetland Inventory

Adapted from *Salt Marsh Manual: An Educator's Guide*

Method: Students will sample organisms from a wetland habitat and collect water samples for microscopic study back in the classroom.

Objectives: Students will be able to

- Identify and/or describe the plants and animals that live in a wetland habitat
- Describe and demonstrate methods for collecting information about the organisms that live in wetland habitats
- Explain plant and animal adaptations to living in wetland habitats

Materials

- Minnow net
- Bucket
- Plankton net
- Pond life identification book
- 1 dish of mud and a trowel
- 1 petri dish and popsicle stick per student
- Magnifying glasses (1 per student)
- 1 4-layered sieve set
- Clipboards
- Glass jar for plankton collection (To be analyzed back in your classroom. See Post-visit Activity 7A: Plankton Lab)

Subjects: Science

Time: 60 minutes or longer

Setting: Outdoors

Grade Level: 3-12

Skills: Observation, analysis, identification, data collection, synthesis

Vocabulary: adaptation, aerobic, anaerobic, bog, delineation, fen, floating plants, harvest, marsh, muskeg, nutrients, peat, population, swamp, transition zone, vegetation, wetlands, wildlife

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Background Information:

Throughout most of history, wetlands have been thought of as wastelands. Today, people are beginning to understand the essential role that wetlands play in the cycle of life. Wetlands are a transition zone between land and water. Because they are transition zones, it can be difficult to determine where a wetland starts and ends.

Wetland Characteristics:

The characteristics of the soil, plants, and water in an area are used to define a wetland. The three main clues that an area is a wetland are:

1) **Hydric (saturated) soils:** The soil is saturated for a long enough time during the year that a low oxygen (anaerobic) state occurs. There are some distinguishing characteristics of wetland soil:

- Sulfurous (rotten egg) smell
- Color: green, dark gray, brown, or black
- Water collecting in a 30 cm deep hole, or soil that has a wet feel (sticks together in a ball or oozes between fingers)
- Mottled coloring (red or black regions that result from mineral staining)

2) **Hydrophytic (water tolerant) plants:** These plants have adapted to live in the low oxygen state of the soil found in a wetland. Obvious plant adaptations relate to obtaining adequate oxygen:

- Shallow or exposed roots that pick up oxygen from the surface or aerobic soil layers
- Plants with hollow tubes or sacs that transport oxygen to the roots (reeds, grasses, sedges)
- Buoyant, floating plants with root systems that dangle in the water

3) **A specific hydrologic (water) regime:** Typically, water level is just at, or slightly below the ground's surface. The source of the water can be rainwater, ground water seeps, periodic river flooding, pooled water resulting from poor soil drainage, or salty ocean tides. Some wetlands are wet all year; others may be wet for only brief periods of time. Some wetlands are waterlogged less than seven days of the year. Signs of water include:

- Spongy or mushy ground (if you kneel, do your knees get wet?)
- Mud or dried mud cracks in low spots
- Water staining on tree trunks or other vegetation
- Mottled or darkly stained vegetation (from previous flooding)
- Topographic evidence of water (gullies or stream channels)

Types of Wetlands:

Wetlands include marshes, swamps, bogs, fens, muskeg, mires, ephemeral pools, estuaries, salt marshes, and mangrove swamps. The classification of a wetland depends on the dominant large vegetation, source of water, and the presence or absence of peat.

For example, the word “marsh” describes a wetland with non-woody vegetation that grows taller than the water (Ex: cattails). On the other hand, a swamp is dominated by trees.

Wetland Functions:

Physical/Hydrological Functions:

- Absorb/retain excess water (thereby reducing flooding)
- Provide coastal protection from storms
- Allow for ground water recharge
- Strain silt and debris from water

Chemical functions:

- Filter impurities from the water
- Neutralize toxic substances
- Provide waste treatment
- Mix nutrients and oxygen into the water

Biological Functions:

- Provide resting place for migratory birds
- Feed and protect young animals
- Provide nutrient rich foods

Socioeconomic Functions:

- Have commercially important fish, bird, and animal populations
- Provide fuel (peat can be burned for energy)
- Timber and fiber harvest
- Recreation, aesthetics, and education

Wetland Conservation:

Realizing that wetlands are important for both wildlife and humans, private groups and government agencies have been working to conserve wetlands. For example, one of the primary goals of Waterfowl Production Areas (part of the National Wildlife Refuge System) is the conservation of wetland habitat and its associated wildlife and plants. A large number of national wildlife refuges have wetland habitat. Organizations such as Ducks Unlimited and The Nature Conservancy have been active in setting aside wetland conservation areas. Local groups have also been important in wetland conservation.

Despite our increasing understanding of the importance of wetlands to wildlife and humans, there is still pressure to drain or fill wetlands for human uses. As the human population continues to grow, we will be faced with some tough decisions about what to do with our wild lands. An increased understanding of the values of wetlands may help us to make these decisions.

(Dennison and Berry 1993; Horne and Goldman 1994)

Suggested Procedure:

1. Before students survey the wetland, provide them with some background information about wetlands, as appropriate. For younger students, you may want to tell them there is a proposal to develop this wetland for a new condominium complex. They are the scientists that have been asked to survey this wetland to help determine if it should be left as a wetland or filled for the condominiums.

2. Place the students in groups of 2-3. Give each team the necessary materials to explore the marsh habitat. Remind them it is okay to get their feet a little wet when they are examining the marsh life along the shore. Remind them of safety, if appropriate.

   NOTE: If you want the students to note visible life in the water, they will need to do this BEFORE they stir up the mud in the marsh.

3. The students should catalog and identify as much of the marsh life as they can in the time allowed. Remind them they may want to spread out so each group is in a slightly different area. Allow the students 15-25 minutes to complete their exploration of the marsh.

4. Soil and Mud Creatures: Gather students around the sieve set and ask for two volunteers. The sieves are stacked with the coarsest screen (largest holes) on top and the finest screen (smallest holes) on the bottom.
   a. Have one student place a “golf ball” size mud sample on the top sieve and carefully loosen it as the other student pours water over the mud.
   b. When the mud has passed through the top screen, separate the sieves and pass them out to the students.
   c. Students should examine their sieves for animals. If the animals can be seen with the naked eye, they should place them in their petri dishes. They may also take a small scrape of mud to look at under the magnifying glass. BE CAREFUL: use a small amount of mud for easier viewing. (If possible, you may want to keep a small sample of the mud to look at under the microscope upon return to your classroom. Consult Refuge staff to find out if this is possible.)
   d. Encourage the students to identify the creatures in their samples by using a field guide. Some of the creatures may require a microscope to be seen.
   e. Have students draw sketches of their mud creatures

5. Plankton Tow: Gather the students around the plankton net and show them how it works. Tie the end of the plankton net to something secure. Throw the plankton net out into the water, keeping it somewhat close to the surface (you do not want it to hit the bottom of the marsh). Drag the net back and forth through the water several times. The plankton sample will be collected in the jar at the bottom of the net. Transfer this to your own jar, and take this home for further investigation back at school using the microscopes. Take a few samples to ensure you will have enough plankton.

6. At the end of this activity, after the students have cleaned their equipment, gather the students together. Facilitate a discussion by asking the following questions:
   a. What types of animals live in the mud? In the plants along the shore? In the open water?
   b. What types of animals eat the mud creatures? Who eats the animals that live in the plants along the shore?
   c. What are some of the important functions of wetlands?
   d. What are some of the adaptations the animals and plants have for living in the wetlands?

7. Discuss the values of this wetland. As scientists, and as citizens, do the students think the wetland should be left as it is? Or should it be filled so condos can be built? Why? Why not?

Extensions/Adaptions:

1. Do parts or all of this activity, depending on the time and equipment available.

2. Sample a different aquatic habitat, such as a lake, pond, or stream using appropriate equipment. Compare the habitats using the collected data.

Assessment Ideas:

1. Student Page - “Wetland Inventory”

2. Have students write a paragraph explaining how the wetland plants and animals are adapted to live in wetlands. What would happen to the different plants and animals if the wetland was filled? Why?

WETLAND INVENTORY

Team Members:_____

PLANTS: Draw or describe four of the species that are living along the shore of the wetland. Then, use a field guide to try to identify these plants.

Do any of the plants have these adaptations (Check any that you see):

- "Knees" that jut out of the ground and extend above the high water mark
- Shallow or exposed roots
- Hollow tubes or sacs
- Floating plants with roots that dangle in the water
- Swollen tree trunks that are thickened to the height of deepest water
- OTHERS?

How would these adaptations help a plant to survive in a wetland?

ANIMALS: Use your magnifying glass and minnow net, and your own eyes to look at animals that live in the wetland. Remember, be careful if you handle any of the animals! Draw or describe four of the species that you find. Using a field guide, try to identify these species.

Do any of the animals that you see in the wetland have these adaptations (Check any that you see):

- Webbed feet
- “Paddle” tails
- The ability to float on the water
- The ability to swim
- OTHERS?_____

How would these adaptations help an animal to survive in a wetland?

SOIL and MUD CREATURES:

Does the soil have any of these characteristics (Check any that you find):

- A sulfurous (rotten egg) smell
- Soil color: green, dark gray, brown, or black
- Water collecting in the hole from which you took the soil sample
- A wet feel (it sticks together in a ball or oozes between fingers)
- Several soil colors mixed together (Mottled coloring from mineral staining)

Why do you think the soil has these characteristics?

Draw or describe four of the mud creatures you see in your petri dish: using a field guide, try to identify these species.

CONCLUSIONS: What do you think should happen with this wetland? Why?

On-Site Activity G: No Trash Lunch

Adapted from *Salt Marsh Manual: An Educator's Guide*

Method: Students will learn about where the food and packaging in their lunch comes from and the importance of waste reduction.

Objectives: Students will be able to

- Explain where the food for their lunch came from
- Recycle as much of their lunch waste as possible
- Explain the role of reducing, reusing, and recycling

Materials:

- Students' lunches
- Recycle and trash bins

Subjects: Science and Social Studies

Time: 20 minutes

Setting: Outside (or classroom)

Grade Level: K-8

Skills: Critical thinking, discussion, personal and civic responsibility

Vocabulary: biodegradable, habitat, recycle, reduce, wildlife

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Background Information:

The United States of America has over 270 million residents. We make choices every day that affect wildlife and its habitat. The way we raise food, package food, and care for the land all have impacts. The widespread use of chemicals to kill pests can impact wildlife. Excess product packaging quickly ends up in land fills. Long distance transportation of food impacts wildlife because it requires the use of fossil fuels. Amazingly, the average person generates approximately 1500 pounds of garbage per year or 4 pounds of garbage every day.

Many items made today are thrown away after one use. Often, these items are made to resist natural degradation - they are not biodegradable. The disposal of this almost permanent material is a big problem. Household trash generally contains up to 60 percent paper, 10 percent bottles, 10 percent cans, 15 percent plastic containers, and 5 percent food material. All of these items can be recycled or reused. Remember, no matter what we do to our waste material - burn, bury, or pour it down the drain - it never

disappears, it merely changes in form. We don't want the new form to be detrimental to our environment!

We need to think of new ways to decrease our negative impacts on wildlife in our every day choices. Can we raise food with less chemicals? Can we reduce the amount of products we use? Can we buy products with less packaging? Can we re-use our "throw away" products? Did you know it takes 80 acres of trees to produce all the copies of the New York Times for one Sunday? Seventeen trees can be saved every time one ton of paper is recycled. Aluminum cans can be remelted for new cans. Glass can be crushed and mixed with asphalt for paving roads. The table below lists waste materials, where they come from, and approximately how long they take to break down naturally.

Material:	**Made From:**	**Biological Breakdown Time:**
Paper	Trees	30 days
Glass	Water and sand (minerals)	500 years
Aluminum	Rocks (minerals)	200-500 years
Tin	Rocks (minerals)	100 years
Plastic	Oil (ancient aquatic microorganisms)	500 years - forever
Food products	Plants or animals	14-90 days

The variation on the time for biological breakdown depends mostly on the type of garbage and under what conditions the breakdown occurs (i.e. sunlight, heat, rainfall, etc.)

Suggested Procedure:

1. After the students finish eating their lunches, have them throw their waste material into the appropriate recycling and compost bins.

2. Discuss the contents of all the bins, including where the products came from and how they can be reduced, reused, or recycled (see above table). Ask them questions like, "Who had a tree in their lunch box?" etc. to get them thinking about the original origins of

the products they brought. If you are going to look at the plankton from a marsh or pond, help students understand that ancient aquatic microorganisms are used to make plastic.

3. Discuss the importance of recycling and what would happen if we did not recycle anything. Emphasize to the students that individuals CAN collectively make a difference by reducing waste, re-using products and recycling.

4. Discuss how materials are cycled through systems. Discuss the importance of decomposers and decomposition. Nature recycles!

5. Ask the students for suggestions as to how they can help (as individuals) to solve the problem.

   Examples: Reduce by avoiding overpackaged products
   Reduce by avoiding disposable containers
   Reuse lunch bags
   Reuse sandwich wrap/baggie
   Recycle aluminum cans and cardboard

Challenge the students to design a “no trash” lunch - make a list of what would go in it.

Extensions/Adaptations:

1. Initiate composting and vermi (worm) composting in your classroom.

2. Back at school, look at the trash that your school creates. Discuss possibilities for reducing waste and recycling more at school.

3. Visit a landfill. Discuss how much wildlife habitat is taken up by landfills.

Assessment Ideas:

1. Have the students keep track of what types of garbage are produced at home for one week and write down how these items could be reused or recycled.

2. Have students trace the path of their lunch food all the way back to its origins.

On-site Activity H: Manage a Refuge!

Method: Students will design with a "management plan" for a small plot of land on the Refuge. They will survey their plot of land and determine ways to make suitable habitat for a particular species or group of species.

Objectives: Students will be able to
- Define wildlife management
- Explain changes that can be made to a habitat as a part of wildlife management
- Discuss how management can be complex and involve making difficult decisions and choices

Materials:
- Clipboards
- Copies of the Student Pages "Refuge Management Plan" and "Management Tools"
- Species cards for chosen species
- Strings to mark off mini-refuge boundary (different lengths)

Subjects: Science, Social Studies, Language Arts, Career Education

Time: 50-60 minutes

Setting: Outdoors

Grade level: 6-12

Skills: Analysis, description, discussion, synthesis, cooperation, planning, oral presentation

Vocabulary: endangered, habitat, population, resource, species, threatened, waterfowl, wildlife, wildlife management,

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Background Information:

The term "natural resource" is a broad term, but it can be defined as those products of the natural world that are of value to humans. Thus, a natural resource can be an animal, plant, mineral, open space, and even a human experience in the outdoors. Wildlife is often called a natural resource. Wildlife management is defined as:

the application of scientific knowledge and technical skills to protect, conserve, limit, enhance, or extend the value of wildlife and its habitat

By its very definition, management must have particular goals. For example, an area could be managed in order to improve nesting habitat for waterfowl. Or, a pond could be managed to increase the populations of certain fish species. The management goals determine which techniques will be used on a piece of land or a body of water.

Who is responsible for the wildlife on public and private lands in the United States? By law, wildlife is publicly owned in the United States. This means that even when land or water is owned by a private citizen, the wildlife on that land is still publicly owned, with few exceptions. Thus, State and Federal governmental agencies are primarily responsible for wildlife. State agencies emphasize the management of nonmigratory wildlife. Federal agencies, especially the U.S. Fish and Wildlife Service, emphasize management of migratory species, certain marine mammals (sea otters, polar bears, walrus), wildlife that resides on refuge land, and threatened and endangered species.

Management of wildlife can be direct or indirect. Direct management involves manipulation of the plant or animal population. An example of direct management is hunting and its regulation. Indirect management involves altering the habitat to favor or inhibit target species. For example, prescribed fires are sometimes used to remove excess dead plant material, control woody species, and improve nutritive content of plants. Grazing is also used as a management tool. (See p 155 for examples of management tools)

Management Tools Used on Red River National Wildlife Refuge:

Uplands: Prescribed burns and removal of hardwood in Red-cockaded woodpecker cluster
Former Agricultural Fields: Reforestation with species of hardwoods that occurred there historically
Swamps and Marshes around the lake: Protection
Lake: Control of water hyacinths, fish surveys
General: Nesting box programs for prothonotary warblers, Eastern bluebirds, and wood ducks, hunting and fishing regulations and enforcement, bird banding, environmental education, reptile and amphibian surveys and counts, raccoon removal before alligator snapping turtle nesting, turtle nesting monitoring.
Prairie Demonstration Ares: Seed distribution, plantings and annual mowing or burning

In this activity, students are given a small plot of land (10-20 square feet) that is their mini-refuge. Using their string, they rope off their mini-refuge (Scale: 1 foot = 1 mile). They are provided with descriptions of a particular species for which they develop a management plan. For the purposes of this activity, the descriptions of the management tools have been simplified.

Suggested Procedure:

1. Select an area that has several different habitat types in somewhat close proximity to one another (field, forest, stream, marsh, etc.). If this is not possible, the activity will also work if students are given different areas in the same habitat type.

2. Discuss the concepts of wildlife management including direct and indirect management with the students.

3. Divide the students up into teams of 3-4. Tell them they are about to become managers of a new mini-refuge (Scale: 1 foot = 1 mile). As managers of a mini-refuge, students will be managing for a particular species of wildlife. They will be provided with species card that includes a description of a species and its habitat requirements. Distribute species cards and Student Pages.

4. Review what students should accomplish while “managing” the mini-refuge:
   a. Determine what kind of habitat their mini-refuge has on it.
   b. Draw the mini-refuge in its current condition. (For older students, you can have them draw the map to scale. If you want them to draw the map to scale, you may want to provide graph paper).
   c. Assess how well the mini-refuge meets their species’ needs. What habitat components are already present? What is missing? Is there anything they can do to make their mini-refuge better for their species (add ponds, plant important food species, etc.)?
   d. Develop a management plan for their mini-refuge and write it on the Student Page. They can refer to their Student Page “Management Tools” for ideas of ways to manage their mini-refuge. A good management plan includes:
      i. A map of the mini-refuge, including boundaries, stream, pond, trail, road, and restroom areas.
      ii. A list of the management tools selected.
      iii. Reasons for selecting the management tools.

5. Assign, or let each team choose, an outdoor spot for their mini-refuge. Using their string, they should rope off their mini-refuge (Scale 1 foot = 1 mile). Try to provide strings of different length to different teams to help illustrate that refuges vary in acreage.

6. Allow approximately 30 minutes for student teams to develop their management plans. Monitor progress.

7. Bring the students back together and allow each group to give a short description of their mini-refuge, including the mini-refuge’s name, focal species, and chosen management tools.

8. Discuss the different options that each group chose in the management of their mini-refuge. Ask:
   a. What would have happened if you were told to manage for a different species?

b. What if you needed to manage for several different species on the same mini-refuge? How would that have made your choices more complicated? Is managing for several species more realistic? (You can illustrate this idea by asking a group what they would change in their management plan if they had to manage for their group's species as well as another group's species.)

c. Did it help to have a few different habitat types on a mini-refuge? Why? (Habitat diversity can often offer a species more of its requirements than one habitat)

9. Discuss some of the management tools that are used on Red River National Wildlife Refuge. Remind students to look for areas on the Refuge where they can see evidence of these wildlife management tools. Have they seen any such areas already?

Extensions/Adaptations:

1. Have students manage for more than one species on the mini-refuge.

2. Determine how much public use you would have on the mini-refuge.

Assessment Ideas:

1. Student Page - "Refuge Management Plan"

2. Have each student teams evaluate and offer suggestions for another student team's management plan.

3. Provide a map of another mini-refuge to students. Ask them to develop a management plan for their species on the new mini-refuge using the information provided on the map.

Example Species Card: Wood Duck (*Aix sponsa*)

Food:	Wood ducks eat a variety of foods, including acorns, seeds, berries, grain (from agricultural fields), aquatic plants, aquatic and terrestrial insects, and other invertebrates. Adults: Acorns are a staple diet of the adult birds. So, good habitat often has mature oak trees that supply the acorns. Adults can feed some distance from open water. Ducklings: Insects are an important food for ducklings.
Water:	As aquatic birds, wood ducks are highly adapted to life in the water. They spend a great deal of their lives on or near forested wetland habitat, marshes, and beaver ponds.
Shelter:	Wood ducks need areas with flooded shrubs, trees, or both shrubs and trees. Wood ducks do not nest on the ground - they need tree cavities or nest boxes. Cavities are usually at least 5 feet above the ground. Also, a nest cavity entrance that is less than 4 inches in size is safer from predators than a larger hole. Tree cavities: Trees that are greater than 16 inches in diameter often provide the best cavities. Sometimes, females will use an abandoned nest hole of another species. Artificial Nest Boxes: Nest boxes should be placed along shallow pond edges where there is abundant vegetation in which ducklings can hide.
Space:	The maximum density of wood duck nests may be 7 nests per acre.
Arrangement:	It is not enough to have food, water, shelter, and space. These elements must be in the proper arrangement. For the wood duck, food must be near permanent water. The nest cavity or box should be less than ½ mile from open water. Also, once hatched, ducklings survive better in sheltered areas that also have food. Shoreline pond vegetation can provide shelter for ducklings and insects for them to eat.

Other species that can benefit from Wood Duck management: mallard, black duck, hooded merganser, great blue heron, yellow-rumped warbler, prothonotary warbler, belted kingfisher, swamp sparrow, pileated woodpecker, red-headed woodpecker, screech owl, red-bellied watersnake, painted turtle, bullfrog, and beaver.

Management Tools	What does this tool do for wildlife and their habitat?

Artificial Feeders:	Used mostly to feed wildlife in urban/suburban areas
Brush Piles:	Increases the amount of protection for species like rabbits and quail and songbirds
Prescribed Burning:	Can encourage plant growth and make plants more nutritious Can decrease the number of shrubs and trees Can improve water and protection conditions in a wetland that has too much vegetation
Create Dams:	Raises the water level and creates pools Provides fish with a place to rest and hide
Fertilize Vegetation:	Makes plants more nutritious for herbivores (mule deer, etc.)
Leave Grain Unharvested:	Provides food and protection for a variety of wildlife
Decrease Hunting/Fishing:	Decreases the number of animals that can be hunted/fished Helps populations of animals to increase in number
Increase Hunting/Fishing:	Increases the number of animals that can be hunted/fished Needed when the population is too high - crowded habitat, animals are in poor condition (thin), or there is lots of fighting.
Grazing:	Improves nutritional value of vegetation Improves water and protection conditions in a wetland that has too much vegetation

Nesting Structures:	Some species nest in cavities or in large tall trees Nesting boxes and platforms can help these species during breeding season
Plant Trees/Shrubs:	Provides food for some wildlife (buds, leaves, acorns, nuts) Can block the wind and provide protection
Build Pond/Wetland:	Benefits fish and water birds
Deepen Pond Edges:	Improves pond for fish Decreases the amount of vegetation around pond edge
Transplant Animal or Plant:	Can be done with all kinds of organisms Brings an organism into a suitable habitat if it cannot get there on its own
Perching/Roosting Platforms:	Some species roost or search for food from trees/tall shrubs

(Management tool descriptions adapted from *Wildlife Habitat Evaluation Handbook*)

REFUGE MANAGEMENT PLAN

Team Members:

Mini-refuge Name:

Species we are managing for:

1. Map of the mini-refuge: Draw the mini-refuge as it looks before you make any changes.

Map Scale: _____

Look at your species card. The mini-refuge may or may not have everything your species needs. Make a list of what the mini-refuge has for your species and what the mini-refuge needs for your species:

The Mini-refuge Has: The Mini-refuge Needs:

2. What management tools can you use to make the habitat on the mini-refuge better for your species?

Management tool:	**How will this management tool improve the habitat for the species?**

3. On your map, draw any changes to the land that will occur because of your management plan. Use a different color so it is easy to see the changes that result from your management plan.

4. Is there nearby land that would help improve the mini-refuge for your species (if you could buy it)? Describe the habitat of this land. What does it have that would help your species?

5. How will you know if your management plan is successful? How will you know if you need to make changes to your management plan?

On-site Activity I: What Should We Do with this Land?

Adapted from *Habitat Fun Pack,* U.S. Fish and Wildlife Service (1989) and *Salt Marsh Manual: An Educator's Guide*

Method: In this activity, students participate in a role-play in which they are stakeholders in a land-use decision.

Objectives: Students will be able to

- Gather evidence and use background information to make arguments for and against a particular land-use proposal
- Make a decision about how to manage a piece of land
- Evaluate the consequences of a land-use decision

Materials:

- Stakeholder identification cards
- Paper, pencil, clipboards for student teams
- Stopwatch

Subjects: Science, Social Studies, Civics/Government, Language Arts

Time: 60 minutes

Setting: Outdoors

Grade Level: 4-8

Skills: Analyzing, discussion, problem definition, decision making, problem solving, oral communication

Vocabulary: recycle, stakeholder, wildlife management

Background Information:

Throughout our lives, we are faced with choices that have an impact on our community, state, nation, and planet. Sometimes these decisions relate to the way we live our life everyday. For example, we make choices in the products we buy, the way we get to work/school, and in whether or not to recycle. Other times, our decisions relate to what happens to lands in our community. Do we develop a piece of land? Do we leave it as is? Do we manage it using wildlife management principles?

Land-use decisions are often difficult to make. There are usually multiple people and groups of people who are impacted by such a decision. The different stakeholders usually have valid arguments for and against each proposed land-use. These

stakeholders want their opinions to be heard. Arguments can become quite heated as stakeholders put forth their opinions.

In the end, after the stakeholders have voiced their opinions and all kinds of evidence have been collected, a decision must be made as to what will be done with the land. Land-use decisions are complex. They involve legal, economic, ecological, political, social, and emotional components. In reality, a land-use decision is infinitely more complicated than that presented for this activity.

Suggested Procedure:

1. Place the students into small groups (2-4 students).

2. Read the following to them. You may want to pass out the Stakeholder Identification Cards as you read the description, so each group knows their role.

Look around you. Look above, below, behind, and to the side. You are standing on a piece of land that is currently owned by our city, Rocky Point. We must decide what we are going to do with this land.

*For many years, this land has been as it is now, a natural area. However, no formal decision has ever been made as to the future of this land. The **City Council** feels the time has come to reach such a decision.*

There are some different opinions as to what we should do.

- *The **biologists** believe this land should be left as a natural area that provides habitat for a variety of wildlife species.*
- *A development company, **Builders for Tomorrow**, has submitted a proposal to build a shopping center that would serve the needs of our community.*
- *The **Historical Society** values the 100 year-old farmhouse and barn on the property, and would like to leave that intact.*
- *The local sports peoples' group, **Rocky Point's Sporters**, has used this land for hunting and fishing for the last 20 years and would like to continue to do so.*
- *The **businesspeople** of Rocky Point support economic development of the community and the proposal from Builders for Tomorrow.*
- *Lastly, our local **Wildlife Observers** group is here because they currently use this area for wildlife watching and would like to continue to do so.*

3. Tell the students they will need to work with their team members to develop a two-minute proposal for what they think should happen with this piece of land. The proposal should include at least 3 supporting arguments. In designing their proposal, the team should investigate the land and read their Stakeholder Identification Cards. The team should pick one or two people that will present the group's proposal to City Council.

4. While the stakeholder groups are developing their proposal, explain the role of City Council to the students in that group. On their card, it explains their responsibilities. Have them pick one member who will be a timekeeper so each group is limited to two minutes to present their proposal.

5. Bring the students back together. Depending on the group, you may want to establish some guidelines before the council meeting begins. For example, you may want to have a rule that there are no interruptions during the proposal presentations (or not?) Will you permit questioning at the end? (This may depend on time constraints.)

6. Turn "control" over to City Council and have the stakeholders present their arguments. After the presentations of the proposals, give City Council a few minutes to reach a decision as to what will be done with this piece of land.

7. At the end of the activity, students should be given the opportunity to discuss what happened:

- *What are the consequences of City Council's decision? What can/cannot be done on the land as a result of the decision?*
- *What additional information would have helped in planning the proposals? Where could a person go to get this information?*
- *What additional information would have helped the council in reaching a decision? Where would a person find that information?*
- *Was it difficult or easy to decide what to do?*
- *Were you assigned to a group that you did not want to represent? How did that make you feel?*
- *Would your decision have been different if there was an endangered plant or animal that lived on the land? What if the town needed the money from the shopping center to survive?*

Extensions/Adaptations:

1. Have students research recent land-use decisions in your community

2. Have students attend a County Commissioners' meeting

Assessment Ideas:

1. Have students write about their group's proposal (or decision if you were a City Council member). How did the outcome of the decision make them feel? Why do they feel it was the right decision? Why not?

2. Have students describe what they would have done with the land if they had to make this land-use decision on their own. Which arguments were the most convincing? The least convincing?

CITY COUNCIL

KEEP IN MIND: Your job is to help find the best solution for all of the town's citizens. The town needs the new jobs offered by the shopping center, but the town will have to pay for the new shopping center roads. Where will the money come from? The town needs to clean up its river. The wetland on this land serves as a natural water filter to remove silt and pollutants.

You were elected by the people of the town to represent them - ALL of them
You must listen carefully to all the speakers and people from the audience before you decide what to do with the land
You may reach a decision that is a combination of several proposals
One of you should be a time keeper (2 minutes per proposal)

BIOLOGISTS

KEEP IN MIND: It is your job to describe the kinds of plants and animals that live in this area and their needs for survival. It is also your job to communicate to the other stakeholders what these natural systems provide for the city of Rocky Point.

The natural area provides habitat for _____ (Quickly survey the area for signs of animals). The loss of the trees and wetlands would mean a loss of important migratory and nesting habitat.
There are not many areas like this left in Rocky Point.
Educators, students, hikers, photographers and other people could come and learn about local wildlife that live on this land and in its waters.
The wetland on the land is a natural water filter.

BUILDER'S FOR TOMORROW

KEEP IN MIND: You represent the investors and builders in the area. You and your investors will make a good profit if the shopping center is built. The town will also benefit from the increased business.

The town has grown a lot in the past 10 years and could use the convenience of a new shopping center.

The town will have new jobs because of the shopping center.

Rocky Point already has a city park for people to enjoy.

HISTORICAL SOCIETY

KEEP IN MIND: You work to preserve and restore the old places in this town, there are not many places left.

The first family to settle in the area built their barn on the edge of the wetland. It is still standing today.

The barn is over 100 years old and should be left standing.

If the land is sold to Builder's For Tomorrow under their current proposal, the barn will be torn down.

ROCKY POINT'S SPORTERS

KEEP IN MIND: You represent the people in town who like to fish and hunt on this land.

Men and women interested in outdoor sports such as hunting and fishing want to protect natural areas where fish and wildlife live (Look around you for signs of animals)

There are fewer and fewer places to go and enjoy these activities with your children and friends.

You want to save the few natural places near the community that are left.

BUSINESSPEOPLE

KEEP IN MIND: You represent local businesspeople and want the town to grow and prosper.

The shopping center would bring jobs and money into the town. You think it would be good for everyone.
Rocky Point already has a park. It is never very crowded.
You support Builders for Tomorrow.

WILDLIFE OBSERVERS

KEEP IN MIND: You represent all of the people that like watching wildlife.

If the shopping center is built, the diversity of wildlife will greatly decrease. This quality habitat will be lost forever.
Not only are there very few areas left for the wildlife to live in, there are very few places for people to watch and enjoy wildlife.
The city park does not have good habitat for wildlife. You have only seen a few different species at the park. (Quickly survey this area for signs of animals)

CHAPTER 7
Post-visit Activities

A. Refuge Reflections

B. Make a (Mini) National Wildlife Refuge

C. Plankton Lab

D. Marsh Food Pyramid

E. Migration Mapping

F. Planning for People and Wildlife

G. Attracting Wildlife to Your School

Post-visit Activity A: Refuge Reflections

Method: Students will express to the class the most interesting/meaningful thing they learned on their field trip using a method of their choice (Ex: creative writing, poetry, drawing, painting, poster, research paper, presentation, etc.)

Objectives: Students will be able to

- Make a product that demonstrates the most meaningful/interesting part of their experience at the Refuge
- Discuss the most meaningful part of their experience at the Refuge with classmates

Materials: Dependent on the students' projects

Subjects: A variety of subjects are possible dependent on the student's choice of project

Time: Introduction (10-15 minutes), Activity (variable - may assign as homework)

Setting: Indoors or outdoors

Grade Level: K-12

Skills: Synthesis, evaluation, personal reflection, writing, drawing, painting, oral presentation

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Background Information:

Often, a field trip allows students to get out of their normal routine - this activity is designed to give students a chance to reflect on the field trip. Each student's field trip experience will have been unique in some way. There are a variety of ways for students to reflect on these experiences, and there is value in letting students self-select their mode of expression.

This activity requires flexibility and planning on the educator's part. The projects will all be slightly different in their form and apparent effort, making them challenging to grade. You may want the students to give oral presentations about what they thought was the most meaningful part of their field trip. The presentations can serve as a way to assess student learning.

Suggested Procedure:

1. Tell the students you want them to brainstorm (individually) the parts of the field trip that meant the most to them.
2. Explain to the students that you want them to find a way to express what was the most interesting or meaningful thing that they learned or experienced on the field trip. You may want to give them some personal examples here (I was sitting quietly by myself, and a monarch butterfly flew in front of my face and then landed on a bush a few feet away from where I was sitting, etc.).
   Students can use this experience as a starting point for their project, but their project should not just be an explanation of their experience. The project should demonstrate something they learned from the experience. The students can pick any form of expression that they would like to use. Again, examples may be helpful here:

Poetry	*Creative writing*	*Research paper*
Paintings	*Sketches*	*Poster*
Diorama	*Model*	*Others???*
Newspaper article		

3. Give the students a few minutes to think of ideas. You may want to assign this project as homework so students are able to think about their experiences without the buzz of the classroom. Let them know they will be sharing their project with the class.

4. When the assignments have been completed, bring the students into a circle and have them share their project (or have students give a more formal presentation). Again, you may want to share a project that you have done as a result of the field trip.

Extensions/Adaptations:

1. Have the students research the biology and ecology of some aspect of their experience and incorporate it into their project.

2. Have the students design a “new” creature that is adapted to one of the habitats on the Refuge. It could be a specialized creature that only lives in that particular habitat or a generalist that can adapt to a number of different habitats. They should make a model or draw a picture of the creature and explain its adaptations to the class.

Assessment Ideas: Student projects and/or presentations

Post-visit Activity B: Make a (Mini) National Wildlife Refuge

Adapted with permission from *Partners for Education: A Teacher's Guide to Using National Parks as Classrooms* - " Create a National Park"

Method: This lesson is designed to help students apply and personalize the concept of a national wildlife refuge. In small groups (2-3 students), students will create a miniature refuge and try to figure out how they would "manage" this land.

Objectives: Students will be able to
- Explain reasons why refuges are needed
- Describe the characteristics of refuges
- List problems facing refuges

Materials:
- Clipboard
- Paper and pencil
- Magnifying glasses (1 per group)
- One 15-foot piece of string

Subjects: Social Studies, Civics, Science, Language Arts, Art, Math

Time: 60-90 minutes

Setting: Outdoors on school grounds

Grade Level: 2-8

Skills: Cooperating, persuasive writing, drawing, oral communication, working with scale

Vocabulary: conservation, endangered, extinction, habitat, management, prairie pothole, species, threatened, waterfowl, wetland

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Background information:

(Also see background information in Pre-visit Activity A: What is a National Wildlife Refuge?)

There are over 530 national wildlife refuges; these refuges include a diversity of habitats, including tallgrass prairies, wetlands, arctic tundra, and estuaries, just to name a few. The Refuge System forms a valuable network of lands for the conservation of a wide diversity of fish, wildlife, and plants.

Refuges support 22 percent of threatened and endangered species. Some refuges were acquired with the specific purpose of helping threatened and endangered species. Several of the early refuges helped to rescue bison and elk from extinction. Merritt Island NWR (Florida) has more endangered species than any other refuge. Setting aside land in refuges benefits present and future generations of wildlife and people.

Waterfowl Production Areas (WPAs) are also a part of the Refuge System, and they provide critical habitat for waterfowl as well as other wildlife. Waterfowl Production Areas became a part of the Refuge System in 1966. There are over 3,000 WPAs in the United States, covering over 668,000 acres. Most WPAs (almost 95 percent of them) are located in North Dakota, South Dakota, Minnesota, and Montana. Many WPAs are in prairie wetlands called prairie potholes. These wetlands are often temporary and may not be wet throughout the year, but they provide critical habitat for wildlife on the prairie landscape. They are open to the public for hunting, fishing, trapping, wildlife observation, photography, environmental education, and interpretation.

The primary purpose of refuges is for the conservation and management of fish, wildlife, and plants for the benefit of people. If treated with respect today, refuges will provide enjoyment and other benefits to the generations of tomorrow.

Suggested Procedure:

1. Discuss the concept of a national wildlife refuge with your students. Ask the students if they have ever been to a national wildlife refuge. What makes a refuge different from an open space area, national park, city park, etc.? Who owns a national wildlife refuge? Why establish a national wildlife refuge ?

2. Ask students what they would want if they were to create a “perfect” refuge.

3. Group the students (2-3 per group) and distribute the materials.

4. Assign, or let each pair choose, an outdoor spot for their miniature national wildlife refuge. Using their string, they should rope off their mini-refuge (Scale: 1 foot = 1 mile).

5. Students should move about their mini-refuge on their hands and knees. Using their magnifying glasses, the students should try to determine the areas that will be good habitat for wildlife. Remind them that 1 foot on their mini-refuge equals 1 mile of a full-size refuge. Are there any scenic areas? Are there good spots for observing wildlife without undue disturbance? Provide them with examples, showing them how a hole could be considered a canyon, a puddle considered a lake, etc.

6. Give the class approximately 20 minutes to set up their mini-refuge, and establish any trails in their mini-refuge.

7. After the students have marked their mini-refuge's boundaries using string, they should begin making sketches and taking notes for a brochure of their mini-refuge. The finished brochure should include drawings of several plants or animals that visitors might see at the mini-refuge, descriptions of the habitats found on the refuge, and a map of the refuge. (For older students you may want to require that the map of the refuge is drawn to scale.) The brochure can be completed inside later, but any necessary notes and sketches should be made during this time period outside.

8. Once the mini-refuges are set up, the students may want to encourage people to come and learn about their mini-refuge. Split up the student groups: one student should stay at the mini-refuge, the other(s) should visit the other mini-refuges. The student who stays must educate the visitors about the mini-refuge. (Allow the pairs to switch - each student should visit at least one mini-refuge)

9. After they have visited the other mini-refuges, ask the students the following questions:
   a. Were people excited to learn about their mini-refuge?
   b. Were visitors always careful with the mini-refuge's resources?
   c. Did they have too many visitors?
   d. What would they change?
   e. What problems occurred?

10. Provide time back in the class for students to complete their brochures or assign the brochures as homework.

Assessment Ideas:

1. Brochures of mini-refuges

2. Discuss: What can you do to help protect the plants and animals on a national wildlife refuge? Who has the responsibility for protecting refuges for future generations?

Post-visit Activity C: Plankton Lab

Adapted from *Salt Marsh Manual: An Educator's Guide*

Method: Students will draw, observe, and identify a variety of planktonic plants and animals. They will also discuss the role of plankton in a wetland.

Objectives: Students will be able to
- Explain the difference between zooplankton and phytoplankton
- Draw a food web that shows the role of plankton in a wetland

Materials:
- Microscopes
- Petri dishes
- Pond life Identification guide
- Pencil
- Copies of Student Page "Plankton Lab Data Sheet"

Subjects: Science, Art

Time: 30-50 minutes

Setting: Classroom

Grade Level: 4-12

Skills: Identifying, drawing, synthesis, discussion

Vocabulary: adaptation, algae, aquatic, bacteria, community, crustacean, diatom, dinoflagellate, larvae, nutrient, pollution, population, predator, species, toxin

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Background Information:

The word "plankton" comes from the Greek word *planktos* meaning "drifting." This ecological term refers to the community of plants and animals that drift near the surface of both fresh and marine bodies of water; currents and tides carry plankton through the water. Some plankton are fairly large, but most are microscopic in size (not visible by the naked eye).

Planktonic animals are referred to as zooplankton. Some zooplankton live their entire lives as part of this drifting community. Small shrimp-like crustaceans, such as copepods and krill, are examples. In lakes, zooplankton are an important food source for many fish. Other *species* are planktonic (drifters) as eggs or larvae, and then become free swimming or settle down to become sedentary (stay in one place) during their adult stages. Among the myriad of organisms included in this latter group are clams, mussels,

crabs, and many species of commercially important fish. Larval planktonic forms are especially abundant near shore, where they are also likely to be exposed to predation and pollution. Many zooplankton are able to move up and down in the water column, pursuing food and escaping predators. However, their small size prevents them from moving against the currents.

Planktonic plants are called phytoplankton. The primary importance of these plants is their ability to capture the solar energy to make food. They release oxygen in the process. Most “higher” aquatic organisms depend on these microscopic single-celled organisms for food and oxygen. Phytoplankton also contribute a significant portion of the oxygen found in the air we breathe.

There are several types of phytoplankton: blue-green algae, green algae, diatoms, and dinoflagellates.

Blue-green algae: Blue-green algae is the largest and most diverse group of photosynthetic bacteria. These organisms vary greatly in shape and appearance; they may be found in colonies or filaments. Some blue-green algae have evolved to make extensive use of density changes in order to regulate their vertical position in the water column of a lake. Some have a gas bubble inside their bodies to help regulate buoyancy. Blue-greens are often inedible and can be considered the “weeds” of the phytoplankton.

Green algae: Green algae is also a diverse group of photosynthetic organisms, but their cell wall is made of cellulose, the same substance that makes up the cell wall of higher plants.

Diatoms: These are single-celled algae encased in two-part silicon (glass-like) shells. Like all plants, diatoms need sunlight. Since their glass shells tend to cause them to sink, they have various adaptations to slow/prevent sinking. One such strategy involves increasing the organism’s surface area. Diatoms may have long spines, may be round and flat, or may form long chains. Diatoms can also regulate their density, but not to the degree blue-green algae are capable.

The clear color of the silicon shells may help protect the diatoms from being eaten, as do the spines mentioned above. When diatoms die, their shells settle to the bottom of the lake or ocean. In some places, layers of diatoms from prehistoric times are so thick they are mined as diatomaceous earth (consisting of diatoms or their fossils).

Dinoflagellates: While considered members of the phytoplankton, dinoflagellates have characteristics of both plants and animals. Like plants, they contain chlorophyll that allows them to convert sunlight into food. They also have a plant-

like cell structure. However, like animals, many varieties of dinoflagellates eat microscopic pieces of matter found in the water. Some dinoflagellates even eat each other! Dinoflagellates have two whip-like appendages that provide some mobility.

Some dinoflagellates produce a toxin that causes mussel poisoning. During summer months, mussels or other shellfish eat large amounts of these dinoflagellates. Quarantines are established to prevent people from eating these shellfish because the people would become seriously ill.

A “plankton bloom” or plankton population explosion, occurs when the water is unusually rich in nutrients. Some species of dinoflagellates may occur in such high numbers they color the water a dark red, otherwise known as “red tides.” Some red tides may result in the death of large numbers of fish because the plankton use up so much oxygen, there is not enough left over for other organisms. Many dinoflagellates are luminescent at night, producing a soft glow when the water in which they float is disturbed.

Suggested Procedure:

1. Begin the activity with a brief discussion about plankton. Make sure the students understand the different types of phytoplankton and the difference between zooplankton and phytoplankton.

2. Distribute the plankton sample (from the glass jar collected on the field trip) among the students’ petri dishes.

3. Have the students observe their samples under the microscopes. Encourage students to move their dish around in order to examine the entire sample.

4. Direct the students to draw several of the organisms they see under the microscope and to answer the questions on their data sheet.

5. Instruct the students to identify the organisms they draw by using an identification guide. Try to determine whether it is a phytoplankton or zooplankton. Is it a larva? A crustacean? Do not worry if they cannot find the exact species - there are many different kinds of plankton.

6. Discussion:
   a. Distinguish between zooplankton and phytoplankton.
   b. Describe one food chain having at least three members, including phytoplankton and zooplankton.
      (Ex: phytoplankton-> zooplankton-> fish->people)

c. Why does it matter that blue-green algae is not very edible for zooplankton and higher animals?
d. Why is it important for diatoms (phytoplankton) to float near the surface, rather than sink to the ocean bottom? *(Diatoms need sunlight to make food. Floating near the surface allows them to capture as much light as possible)*
e. What are two ways in which diatoms prevent sinking? *(Increased surface area through spines, chains, round shapes; regulate density with oils or gas bubbles)*
f. Explain what "planktonic blooms" are, their causes, and their effects on the local environment. *(Planktonic blooms are plankton population explosions. They occur when the water is unusually rich in nutrients. Shellfish that eat too much of some plankton can become poisonous. Other plants can be choked out by planktonic blooms.)*
g. Describe a way that you could be affected by plankton.
h. Suppose an ecological disaster were to kill all the phytoplankton in the ocean. Describe what would happen to life in the ocean. Why? What would happen to the earth's atmosphere? *(Phytoplankton are the prime producers of oxygen and they are the base of the food pyramid. Without them, marine animals would die off and the atmosphere would lose a major source of oxygen.)*

Extensions/Adaptions:

1. Have the students draw a painting or mural that shows a food web in a marsh, including phytoplankton and zooplankton

2. Include a study of the mud creatures from the Refuge that can only be seen with a microscope

Assessment Ideas:

1. Student Page - "Plankton Lab Data Sheet"

2. Have students draw a wetland food web.

PLANKTON LAB DATA SHEET

What is “plankton”?

How is plankton connected to the other animals that live in a wetland?

Draw AND number what you discovered in your petri dish below:

ANSWER THESE QUESTIONS FOR ANY PHYTOPLANKTON YOU SEE (Put a number next to your answers that shows which plankton you are writing about):

a. What color is it?
b. What special features does it have that may help keep it from sinking?
c. What special features does it have that may protect it from predators?
d. Does it move? How?

ANSWER THESE QUESTIONS FOR ANY ZOOPLANKTON YOU SEE (Put a number next to your answers that shows which plankton you are writing about):

a. Which kinds of zooplankton did you see?
b. How does the zooplankton move?
c. Is the zooplankton a larva or adult?
d. Do the zooplankton have any special features that might protect them from being eaten by predators?

Post-visit Activity D: Marsh Food Pyramid

Adapted from the *Habitat Pac: Estuaries and Tidal Marshes, National Institute of Urban Wildlife* - "Marsh Math"

Method: Students will use an example food chain in order to understand the energy needed to support a top predator. This will give them experience with the concept of a food pyramid.

Objectives: Students will be able to

- Calculate the number of each level of organism that is necessary to support a marsh food pyramid
- Explain what is meant by a food pyramid in relation to energy in an ecosystem
- Explain how energy flows through (one-way) an ecosystem while matter cycles

Materials: Copies of the Student Page - "Marsh Food Pyramid"

Subjects: Math, Science

Time: 50 minutes

Setting: Classroom

Grade Level: 4-12

Skills: Multiplication, division, addition, problem solving, application

Vocabulary: decomposer, ecosystem, food chain, food pyramid, nutrient, wetland

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Background Information:

Wetlands function as "nutrient traps." This buildup of nutrients makes wetlands productive environments. The following math exercises will help students understand just how productive a marsh may be. The math problems illustrate the principle that a large number of organisms are needed at the bottom of a food pyramid to support a small number of organisms at the top.

Within a food pyramid, individual food chains exist. One marsh food chain includes hawks, sparrows, grasshoppers, and grass.

grass ÷ grasshopper÷ sparrow÷ hawk

Which organism in this food chain is at the top of the pyramid? (Hawk)

Which organism is at the bottom? (Grass)

There are more organisms at the bottom of the food pyramid than at the top. When moving up the food pyramid, the number of organisms decreases. A large number of grass plants feed thousands of insects. In turn, these insects feed a few hundred sparrows that feed only a few hawks. The reason for this is useable energy is lost during the transfer from one organism to the next. In fact, only about 10 percent of useable energy is transferred. Energy is lost for multiple reasons. Several reasons are:

- Not all of the plant/animal is eaten
- Loss to heat
- Some energy cannot be used. It is egested or excreted.

So, useable energy has a one-way flow through an ecosystem. Useable energy is lost at every step. On the other hand, matter can be recycled through the ecosystem by decomposers.

During the lesson, the food chain described above will be examined. For the purpose of this exercise, the animals eat only one type of organism. Remember to explain to students that in real life most organisms eat more than one type of food.

NOTE: The data used in these exercises were simplified and do not represent actual numbers calculated for a marsh; however, they are reasonably close to what occurs in real life.

Suggested Procedure:

1. Inform the class that the following data was recorded by a wildlife biologist. Write the following data on the chalkboard:

   a. *One hawk weighs 600 grams and eats 600 grams of sparrows each week.*

   b. *One sparrow weighs 20 grams and eats 50 grams of grasshoppers each week.*

   c. *One grasshopper weighs 1 gram and eats 15 grams of grass each week.*

   d. *One grass plant weighs 5 grams.*

2. Give each student a copy of the Student Page. Students should use the data written on the board to do their calculations. Encourage the students to help each other solve the problems. The use of fractions can make the problems more difficult.

3. On the chalkboard draw a food pyramid. Students should fill in the names and numbers of the organisms found on this food pyramid; the numbers come from their calculations.

4. Next, ask the students to draw a food pyramid with 5 hawks. What would happen to the numbers of the other organisms? Create a food pyramid with 10 hawks.

5. Ask the students how the marsh is able to support all of the plants and animals that live there? (The nutrients are brought in with the creek and trapped in the marshes. That results in a very productive habitat.)

6. Discussion: Get a discussion going with the following questions
   a. What other marsh organisms feed on grass? (Many...worms and ducks for example)
   b. How is the productivity of the marsh linked to grasses? (Vegetation is the basis for the food pyramid that supports a large number of organisms.)
   c. Discuss why the number of organisms at each higher level is lower than the previous level (Loss of useable energy at each transfer)
   d. Discuss any questions the students have as a result of this activity. Have them think about the dynamics of a food pyramid in a pond, lake, or river.

(Answers to Student Page: 1 = 30 sparrows, 2 = 50 grasshoppers, 3 = 3 plants, 4 = 1500 grasshoppers, 5 = 4500 plants)

Extensions/Adaptations: Try the same activity using an aquatic food chain. Which chain is longer? Why?

Assessment Ideas: Student Page - “Marsh Food Pyramid”

MARSH FOOD PYRAMID

1. How many sparrows must the marsh have to feed one hawk for one week?

_____	÷	_____	=	_____
Total weight of sparrows that one hawk eats		Weight of one sparrow		Number of sparrows needed to feed one hawk

2. How many grasshoppers must the marsh have to feed one sparrow for one week?

_____	÷	_____	=	_____
Total weight of grasshoppers eaten by one sparrow		Weight of one grasshopper		Number of grasshoppers needed to feed one sparrow

3. How many grass plants must the marsh have to feed one grasshopper for one week?

_____	÷	_____	=	_____
Total weight of grass eaten by one grasshopper		Weight of one plant		Number of plants needed to feed one grasshopper

4. How many grasshoppers are needed to feed the numbers of sparrows eaten by one hawk?

_____	X	_____	=	_____
Number of sparrows needed to feed one hawk		Number of grasshoppers needed to feed each sparrow		Number of grasshoppers needed to feed all the sparrows eaten by one hawk

5. How many grass plants are needed to feed all the grasshoppers that are eaten by all the sparrows that are eaten by one hawk in one week?

_____	X	_____	X	_____	=	_____
Number of plants eaten by one grasshopper		Number of grasshoppers eaten by one sparrow		Number of sparrows eaten by one hawk		Number of plants to feed all the grasshoppers, eaten by all the sparrows that are eaten by one hawk.

Draw a food pyramid with four levels, one for each level of the food chain. At each level of the food pyramid, write the name of the correct plant or animal and the number of individuals of each plant or animal needed to support the food pyramid.

Draw another food pyramid with five hawks at the top. What would happen to the other animals' numbers?

Food For Thought:

Why is the sun above everything?
What would happen if there were no green plants?
What would happen to the plants if there were no meat eaters?
What if there were no decomposers?
Why is a person at the top of the food pyramid?
How does a person act as a producer, consumer, and recycler?

Post-visit Activity E: Migration Mapping

Adapted from *Wild About Life Activity Guide*

Method: Students learn about the migration patterns of two Neotropical migratory birds, the Swainson's thrush and the wood thrush. This is done by compiling and mapping data from hypothetical band records.

Objectives: Students will be able to

- Define the terms breeding and wintering grounds, migration route, and stopover point
- Describe the breeding and wintering areas and migratory routes of the wood thrush and Swainson's thrush
- List hazards to migratory birds
- Explain the uses of banding for research and monitoring

Materials:

- Copies of the Student Page - "Migration Mapping" and "Western Hemisphere Map"
- Two containers
- Colored pencils or pens

Subjects: Science

Time: 2 hours

Setting: Classroom

Grade Level: 4-12

Skills: Mapping, synthesis, application, career education

Background Information:

Scientists use a variety of techniques to track wildlife populations. The particular technique employed by the scientist depends on the species of wildlife and the purpose of the study. The original purpose of bird banding was to provide information on migration. Through the recovery of bird bands, data on direction and length of migration, locations of breeding and non-breeding areas, and migratory stopover points are obtained**.**

The Institute for Bird Populations (IBP) in California conducts banding activities across the United States with a network of over 300 banding stations. This program is called the Monitoring Avian Productivity and Survivorship Program (MAPS Program). These

stations are operated by government biologists, independent bird banders, and IBP itself. Birds are captured without injury in large, fine mesh nests called mist nets. They are identified, banded, and then various measurements are taken (age, sex, size, condition, weight).

By operating the nets each summer and compiling data from many stations within a region, much information can be obtained. For instance, changes in populations size can be determined. Banding information can also help identify the stages in a bird species' life cycle during which it is most sensitive to environmental threats. Banding research can be important for determining causes of declines in migratory bird populations. Researchers can monitor both birth rate (productivity) and death rate (survivorship) of these species.

Wood thrushes, for example, experienced a population decline of 1.9 percent per year from 1966-1993. At that rate, remaining wood thrush populations will decline by nearly one half over the next 25 years. The Swainson's thrush population also declined during the same period, but only by 0.2 percent. Banding research can help determine whether the cause of population declines in the wood thrush are due to low productivity on the breeding grounds, high mortality during migration and/or in the winter, or both. Based on this information, managers can design appropriate habitat management programs for the wood thrush.

Suggested Procedure:

1. The banding data sheets contain 25 band records for each of the two thrush species. Make enough copies of these sheets so each student has 6-7 records. Cut the data sheets into strips, with each strip containing a single record. Put the strips from the wood thrush in one container and the strips from the Swainson's thrush in another container.

   NOTE: These band records are based on hypothetical data illustrating actual ranges, migration routes, and causes of recoveries.

2. Introduce the students to the procedure of bird banding. Explain how bird banding helps with monitoring population trends. Also explain the Monitoring Avian Productivity and Survivorship Program (MAPS Program).

3. Show students pictures of the Swainson's thrush and wood thrush. If possible, play recordings of these birds' songs. Such recordings can be obtained from many bird stores.

4. Tell the students they will be wildlife biologists today. They are being sent data regarding the banding and recovery programs of the wood thrush and Swainson's thrush. Their job is to map thrush migration based on these records. Tell the students they will each receive data from 6-7 bands and they will plot the records on the maps. They should use different colors to indicate when the birds are migrating south, when the birds are on wintering grounds, when the birds are migrating north, or when the birds are on breeding grounds.

5. Divide the students into two groups (one group for each species). Pass the hat for each species around to its respective group. Each student should take 6-7 records and use different colors for the following time periods:
   a. June-July: breeding range
   b. August-October: fall (southward) migration
   c. November-March: wintering grounds
   d. April-May: spring (northward) migration

6. After students have plotted their individual data points, they can form groups of four and share their information with the members of their small group. With this information, they should be able to plot spring and fall migration routes, breeding grounds, and wintering grounds of their species.

7. Have each student share one of their records for their species with the class. This will illustrate the various ways banded birds are recovered and the numerous hazards they face.

8. Plot all the band records on the Western Hemisphere map using different symbols for the two species and different colors for the different times of year. When all the locations are plotted, draw lines in the appropriate colors around the breeding and non-breeding grounds of each species. Use arrows to indicate the migration routes. Breeding areas interpreted from the band records can be compared with those shown in a field guide.

9. Point out to the students they now know how scientists create the range maps found in bird field guides. Bring in several bird field guides that contain range maps to illustrate this point to students. Discuss with students what else scientists can learn through band records as well as the limitations of banding.

10. Discuss the environmental threats, natural and human caused, that birds face while migrating. Brainstorm a list of threats and record these on the board. Ask students which threats they can help reduce. What actions could students individually, or as a group, take to reduce threats to birds while migrating? (Ex: keep cats indoors, place falcon silhouettes in windows, use native species in backyard landscaping to improve bird habitat, provide equipment/funding for habitat protection in Latin America)

Answers to Student Page questions:

1. Swainson's thrush breeds from Alaska to Newfoundland and south to California, Colorado, Manitoba, and the northern Appalachians. It migrates through North and Central America and to some extent the Caribbean. It winters from Mexico to Peru and Brazil.

   The wood thrush breeds from North Dakota to Nova Scotia and south to Texas and Florida. It migrates through North and Central America and winters from eastern Mexico to Panama.

2. Hazards to migratory birds include: predators, storms, windows, automobiles, TV towers, power lines, other tall structures, and most importantly, habitat loss.

3. Causes of populations declines include loss of breeding, migration, and wintering habitat.

4. Support efforts to preserve forests both in your region and in the tropics. Investigate the many opportunities to participate in Adopt-an-Acre programs such as that provided by Children's Rainforest Network. Refrain from cutting or pruning trees and bushes, especially during the breeding season. Keep cats indoors. Use non-reflective glass windows or place warning decals on large picture windows - this helps break up reflections.

Adaptations/Extensions:

1. Invite a local conservation officer or U.S. Fish and Wildlife Service employee to bring in samples of actual bird bands and mounted birds to discuss banding in greater detail. Have the speaker discuss what students should do if they see a band on a bird (live or dead).

2. Arrange a visit to a nearby banding station to give students the opportunity to observe bird banding first hand. Contact: The Institute for Bird Populations for the location and operator of MAPS stations in your area. (415-663-1436)

Assessment Ideas: Student Page - "Migration Mapping"

SWAINSON'S THRUSH (ST) RECORDS

1. ST banded in NW California 6/28/94.

2. ST banded in central Colorado 7/21/96, found dead in Peru by an indigenous person in the tropical forest in January 1998. The band was eventually returned with a description of the recovery location to the Bird Banding Laboratory (BBL) in Laurel, MD.

3. ST banded in SW Mexico 2/3/97.

4. ST banded in SW Alaska in early July 1991 was recovered in SE British Columbia after it flew into the window of a private residence in mid-September 1991.

5. ST banded in NE Quebec 6/11/89.

6. ST banded in Guatemala 12/19/98.

7. ST that was banded with a unique combination of 3 colored legbands by a researcher studying bird behavior in central Saskatchewan on 6/11/94 was resighted by a bird watcher in NE Oklahoma on 4/26/96.

8. ST banded 5/11/98 in West Virginia.

9. ST banded in south central Montana on 6/11/93 was subsequently recaptured at the same site on the following dates: 6/27/94, 7/13/95, and 6/20/97.

10. ST banded in north central New Mexico 9/29/98.

11. ST banded in the SW Northwest Territories in July 1991.

12. ST banded in western Oregon 5/31/86 is killed as it flies into a lighthouse on the central Californian coast 4/11/99.

13. ST banded in north central Pennsylvania on 7/7/97.

14. Banded ST found dead on an oil platform off the coast of Louisiana 5/25/95, following the passing of a cold front with heavy rains over the Gulf of Mexico.

15. ST banded in central Ontario in June 1985 was recaptured at the same site many times over several years. It was last recorded 7/23/96.

16. ST banded in N. Wisconsin in early August 1998.

17. ST banded in Massachusetts 6/17/96 recaptured in November of 1997 in Cuba.

18. ST banded in N. Nevada 8/3/97.

19. ST banded in central Alberta during the summer of 1993 was killed by a cat in SE Colorado. It was discovered and reported by the cat's owner.

20. ST banded in Columbia, S. America in January 1999.

21. ST banded in central Yukon Territory in June 1996.

22. ST banded in western Washington 7/7/99.

23. ST banded in NW British Columbia 6/31/96 was recaptured 9/16/96 in SE Arizona, and again 12/31/97 in El Salvador.

24. ST banded in central Idaho during the summer of 1999.

25. ST banded in central Manitoba, Canada 6/13/99.

WOOD THRUSH (WT) RECORDS

1. WT banded 6/21/99 in central New Brunswick.

2. WT banded in SE Ontario, Canada, 6/12/98, recaptured in coastal Alabama 4/13/99.

3. WT banded in central Wisconsin 7/18/97.

4. WT banded in eastern North Carolina at a MAPS station during the summer of 1995, recaptured at the same site in 1997 and 1999. It was not captured in 1996 or 1998.

5. WT banded in Honduras 1/17/96 recaptured in SW Pennsylvania 6/18/96.

6. WT banded in E Nebraska as a juvenile 6/30/98 recaptured as an adult in E Kansas 7/1/99.

7. WT banded in the summer of 1985 in NW Florida.

8. WT banded in NE Texas 5/29/85 as an adult was recaptured at the same site 6/21/94.

9. WT banded in S. Mexico 11/21/99. The forest in which it was banded had begun to be cut down later that same winter. A large tract was clear-cut within 6 months.

10. WT banded in Panama 2/17/96, recaptured in central Tennessee, 6/9/96.

11. A biologist monitoring the nest of a pair of WT he banded during the summer of 1998 in central Minnesota found that although no young WT were successfully raised, the pair did successfully raise one Brown-headed Cowbird.

12. WT banded 6/29/99 in central New York recaptured 8/30/99 in SW Virginia.

13. WT banded at a MAPS station in W. Ohio during the summer of 1996 was recaptured in Costa Rica during December 1998.

14. WT banded in E Georgia 8/5/99.

15. WT banded in SE Quebec 6/17/96.

16. WT banded 7/27/98 in Delaware recaptured 10/1/98 on NE Texas coast.

17. WT banded in central Oklahoma 7/19/88. The study site on which it was banded was not used after this year because construction for a residential development began in 1989.

18. WT banded in south central Pennsylvania 8/11/92. The WT was found dead the following summer near the original banding location. It had been killed by a cat.

19. WT banded at MAPS station in E. Kentucky 6/1/99.

20. A WT that was banded in central Mississippi on 6/21/90 with a unique combination of colored leg bands was resighted by a bird watcher 8/29/90 in coastal Mississippi.

21. WT banded 6/3/99 in central South Carolina.

22. WT band sent in from Illinois during the summer of 1996 with no information about recovery or cause of death. It had been banded on 8/31/96 in NW Ohio.

23. WT banded 8/9/94 in central Main was later recovered after it flew into the window of a residence in Connecticut.

24. The nest of a banded pair of WT in SE South Dakota was monitored in 1994. No eggs were hatched because raccoons ate the eggs.

25. WT banded in central Georgia 7/7/90 was later recovered nearly 50 miles southeast after being struck by an automobile.

MIGRATION MAPPING

QUESTION 1	Wood Thrush	Swainson's Thrush
Where does this bird breed?		
Where does this bird spend the winter?		
Migration route: What routes does this bird use to get from the breeding grounds to the wintering grounds?		

2. List four hazards to migratory birds as illustrated by the band records.
   a. Hazard

b. Hazard

c. Hazard

d. Hazard

3. What could be some causes of population declines in the wood thrush?

4. What can we do to help protect these species?

WESTERN HEMISPHERE MAP

Post-visit Activity F: Planning for People and Wildlife

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Method: Students imagine and research what the area where they currently live was like before humans developed the community, design planned communities, and build and evaluate models of their community designs.

Objectives: Students will be able to

- Describe considerations that are important in land-use planning for cities and other communities of people
- Identify means by which negative impacts on wildlife and other elements of the natural environment can be reduced in developing cities
- Describe actions that can be taken to enhance some contemporary cities as places in which both people and some wildlife can live

Materials:

- Heavy cardboard or masonite
- Salt, flour, and water to make salt clay for a model-building material
- Glue
- Toothpicks
- Natural materials for making buildings, roads, people, wildlife, and other components of a community
- Tempera paint
- Brushes

Subjects: Social Studies, Science

Time: Minimum of five 45-minute sessions

Setting: Classroom

Grade Level: 5-8

Skills: Analysis, application, description, discussion, drawing, evaluation, invention, media construction, problem-solving, small group work, synthesis, visualization

Vocabulary: city, community, land-use planning, pollution

Background Information:

NOTE: This activity is most effectively used to culminate a unit on land-use planning as well as to focus on issues affecting people, wildlife, and environment.

Cities have developed as people have clustered together for purposes of meeting their needs - from shelter to food to physical safety. Cities typically have developed as hubs of transportation and commerce, again serving as a means by which people meet their day-to-day survival needs. The development of cities, however, has been a mixed blessing. The large concentration of people in a given area has displaced plants and animals that previously lived there and has given rise to problems unique to such crowded conditions. For example, varying forms of pollution accumulate in such centers, frequently with inadequate means for handling them - from products of industry to human waste.

Most cities are not the result of careful planning. Most have developed haphazardly, with attention to problems taking place only when crises emerge. Crime, unemployment, poor housing, air pollution, contamination of water supplies by industrial and domestic waste disposal, energy consumption, transportation costs, and land use are all among the serious problems facing cities today.

People are faced with many important choices concerning how and where they will live. Many people in the United States are leaving the cities for suburban and rural life, bringing some of the same problems with them that encouraged them to leave the cities in the first place. New communities - large and small - are being developed. Some are the result of individual families moving into previously undeveloped areas; some are the result of business interests organizing to develop resources in an area and creating entirely new cities in the process. This is happening in areas all over the planet. Areas of some large and old cities are decaying as they are abandoned. In some cities, redevelopment projects are taking place to try to improve the habitability of the older neighborhoods.

Ethical questions arise as people make decisions about where and how they will live. Any development or redevelopment of an area has an impact on the plants and animals that do and can live there, as well as on any people who might live there. Sometimes the development can be of benefit, and sometimes it can cause long-term harm. When such decisions are made, it seems prudent to plan for the impact of our actions as carefully and thoughtfully as possible.

The purpose of this activity is for students to consider the importance of land-use planning in community maintenance, and improvement, and development. The concepts can be applied when considering redevelopment of old cities, as well as building of new cities and alternative communities in which people can live and work.

Suggested Procedure:

1. Ask the students to close their eyes and picture the community where they live. If they live in a city, or if there is a city nearby, ask them to picture how the city looks. Next ask them to try to picture what the area might have looked like before the city or community was built in that spot. What plants were common to the area? What animals? Was there water in the area? What was the topography of the land?

2. Ask for a committee of volunteers to find out more precisely what the land, vegetation, wildlife, water, etc., was like before their community was built. If the students live in a rural area have them find out how the area has changed since the first settlers came to the area. Ask the committee to report back to the rest of the students with this information in approximately one week. Sources could include State, city, or county historical societies, libraries, etc. City, regional, and state/province land-use planning offices also may have such information.

3. Ask the committee to report back to the rest of the students. The committee should report both visually and verbally. For example, the report could list the descriptive characteristics of the vegetation in the area and identify the kinds of wildlife along with the food and water sources upon which wildlife depended. Ask the committee to describe its findings thoroughly enough that the rest of the students can clearly picture what the area looked like before a community was developed there. Also ask the committee to leave a visual record of the major information they found for the rest of the students to use as a reference.

4. Next, ask all of the students, including the committee members who did the research, to divide into working groups of two to four students. Tell the groups it is their task to develop a community in this natural area, given the background information the committee has provided. In designing their communities, the students need to examine how a community can develop where people live and work with the least possible negative effect on the existing vegetation, air quality, water, soil, and wildlife. At the same time, they need to ensure that the needs of the people are met. In order to do this, the students should consider the following, as well as other factors they identify:

    a. **Water sources:** Transportation and treatment
    b. **Economic base:** Industry? Small business?
    c. Kinds of housing
    d. Schools
    e. Shopping areas
    f. **Job sites**
    g. **Economical and recreational features:** open space, green belts, parks

h. **Sewage and waste:** Disposal and treatment
i. Aesthetics
j. Environmental safeguards
k. Ways to expand effectively the number of people who can live in the community, if necessary, retaining minimum effect on the quality of the environment.

5. Once each group has come up with a community development plan, review and discuss their plans.

6. Once their plans have been approved, provide the students with the necessary materials to build a model of their community. (See materials section above.)

7. Once all the groups have developed their models of the communities they have designed, have a “Model Community Design Show,” with each group explaining the design features of its community.

8. Discuss the advantages and disadvantages of each community design in detail. For example, include “What if?” questions, such as, “What if a new school had to be built?” and “What if there is a drought or severe winter, would it be necessary to take special measures to assist the wildlife?”

9. Return to the models after two weeks to a month and ask the students to reflect upon whether they would make any changes in their community designs as if they have had the opportunity to “live” in their communities for a while and might now see the need to do some things differently.

10. Ask a local architect, city planner, wildlife biologist, and/or other resource manager to visit the class in order to review and discuss the various model communities with the students who designed them.

Extensions/Adaptations:

1. Show the students photos of actual cities. Look for advantages and disadvantages of city life, under a variety of circumstances.

2. Obtain a map showing a community 15, 25, 50, 75, or 150 years ago. Evaluate the planning - or lack of - that seems to have taken place and the results.

3. Using one of the commercially available software programs that simulate land use planning and community design, have students develop their community plans on the computer.

4. Review and discuss the following scenario: Ten years have passed since the city was established. In the meantime, the population of the community has doubled. What measures, if any, have been taken to protect the availability and quality of water in the community? What effects, if any, have there been on wildlife in the area as a result of this increase in population? What changes, if any, need to be made in order to protect the availability and quality of the water resources in this community for the next 25 years - for both people and wildlife?

Assessment Ideas:

1. Identify five important land uses to be considered in a community.

2. For each of the previously mentioned considerations, list two ways to reduce effects on the environment and wildlife.

3. In most major cities, land-use planning has been non-existent, minimal, or recent. Describe five methods that might be used to enhance the existence of a city's people and wildlife, with explanations for the methods you choose.

4. Make a plan to re-establish a wildlife species that once thrived in your community. Choose an animal that is not extinct. Show how that plan will fit with the existing plan you already created for your community. Take into account both the habitat needs of the wildlife species and the needs of the community of people. Older students can consider the relevant State and Federal wildlife laws.

NOTE: The complete *Project WILD K-12 Education Activity Guide* can be obtained by attending a Project WILD workshop. Please contact your State Coordinator for more information by going to the Project WILD website at www.projectwild.org.

Post-visit Activity G: Attracting Wildlife to Your School

Adapted from *Rocky Mountain Arsenal National Wildlife Area Teacher Resource Guide*

Method: Students map school grounds and existing wildlife habitat and develop plans for improving the habitat in order to attract wildlife.

Objectives: Students will be able to
- Create a map of their school site
- Make an inventory of existing habitat at or around their school
- Develop a plan for improving wildlife habitat at or around their school
- Practice/simulate “wildlife management” on their own school grounds

Materials:
- base maps: butcher paper or sketch paper (3" x 3")
- construction paper
- marking pens, crayons, or pencils

Subjects: Art, Science, Geography

Time: 2-3 hours

Setting: Outdoors at school, classroom

Grade Level: 4-6

Skills: Mapping, research, synthesis, application

Vocabulary: annuals, perennials, predator, shrub, tree, wildlife habitat

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Background Information:

Your schoolyard can be a rich wildlife habitat that provides the basic needs of animals - food, water, protection, and space - in the appropriate arrangement. You can attract desirable wildlife to your school by planting native shrubs and trees, providing supplemental food, making a birdbath, and constructing nest boxes. If space is limited, students can build a window box planter, and set out a dish of birdseed and a pan of water.

Planting for Wildlife:

Urban and schoolyard habitats require variety. The richer the plant diversity, the richer the wildlife. A mix of trees, shrubs, and herbaceous plants in clusters, and a variety of

plant heights, provide a diverse habitat. Herbaceous plants are nonwoody broad-leaved plants such as sunflowers and goldenrod. You can create edges or borders by planting trees, shrubs, and flowers around open areas. More wildlife will congregate where shrubbery and lawn meet.

Trees are magnets for wildlife. They provide food, protection, and nesting sites for butterflies, birds, and small mammals. Shrubs attract the greatest diversity of schoolyard wildlife. They grow faster and have fewer requirements than trees. Colorful annuals and perennials attract butterflies and hummingbirds.

Water Sources:

Water is essential to wildlife habitat. A birdbath, small pool, or pond will attract a variety of birds and small mammals. A birdbath can be as simple as an upside-down aluminum garbage can lid that is set in the ground and filled with water.

Bird Feeders:

Bird feeders come in all shapes and sizes. You can make feeders out of simple materials, such as plastic margarine containers, egg cartons, milk cartons, and coconut shells. Feeding stations can be placed at four heights: ground level, tabletop, hanging, and tree trunk. To attract towhees, juncos, and mourning doves, you can simply scatter seed on the ground. Ground feeding areas should be in the open, away from places where cats may hide. Tabletop or platform feeders will attract finches, chickadees, grosbeaks, jays, and migrating warblers. Tree trunk feeders containing suet are excellent for attracting woodpeckers and nuthatches. Suet, a dense beef fat, is one of the best cold-weather bird foods. Another favorite winter food for birds is sunflower seeds. They are high in calories and are a good source of energy. Thistle (or niger) seed is essential for attracting goldfinches and pine siskin.

Wildlife Homes:

Wildlife homes provide nesting areas and protection from *predators* and the elements. You can custom-make bird nest boxes from cedar or pine. Bat boxes will encourage bats to roost at your site in the summer, and a colony of bats means fewer insect pests.

Boxes for overwintering butterflies help protect these fragile insects in severe weather. This allows them to grace your area on sunny days. Brush piles made from pruned tree branches and old Christmas trees make nice hideouts for rabbits and chipmunks. Rock pile and rock walls with plenty of crevices are attractive to friendly garter snakes and toads, which are good insect predators.

Extra Guests:

Remember when you provide habitat for one species, other uninvited species may also be attracted to the site. For example, if you set out food and water for birds, raccoons and deer may also help themselves to the feast. Giving these mammals supplemental food is usually discouraged or prohibited in most communities.

Suggested Procedure:

1. Preparation: Make a base map for every two to four students. You can do this yourself or with the class. Draw an outline of your school grounds on the butcher paper. Draw an outline of the school building, roughly to scale, on construction paper. Trace the school shape on the butcher paper in the proper location.

2. Divide the class into teams of 2-4 students. Distribute a base map to each team.

3. Have students create a map key. (You may want to have them include symbols for trees, shrubs, grass/lawn, weed and wildflowers, rocks, hard dirt areas, flower beds, old stumps, fallen logs, etc.) Assign a color to each component for use in later map comparisons.

4. Each team should have a base map, map key, and set of markers or crayons. Students will be taking an inventory of their school site to identify natural and human-made features. Ask them to draw the existing features on their maps using the symbols and colors on their map keys. Mention to younger students that a precise scale for the map is not necessary; they need only draw symbols at their approximate locations. You may want older students to draw a to-scale map.

   On their maps, students can draw and label features that are not included in the key. These features might include parking lots, sidewalks, a playground, and fences.

5. While taking the inventory, students might think about the following: which areas would make good wildlife habitat? Why? (*Nesting holes in trees, dense vegetation for protection, and food plants are good habitat*) Which areas could be improved for wildlife? How? (*Planting trees, constructing nest boxes, and picking up trash all improve habitat*).

6. Have teams compare their completed maps. Which colors are dominant on their maps? Discuss the quality of the school site in terms of attracting wildlife and its

potential for improvement. Discuss which wildlife species students would like to attract and research the habitat needs of those animals. Make a list of native trees, shrubs, and flowers best suited for attracting wildlife in your area.

7. Discuss with the students how they are using the tools and knowledge of wildlife management in making their plan.

8. Have students draw some of their habitat ideas for the school grounds on their base maps. The following books, pamphlets, and kits may be helpful:

   "Backyard Wildlife Habitat Kit" by the National Wildlife Federation. Request Kit #79901, Dept 199, 1400 16th Street NW, Washington, D.C. 20036-2266

   "Xeriscape: Water Conservation Through Creative Landscaping," Colorado State University Cooperative Extension. This is one of many excellent free Service-in-Action information sheets available from your local Cooperative Extension Office.

   "Bird Watching/Recycle for the Birds," National Science Teacher's Association (NSTA). Contains a *Ranger Rick* reprint on making feeders from trash and an article on techniques of bird watching. Request Kit #79258, National Wildlife Federation. Request Kit #79901, Dept 199, 1400 16th Street NW, Washington, D.C.

Extensions/Adaptations:

1. Students should pick an idea for improving their school site and begin working on it. Ideas: planting drought resistant trees and shrubs, providing a water source for animals, making bird feeders and nest boxes, and constructing brush piles for animal protections

2. Invite a representative of a local garden club, Audubon Society, Cooperative Extension Office, or city parks department to discuss planning for schoolyard wildlife. What does the organization do to help wildlife? Ask the speakers to bring pictures or slides.

Assessment Ideas:

1. Maps of school grounds

2. Plans developed for improving school yard for wildlife

APPENDICES

Appendix A: Glossary

abiotic: a non-living factor in an environment (Ex: light)

aerobic: able to live only in the presence of air or free oxygen; conditions that exist only in the presence of air or free oxygen

adaptation: an adjustment to environmental conditions; a modification of an organism or its parts that helps that plant or animal survive and reproduce

aestivation: dormancy, typically seasonal

algae: tiny, non-seed bearing aquatic plants; chlorophyll is often masked by a brown or red pigment

amphibian: an animal that typically begins life in an aquatic habitat using gills to breathe when young, and primarily in a terrestrial habitat using lungs and through moist glandular skin to breathe when an adult

anaerobic: able to live and grow only where there is no air or free oxygen; conditions that exist only in the absence of air and free oxygen

annual: a plant that completes its life cycle from seedling to mature seed-bearing plant during a single growing season and then dies

anthropomorphism: the attribution of human characteristics to non-humans, especially animals

aquatic: growing, living in, or frequenting water

aquifer: an underground bed of saturated soil or rock that yields significant quantities of water

arboreal: tree dweller

bacteria: one-celled organisms that lack a nucleus

bag limit: the maximum number of animals allowed to be taken by an individual in regulated fishing or hunting

behavior: what an animal does

benthos: plants and animals that live at the bottom of a body of water

biennial: a plant that lives for two growing seasons, producing only leaves during the first season, flowers and seeds during the second

big game: a term designating larger hunted species, such as deer and elk (as opposed to “small game”)

biodegradable: capable of being broken down to simple compounds, especially into harmless products, by the action of microorganisms

biodiversity: a term used to represent the variety of life in a given area

biome: a large geographic area with somewhat uniform climatic conditions; a complex of communities characterized by a distinctive type of vegetation and maintained under the climatic conditions of the region

bog: wet, spongy ground, with soil composed mainly of decayed vegetable matter; dominated by spongy mosses

bottomland: an open grassland or forest area usually near a stream, river, or other moving body of water, subject to periodic flooding

brackish: somewhat salty, but less salty than sea water

broadleaf: a plant with wide-bladed leaves, such as an oak or maple; generally refers to flowering trees in contrast to conifers

brood: the offspring of a bird or mammal

browse: brushy plants utilized by deer, elk, or cattle as feed; to eat the twigs and leaves of woody plants

camouflage: color, tones, patterns, shapes, or behavior that enable an organism to blend in with its surroundings

carnivore: a meat eater

carrion: the bodies of dead animals; usually found in nature in the process of decay; not “fresh” meat

carrying capacity: a wildlife management term that expresses the number of animals that a particular habitat can support. It is a characteristic of the habitat, but it is frequently expressed as the population of any given animal that a given area can support

cast: to regurgitate indigestible prey remains

chaparral: dense scrub vegetation of broadleaf, evergreen, or wintergreen shrubs

climate: the average condition of the weather as defined by temperature, precipitation, and wind velocities

commensalism: a relationship between two organisms of different species in which one organism benefits, while the other is generally neither helped nor harmed

community: an association of organisms - plant and animal - each occupying a certain position or ecological niche and interacting with one another

competition: when two or more organisms have the potential for using the same resource (can be inter- or intra-specific)

conifer: a plant that bears its seeds in cones; usually refers to needleleaf trees, although some needleleaf trees do not bear cones

conservation: the use of natural resources in a way that assures their continuing availability to future generations

consumptive use: any use of wildlife which involves an activity that results in the loss of wildlife, plants, or habitat

courtship: a behavior pattern which ensures mating with a suitable partner

consumer: an organism that eats other organisms (plants and/or animals)

crepuscular: active at dawn and dusk

crustacean: a class of arthropods that usually live in water, they have hard exoskeletons, and breathe through gills; i.e. crabs, shrimp, and barnacles

dabbling ducks: ducks which frequent shallow marshes, ponds, and rivers - they “tip up” to feed

deciduous: referring to trees, those that annually shed their leaves

decomposer: an organism (such as bacteria or fungi) that breaks down dead plants and animals

delineation: the process of deciding where something (a wetland) ends or begins

delta: a landform created by alluvial deposits at the mouths of rivers or at the mouths of tidal inlets

detritus: decaying bits of plant and/or animal remains (sometimes resembles gooey mud)

diatoms: single-celled algae encased in two-part silicon (glass-like) shells

dinoflagellates: phytoplankton; have characteristics of both plants and animals
display: an observable behavioral pattern that carries a specific message

diurnal: active or occurring in the daytime

diving duck: ducks which prefer deep water as in lakes and bays - they feed by diving below the surface

ecology: the study of the interrelationships of organisms and their environments

ecosystem: a system made up of a community of living things and the physical and chemical environment with which they interact

ecotone: an area between distinct environments

emergent: rising above a surrounding medium, as in wetland plants protruding above the water level

endangered: a species that is in immediate danger of becoming extinct

environment: the total of all surroundings - air, water, vegetation, human element, wildlife - that has influence on an organism’s existence, including physical, biological and other factors

ephemeral: a plant that grows, flowers, and dies within a few days; temporary

estuary: the lower course of a river where the current is met by ocean tides

ethics: a personal or social moral code

eutrophication: enrichment of soils and water due to fertilization sewage, effluent, or other waters that carry a high plant nutrient component

evergreen: a plant that does not lose all of its leaves at one time (can be broadleaved or coniferous)

exotic species: a foreign plant or animal - one that has been introduced to a new area

extinct: an animal or plant species that no longer exists

fen: low, flat, swampy land

feral: refers to domesticated animals that have gone wild (Ex: cat, dog)

field: an area devoid of trees, and generally characterized by having grasses

floating plant: a wetland plant that floats on the surface of the water

floodplain: any normally dry land area that is susceptible to being inundated by water from any natural source; usually a lowland adjacent to a stream or lake

flyway: a route taken by migratory birds during their flights between breeding grounds in the north and wintering grounds in the south; there are four main flyways in North America (Atlantic, Mississippi, Central, Pacific)

food chain: a sequence of living organisms in an ecological community in which members of one level feed on those in the level below it and in turn are eaten by those in the level above them

food pyramid: demonstrates the loss of energy between different levels of consumers in a food chain

food web: the totality of interacting food chains in an ecological community

forb: an important part of wildlife habitat; in wildlife usage, forbs are weeds and herbs; low growing, annual or perennial, herbaceous plants

forest: a large area of land primarily covered with trees as well as the other organisms, soil, water, and air associated with them

fungi: small, often microscopic plant-like organisms that lack chlorophyll and cellulose in their cell walls. Fungi are important decomposers of organic wastes

game animal: legal designation for animals which may be managed and hunted under regulation

grassland: a vegetation community in which grasses are the dominant plant

grazer: a herbaceous organism that consumes primarily grasses

habitat: the place or type of site where an animal or plant naturally or normally lives, often characterized by a dominant plant form or physical characteristic (Ex: stream habitat, forest habitat)

halophyte: a plant that grows in salty soil

harvest: the intentional gathering of plants, animals, and other natural resources (especially renewable resources) for use; a human intervention in a life cycle in order to use a resource (Ex: hunting)

herb: any flowering plant or fern that has a soft, rather than woody stem

herbivore: an organism that eats living plants or their parts
hibernate: to pass the winter in a dormant or torpid state

home range: the area in which an animal travels in the scope of normal activities - not to be confused with territory

humus: decomposed material in the soil that is a highly complex mixture of organic and inorganic substances

hydrophytic plant: a plant characterized by its adaptations to a water-saturated environment

hypothesis: a potential explanation for a condition or set of facts that can be tested through further investigation

indicator species: an organism whose prominent presence in an environment serves as a marker for that particular ecosystem

indigenous: a naturally occurring species

insectivore: refers to insect eaters

interdependency: mutual dependence

invasive plant: a plant that moves in and takes over an ecosystem to the detriment of other species (often the result of environmental manipulation)

invertebrate: an animal without a backbone or spinal column

lagoon: a shallow body of water, often separated from a sea by sandbars or reefs

larva (pl. larvae): an immature stage that most insects and some water animals pass through after hatching from an egg and before becoming a pupa

lenticel: one of the corky pores or narrow lines on the surface of stems of woody plants that allow the interchange of gases between the interior tissue and the surrounding air

levee: a raised embankment that prevents river overflow

license: in wildlife terms, a legal permit to hunt, fish, trap, transport, keep captive wildlife, or perform taxidermy

lichen: algae and fungus growing together in a symbiotic relationship

life cycle: the continuous sequence of changes undergone by an organism from one primary form to the development of the same form again

limiting factors: influences in the life history of any animal, population of animals, or species (Ex: food, water, protection, space, disease, predation, climatic conditions, pollution, hunting, poaching, and accidents)

management: the intentional manipulation or non-manipulation of habitat and/or the organisms within a habitat

marsh: a wetland without trees, which often has standing water

migration: the act of moving (usually seasonally) from one locality to another for feeding or breeding purposes

mire: a wetland of wet, soggy, muddy ground; sometimes called a bog

mitigation: the policy of constructing or creating wetlands to replace those lost to development

mixed forest: a forest that includes both coniferous and deciduous trees

moor: a wetland in high, poorly drained country; also called a peatland

multiple-use: a term referring to a system of management in which lands and waters are used for a variety of purposes. The uses are not necessarily simultaneous but are intended to be compatible. For example, a tract of forest land can serve as a home for wildlife, provide clean air and water, be a place for recreation, be used to grow and harvest trees, and be aesthetically pleasing at the same time

muskeg: a swamp or bog formed by the accumulation of sphagnum moss, leaves, and decayed matter, resembling peat

mutualism: a close association between two different species whereby each species derives some benefit

natural selection: a process in nature resulting in the survival and perpetuation of only those forms of plant and animal life having certain favorable characteristics that enable them to adapt best to a specific environment

needleleaf: bearing needlelike leaves

niche: the role played by an organism in a biological community; its food preferences, requirements for shelter, special behaviors

nocturnal: active or occurring at night

nonconsumptive use: any use of wildlife, plants, or habitat which does not directly harm or kill (Ex: most forms of birdwatching, photography, hiking)

nongame: all wildlife species which are not commonly hunted, killed, or consumed by humans (Ex: raptors, songbirds)

nonrenewable resource: nonliving resources such as rocks and minerals; resources which do not regenerate themselves, at least not in this geological age

noxious plant: a harmful plant species

nutrients: the raw materials necessary for continuing life processes

omnivore: an organism that eats both plant and animal material

organism: a living thing

parasite: an organism that lives by deriving benefit from another organism, usually by doing harm to the organism from which it derives benefit

peat: partially carbonized vegetable matter (mosses) found in bogs and peatlands; can be used as fuel and fertilizer

perennial: a plant that lives for several years and usually produces seeds each year

pesticide: any chemical preparation used to control populations of organisms, including plants and animals

photosynthesis: utilization of the light energy combined with carbon dioxide and water to produce oxygen and simple sugars which are food for plants

plankton: aquatic plants (phytoplankton) and animals (zooplankton) that drift with the currents

playa: a nearly level area at the bottom of an undrained desert basin, sometimes temporarily covered with water; some qualify as wetlands

pollution: contamination of the environment, especially with human-made wastes

population: the number of a particular species in a defined area

prairie pothole: lakes and wetlands found in rolling grassland, especially central North America

predator: an animal (rarely a plant) that captures and eats animals for food

prescribed burning: the planned application of fire to natural fuels with the intent to confine the burning to a predetermined area; a habitat management tool

preservation: protection which emphasizes nonconsumptive values and uses, including no direct use by humans (contrast with conservation which emphasizes consumptive and nonconsumptive values and uses)

prey: an animal killed and eaten by other animals

producer: an organism (such as a green plant) which uses solar energy to convert inorganic substances into food (i.e. photosynthesis)

public land: land owned by the citizens and administered by the local, State, or Federal agencies

pupa: an insect in the nonfeeding stage (usually immobile) between the larvae and adult stage

raptor: birds that catch and kill their prey using primarily their feet

rare species: a species that has a small number of individuals and/or has a limited distribution; a rare species may or may not be endangered or threatened

recreation: entertainment, frequently implying outdoor activity

recycle: a multi-phased process which includes the removal, separation, and/or division of materials from the waste stream; use of such materials as raw materials for the manufacture of new products, and the use of the new product

refuge: a place that provides food, shelter, and protection for the organisms that live or migrate there

renewable resource: living resources, such as plants and animals, which have the capacity to renew themselves when conditions for survival are favorable

resource: a portion of an environment upon which people have placed or assigned value or see as being available for use

restoration: the process of bringing back to existence, or reestablishing, the original condition of a degraded environment

riverine: associated with rivers, streams, and their floodplains

salinity: the concentration of salt in the water

salt marsh: a low coastal grassland frequently inundated by the tide

saprophyte: an organism that obtains food by absorbing the products of decomposition; a saprophyte lives off dead organisms (Ex: a fungus)

savanna: a grassland with scattered trees or clumps of trees

scat: an animal fecal dropping

scavenger: an organism that habitually feeds on carrion

scrub: a low, woody vegetation composed primarily of shrubs

season: a period of time, usually when something specific occurs (Ex: spring, summer, fall, winter); in wildlife management or conservation terms, that time when hunting, fishing, or trapping is permitted for a particular species

sediment: the matter that settles to the bottom of a liquid; material deposited by water, wind, or glaciers

sere: the series of communities that follow one another in natural succession, as in the change from a bare field to a mature forest; a seral stage refers to such a community

shelter: cover from elements, for natal activity, to travel in, for breeding, for bedding, etc.; varies depending on the species

shorebird:

shrub: a woody plant usually less than 12 feet (4m) tall, usually with more than one stem rising from the ground

sign: something that indicates the presence of something else (Ex: animal tracks)

small game: a term designating smaller hunted species, such as rabbits and squirrels; in many states, species are legally designated as big game, small game, or nongame

snag: a standing dead tree from which the leaves and most of the branches have fallen; typically important as wildlife habitat

species: a population of individuals that are more or less alike and are able to breed and produce fertile offspring under natural conditions; a category of biological classification

stewardship: related to the environment, the concept of responsible care taking; based on the premise that we do not own resources but are managers of resources and are responsible to future generations for their condition

submerged plant: a wetland plant that has adapted to grow under water

succession: the orderly, gradual, and continuous replacement of one plant or animal by another

swamp: a wetland dominated by trees

symbiosis: a close living relationship between organisms

temporary wetland: an environment which only periodically exhibits the characteristics of a wetland (Ex: vernal pool)

terrestrial: ground dweller

territory: the concept of "ownership" or dominance over a unit of habitat; an area defended by an animal against others of the same species; used for breeding, feeding, or both

threatened species: a species whose numbers are low or declining; not in immediate danger of extinction; likely to become endangered if not protected

tidal flat: an mud flat alternatively covered and exposed by tidal action - lacks vegetation

torpor: the dormant state of a hibernating or aestivating animal; a state of inactivity

toxin: a metabolic product of a living organism that is poisonous to other organism, or any substance damaging to living things

transition zone: the intervening area between distinct environments

transplant: in wildlife terms, an animal that is moved to a new area

tree: a woody plant 12 or more feet (>4m) tall with a single main stem (trunk) and a more or less distinct crown of leaves

turbid: having sediment or foreign particles in suspension or stirred up, creating a muddy look

vegetation: the mass of plants that covers a given area; flora, a term often wrongly used interchangeably with vegetation, is a list of the species of plants that compose the vegetation

upland: ground elevated above the lowlands, marshes, or rivers

vernal pool: temporary freshwater pond that exist in the spring

waterfowl: water birds, usually ducks, swans, and geese

watershed: the entire land area that contributes surface runoff to a given drainage system

water treatment: systematic purification of water for human consumption

wetland: areas that, at least periodically, have waterlogged soils, support plants adapted to wet soil, and are covered or submerged by water; bogs, freshwater and saltwater marshes, freshwater and saltwater swamps are all examples of wetlands

wet meadow: grassland with waterlogged soil near the surface but without standing water most of the year

wild: not tamed or domesticated; living in a basically free environment

wilderness area: an area established by the Federal government to be managed and preserved in an essentially untouched condition - wilderness areas are open to some recreational activities -use of machinery, mining, logging, and many other commercial pursuits are generally not allowed in wilderness areas

wildlife: animals that are not tamed, domesticated or confined; may be microscopic organisms or as large as a whale - wildlife includes, but is not limited to

insects, spiders birds, reptiles, fish, amphibians, and mammals

wildlife management: the application of scientific knowledge and technical skills to protect, preserve, conserve, limit, enhance, or extend the value of wildlife and its habitat

wildlife manager: a person who manages wildlife habitat and/or other related human activities

woodland: a wooded area, generally more open canopy than a forest

Appendix B: Correlations with State Grade Level Expectations

Pre-visit Activities

1. The Web of Life Students will conduct a web of living and non-living components of an ecosystem.
2. Habitats: Survey and Compare Students will conduct simplified wildlife surveys at the refuge to compare and contrast.
3. How Many Bears Can Live in this Forest? Students will become “bears” to look for one or more components of habitat.
4. Migration Headache Students will become migrating water birds traveling between nesting habitats and wintering grounds.
5. Wetland Metaphors Students are presented with a selection of objects for investigation as metaphors for the natural functions of wetlands.

On-Site Activities

A. Adaptations Everywhere Students will observe plants and animals at the refuge and record the adaptations.
B. A Habitat Expedition Students will explore and learn about plants and animals that live in a variety of habitats.
C. Start a Nature Journal Students will make observations and inferences to record in a nature journal.
D. Plant Diversity Students will observe plants in different habitats to study the differences between the plants in each habitat.
E. Create a Class Field Guide Students will observe plants and wildlife to make drawings and observations to compile a class field guide from the trip.
F. Wetland Inventory Students will sample organisms from a wetland habitat and collect water samples for microscopic study.
G. No Trash Lunch Students will learn about food packaging and waste reduction.
H. Manage a Refuge Students will design a “management plan” for a small plot of land and determine ways to make suitable habitat for a particular group of species.

Suggested Grade Level Activities and Correlations

3rd Grade Suggested Activities

Activity	Subject Covered	GLE Correlations
A	Adaptations	LS 35, 36, 38, 39
C	Plants & Animals	SI 3, 5, LS 38
D	Plant Diversity	SI 1, 9, LS 35, SE 57
F	Ecosystems/Wetlands	SI 3, 5, LS 39
2	Ecosystems/Habitats	SI 3, 5, LS 39, SE 57

4th Grade Suggested Activities

Activity	Subject Covered	GLE Correlations
A	Adaptations	SI 9, 17, LS 41, 50, 52, 53
B	Ecosystems/Habitats	SI 1, 9, , LS 41, 45, 50, 51
C	Plants & Animals	LS 41, 52
D	Plant Diversity	LS 52, 53, 54
E	Plants & Animals	LS 48, 49
F	Wetland Ecosystem	LS 41, 45,50, 51, S.S./Places & Regions 6
1	Food Webs	LS 54, SE 71
2	Habitats	SI 9, LS 53
3	Habitats	LS 50, 53, 54
4	Adaptations	LS 41, 52, 53
5	Ecosystems	LS 41, 45,50, 51, S.S. 6

5th Grade Suggested Activities

A	Adaptations	SI 6, LS 29, SE 48
B	Ecosystems/Habitats	LS 23-28 & SE 48
D	Plants/ Habitat	SI 7, 8, LS 27, 28
F	Ecosystems/Habitats	SI 6, LS 26
H	Non-native Species /Natural Cycles	SE 48, 50, 51

1	Food Web/ Living/Non-living	LS 23, 24, 25, 28
2	Ecosystems/Habitats	SI 6, LS 26
3	Carrying Capacity	LS 26, SE 48
4	Adaptations/Carrying Capacity	LS 29, SE 48
5	Ecosystems	LS 26, SE 51

6th Grade Suggested Activities

A	Adaptations	SI 6
D	Ecosystems/Adaptations	SI 7, 8
F	Ecosystems/Habitats	SI 3, 6, 11, 18
2	Ecosystems/Habitats	SI 6

7th Grade Suggested Activities

A	Adaptations	LS 30, 34
D	Ecosystems/Adaptations	SI 7, 8, LS 30, 32
F	Ecosystems/Habitats	SI 3, 11, 18, LS 32, SE 35
H	Non-native Species/ Natural Cycles	LS 31, 32, 39
1	Food Webs/Biotic/Abiotic	LS 24, 29, 40
3	Carrying Capacity	LS 32, 34
4	Adaptations	LS 32, 34, SE 43
5	Ecosystems	SE 39, 42, 43

Appendix C: List of Agencies and Organizations

The following list is not meant to be comprehensive. It includes some of the agencies and organizations involving wildlife and habitat conservation.

FEDERAL AGENCIES:

Bureau of Land Management
Interior Building
1849 C Street NW
Washington, DC 20240
(202) 452-5128

Cooperative Extension Service
US Department of Agriculture
14th & Independence Ave, SW
Washington, DC 20250
(202) 720-3029

National Marine Fisheries Service
US Department of Commerce, NOAA
1315 East-West Highway
Silver Spring, MD 20910
(301) 713-2370

National Park Service
Interior Building
PO Box 37127
Washington, DC 20013
(202)208-4747

Natural Resources Conservation Service
PO Box 2890
Washington, DC 20013
(202)720-4525

NRCS in Monroe
4974central Ave. Suite B
Monroe, LA 71203
(318) 387-8683

US Army Corps of Engineers
HQ USACE (CECW-ON)
20 Massachusetts Ave, NW
Washington, DC 20314
(202)761-0011

US Department of Agriculture
Office of Public and Media Outreach
412A Jamie Whitten Building
Washington, DC 20250
(202) 720-2798

US Environmental Protection Agency
Environmental Education Division
Mail Code 1707
401 M Street SW
Washington DC 20460
(202) 260-4965

US Fish and Wildlife Service
Media Services
Main Interior Building
1849 C Street NW, Rm 3447
Washington, DC 20240
(202) 208-5634

USDA Forest Service, CF
Natural Resource Conservation Education
PO Box 96090 (4 SE)
Washington, DC 20090
(202) 205-1545

STATE AGENCIES:

Louisiana Department of Wildlife and Fisheries
368 CenturyTel Dr.
Monroe, LA 71203

LA Extension Service
704 Cypress Street
West Monroe, LA 71291
(318)323-2251

LOCAL AGENCIES:

ORGANIZATIONS:

American Fisheries Society
5410 Grosvenor Lane
Bethesda, MD 20814
(301) 897-8616

American Humane Association
63 Iverness Drive East
Englewood, CO 80112
(303) 792-9900

Defenders of Wildlife
1101 14th Street NW, Suite 1400
Washington, DC 20005
(202) 682-9400

Ducks Unlimited
1 Waterfowl Way
Memphis, TN 38120
(901) 758-3825

Earth Island Institute
300 Broadway, Suite 28
San Francisco, CA 94133
(415)788-3666

Greenpeace
1436 U Street, NW
Washington, DC 20009
(202)462-1177

International Association of Fish and Wildlife Agencies
444 North Capitol Street, NW
Washington, DC 20001
(202)624-7890

Izaak Walton League of America
707 Conservation Lane
Gaithersburg, MD 20878
(301) 548-0150

National Audubon Society
700 Broadway
New York, NY 10003
(212)979-3000

LA Chapter of the Audubon Society
P.O. Box 82525
Baton Rouge, LA 70884-2525

National Wildlife Federation
1400-16th Street NW
Washington, DC 20036
(202)797-6800

Safari Club International
4800 West Gates Pass Road
Tucson, AZ 85745
(602)620-1220

Sierra Club
730 Polk Street
San Francisco, CA 94109
(415)776-2211

The Nature Conservancy
1815 N. Lynn Street
Arlington, VA 22209
(703) 841-5300

The Wilderness Society
900 - 17th Street NW
Washington, DC 20006
(202)833-2300

The Wildlife Society
5410 Grosvenor Lane, Suite 200
Bethesda, MD 20814
(301) 897-9770

Wildlife Management Institute
1101 - 14th Street NW, Suite 801
Washington, DC 20005
(202) 371-1808

World Wildlife Fund
1250 24th Street, NW
Washington, D.C. 20037

Appendix D: List of Federal and State Legislators

U.S. Senators:

David Vitter
Mary Landrieu

U.S. Congressmen:

John Fleming

Louisiana Senators:

B. L. “Buddy” Shaw

Louisiana Congressmen:

Henry Burns

Appendix E: References and Resources

References:

A Guide to Environmental Education for National Wildlife Refuges and Fish Hatcheries in the Southeast Region. U.S. Fish and Wildlife Service.

Aquatic Project Wild. (1992) Council for Environmental Education.

Brower, J.E., J.H. Zar, and C.N. von Ende (1990) *Field and Laboratory Methods for General Ecology* (3rd edition). Wm. C. Brown Publishers. Dubuque, Iowa.

Dennison, M.S. and J.F. Berry (1993) *Wetlands: Guide to Science, Law, and Technology*. Noyes Publications, New Jersey.

Educator's Guide to the St. Marks National Wildlife Refuge. (1990) St. Marks Refuge Association, Inc.

Excellence in Environmental Education. (1999) North American Association for Environmental Education.

Habitat Fun Pack. (1989) U.S. Fish and Wildlife Service.

Horne, A.J. and C.R. Goldman (1994) *Limnology*, McGraw-Hill, Inc. New York

Partners for Education: A Teacher's Guide to Using National Parks as Classrooms (1996). National Park Service and Shepherd College.

Project Learning Tree. (1993) American Forest Foundation.

Project Wild. (1992) Council for Environmental Education.

Rocky Mountain Arsenal National Wildlife Area: A Teacher Resource Guide. (1993) U.S. Fish and Wildlife Service and U.S. Army.

UNESCO-UNEP (1976) "The Belgrade Charter." *Connect: UNESCO-UNEP Environmental Education Newsletter*, Vol 1 (1) pp. 1-2.

UNESCO (1978) *Final Report Intergovernmental Conference on Environmental Education*. Organized by UNESCO in Cooperation with UNEP, Tbilisi, USSR, 14-26 October 1977. Paris: UNESCO ED/MD/49.

Van Matre, S. (1990) *Earth Education*, Institute for Earth Education.

Quivira National Wildlife Refuge: Educator's Guide. (1998) Quivira National Wildlife Refuge.

Salt Marsh Manual: An Educator's Guide. (1989) San Francisco Bay National Wildlife Refuge.

Wild About Life Activity Guide. U.S. Fish and Wildlife Service.

Wildlife Habitat Evaluation Handbook. (1991) Cooperative Extension.

WOW! The Wonders of Wetlands. (1995) Environmental Concern Inc. and The Watercourse.

Suggested Resources:

Activity guides:

Aquatic Project Wild. (1992) Council for Environmental Education.

Biodiversity Basics. (1999) World Wildlife Fund.

Discover Nature series: Things to know and things to do. Stackpole Books. Author: Lawlor, E.P.

Environmental Respect. (1987) Safari Club International.

Project Wet. (1995) The Watercourse and the Council for Environmental Education.

Project Wild. (1992) Council for Environmental Education.

Project Learning Tree. (1993) American Forest Foundation.

Ranger Rick's Nature Scope. National Wildlife Federation.

The Leopold Education Project: Lessons in a Land Ethic. Leopold Education Project.

WOW! The Wonders of Wetlands. (1995) Environmental Concern Inc. and The Watercourse.

Review of Activity Guides:

The Environmental Education Collection: A Review of Resources for Educators. (1997, 1998) North American Association for Environmental Education (3 Volumes)

The Biodiversity Collection: A Review of Biodiversity Resources for Educators. World Wildlife Fund in conjunction with the North American Association for Environmental Education.

Environmental Education Guidelines:

Environmental Education Materials: Guidelines for Excellence. (1999) North American Association for Environmental Education.

Excellence in Environmental Education. (1999) North American Association for Environmental Education.

Field Guides:

A Field Guide to Wildlife Habitats of the Eastern United States. (1989) Simon & Schuster, Inc. Author: Benyus, J.M.

A Field Guide to Wildlife Habitats of the Western United States. (1989) Simon & Schuster, Inc. Author: Benyus, J.M.

Field Guide to the Birds of North America. The National Geographic Society, Washington, D.C.

Peterson First Guides: Mammals, Reptiles, Birds, Fishes, etc. (1987) Peter Alden, Houghton Mifflin Co., Boston, Massachusetts.

The Audubon Society Nature Guides-Wetlands. (1985) Alfred A. Knopf, Inc.

The Audubon Society Pocket Guides: Reptiles and Amphibians, Birds, Flowers, Insects, Mammals, Seashells, Trees. (1988) Alfred A. Knopf, Inc.

Tracking and the Art of Seeing: How to Read Animal Tracks and Sign. (1999) HarperCollins Publishers. Author: Rezendes, P.

Magazines:

Natural History: The Magazine of the American Museum of Natural History

W.O.W. Wild Outdoor World, Rocky Mountain Elk Foundation.

Appendix F: Field Trip Planning

Pre-Visit Planning Sheet
Red River National Wildlife Refuge

(We must receive this 2 weeks prior to your visit.)

Location Address: 555 Sunflower Rd.
Off Jimmie Davis Blvd
Bossier City, LA

Mailing Address: North Louisiana
Refuges Complex.
11372 Hwy 143
Farmerville, LA 71241

Your Name(s)		Date of Visit	
Phone Number		Arrival Time	
School/Organization		Departure Time	
Address		Number of students: Number of adults:	
Means of Transportation		Grade level:	

Please list the names of ALL teachers and parents who will be coming on the field trip. Circle those who have attended an orientation:

_____
_

THEME: State the themes or goals of your trip to the Refuge.

SPECIFIC OBJECTIVE(S): As a result of the trip to the Refuge, my students will be able to

SCHEDULE: Based upon your general objectives, select appropriate activities and/or audiovisuals.

a. Indicate your equipment needs on the attached "equipment check-out list" found at the end of this form.
b. Complete the "Field Trip Schedule" form below. For each activity, please include the location and leader of the activity, as indicated.

c. Remember to consider lunch time, moving time, and rest room breaks.

Estimated Time	Activity/Activities	Location	Teacher
	ARRIVAL		
	DEPARTURE		

PRE-TRIP PREPARATION: If you have done or will be doing any pre-trip activities with your class, please list them here:

SPECIAL NEEDS: Do any of your students have special needs? If so, please describe their needs.

HOW CAN WE HELP?

Opening:

Closing:

Other?

EQUIPMENT CHECK-OUT LIST

Please indicate, under the column "# OUT" the quantity of equipment that you will need for the selected activities. The equipment you request will be counted and ready for you when you arrive at the Refuge.

BEFORE YOU LEAVE THE REFUGE, CLEAN AND COUNT ALL EQUIPMENT AND FILL IN THE "# IN" COLUMN. The replacement of lost or broken items is the group's responsibility.

LOST/DAMAGED EQUIPMENT POLICY: Teachers and group leaders are responsible for equipment that is lost or broken during the field trip. The class should decide what to do about the missing equipment. This helps to teach students about responsibility.

Equipment Checked Out		Equipment Checked In	
#	Name of Equipment	#	Name of Equipment

SAMPLE PARENT LETTER

FIELD TRIP TO Red River National Wildlife Refuge

DATE: _____

Dear Parent/Guardian:

Our__grade students have a unique opportunity to explore the Red River National Wildlife Refuge on_____. We will be taking a short hike and participating in a variety of outdoor activities.

Students will be divided into groups, and will complete several activities. The teachers leading each group will be_____.

We need one parent to be a group leader for each group as well. We would love to have you come with our class to the Refuge. Also, we would greatly appreciate the help during this fun-filled learning experience. *If you can volunteer to attend this field trip, please mark the appropriate box on the permission slip, or call _____ .*

The field trip bus will leave the school promptly at____ am and return no later than pm. Because the trip is scheduled during the regular school day, you will not need to make different transportation arrangements. Your child will need to bring/wear the following items:

REQUIRED:
Sack Lunch (With name marked)
Drink (No glass please)
Plastic water bottle
Appropriate clothes (LONG PANTS, socks, hat)
Closed-toe shoes that can get wet and dirty
Change of clothes and/or shoes to keep on bus
Rain gear/jacket (No umbrellas please)
Pencil

SUGGESTED:
Sun screen
Insect repellant

DO NOT BRING:
Umbrellas (they have sharp points that can be dangerous)
Radios, CD players, electric games
Valuables that might get lost or damage

In case of emergency, please contact: Red River National Wildlife Refuge, Bossier City, LA.
Phone: 318 742-1219. Please fill out the attached permission slip and send it back by _____.
We hope that your child will be able to attend. This will be a wonderful learning opportunity.

SAMPLE PERMISSION SLIP

FIELD TRIP TO Red River National Wildlife Refuge

TO: Parents of _____
FROM: _____

SUBJECT: Field trip to Red River National Wildlife Refuge
Date Time

My child_____ has my permission to attend the ___grade field trip to Red River National Wildlife Refuge on_____. I understand that because this trip is during school, my child will follow normal transportation procedures. There is no cost to students.

PLEASE RESPOND TO THE FOLLOWING ITEMS:

1. Does your child have any physical limitations? __ Yes __ No
   If so, please describe_____

2. Does your child have any allergies? __ Bee stings __ Other
   If so, please describe _____

3. Who is your child's doctor?
   Doctor's Name _____ Phone number _____

4. Is your child taking any type of medication __ Yes __ No
   If so, what kind? _____

5. Has your child had a tetanus shot within the last 10 years? __ Yes __ No

In case of emergency, please contact:

Name_____Relationship_____Phone_____

I understand that my student will be traveling on a school bus for this trip. My student will bring a sack lunch and wear appropriate clothing that will allow him/her to be outside all day. I understand that my child will be hiking and doing field investigations
Parent/Guardian signature:_____Date:_____

I can be a group leader for this field trip.
Please call me at this number: (day) _____ *(evening)* _____

SAMPLE GROUP LEADER INFORMATIONAL LETTER

Field Trip to Red River National Wildlife Refuge

TO: **Group leaders**

FROM:

SUBJECT: **Field trip to Red River National Wildlife Refuge**
Date
Time

Dear Group leader:

Thank you for volunteering to be a group leader our field trip to Red River National Wildlife Refuge on _____.

The buses will leave the school promptly at ____ am and return no later than____ pm. There will be a short group leader orientation session at_____ on_____, just before we board the bus.

We will be doing a variety of activities at the Refuge. You and a teacher will be responsible for a group of 10 students. Please be prepared to participate in the activities and assist the students when and if they need your help. Also be prepared to help students take safety precautions when necessary, and follow “The Rules of the Refuge.”

You will need:

- A sack lunch (with name marked)
- A drink (no glass please)
- Water bottle
- Pencil
- Comfortable clothing: long pants, hat, socks, closed-toe shoes, and rain gear/jacket
- You may also wish to bring sun screen and insect repellant.

In case of emergency, please contact: Red River National Wildlife Refuge, Monroe, LA. Phone: (318) 387-1114.

Thank you again for volunteering to be a group leader this trip. We are looking forward to an exciting and meaningful learning experience. If you have any questions, please contact_____at_____.

Appendix G: Field Trip Evaluations

STUDENT/GROUP LEADER EVALUATION

Students and group leaders should have the opportunity to evaluate the field trip and their learning experiences. Their input can help you to improve future field trips. On the bus ride back to school, have the students and group leaders fill out this evaluation sheet about the field trip. Give copies of the evaluation to the Refuge staff so that we can improve our ability to give you an effective and enjoyable field trip.

--
We want to know what you thought of today's field trip. On the way back to school, fill out this sheet. It's your ticket off the bus!

Name: Date:

My favorite activities were:

One thing I learned from this trip is:

I still want to know:

What I liked most about the trip was:

Maybe next time you could:

EDUCATOR FIELD TRIP EVALUATION

Red River National Wildlife Refuge
Bossier City, LA 71112
(318) 742-1219

We hope that you will help us to enhance this guide and our education program so that you and future educators will have an ever-improving educational tool for your school. Please complete the following questions. Feel free to use the back of the pages if you need additional space. Thank you!

Educator (optional):_____ Group (optional):_____

Age level:_____ Number of students:_____ Date of Visit:_____

FIELD TRIP EXPERIENCE

1. OVERALL VISIT: What was your general impression of your group's visit? Please consider organization, facilities, refuge staff support in planning and scheduling, and educational value.

2. Please describe the trip you "planned" or attach your agenda.

3. Did your actual trip deviate from your original plan? In what ways? Why?

4. ACTIVITIES: For each activity you used as part of your field trip, please write the name of the activity and answer the following questions.

	Was it successful?	**Interesting to students?**	**Adequate time allowed?**	**Concepts conveyed?**
Pre-visit:				
On-site:				
Post-visit:				

Did you adapt any of the activities to adapt to your needs? If so, what did you change?

1. FUTURE FIELD TRIPS: What would you do differently next time?

2. IDEAS FOR THE REFUGE STAFF: What could we do next time that would help you (equipment, facilities, lesson plan topics, materials, teacher aids, etc.)?

WORKING WITH THE EDUCATOR'S GUIDE

The *Rhythms of the Refuge Educator's Guide* has been provided for your use to help you conduct pre-visit and post-visit activities, as well as on-site activities. We would like to know what you liked and what we could improve upon in this guide. Please rate the following sections from "1" (least helpful) to "5" (most helpful):

1.	Information on this refuge and the Refuge System	1	2	3	4	5
2.	Facilitating a Field Trip	1	2	3	4	5
3.	Pre-visit Activities	1	2	3	4	5
4.	General Refuge Activities	1	2	3	4	5
5.	On-site Activities	1	2	3	4	5
6.	Post-visit Activities	1	2	3	4	5
7.	Appendices	1	2	3	4	5

Overall Guide:

13.	Activities appropriate to grade level	1 No	2	3	4	5 Yes
14.	Usefulness	1 Low	2	3	4	5 High
15.	Content	1 Boring	2	3	4	5 Interesting
16.	Presentation	1 Unattractive	2	3	4	5 Attractive
17.	Organization	1 Hard to use	2	3	4	5 Easy to use

Please add any other comments or suggestions - you are our best source of ideas for improving our program! Thanks for your interest! Please return this evaluation to the address listed on the first page of this form.