Section One

Background Information

Background Information

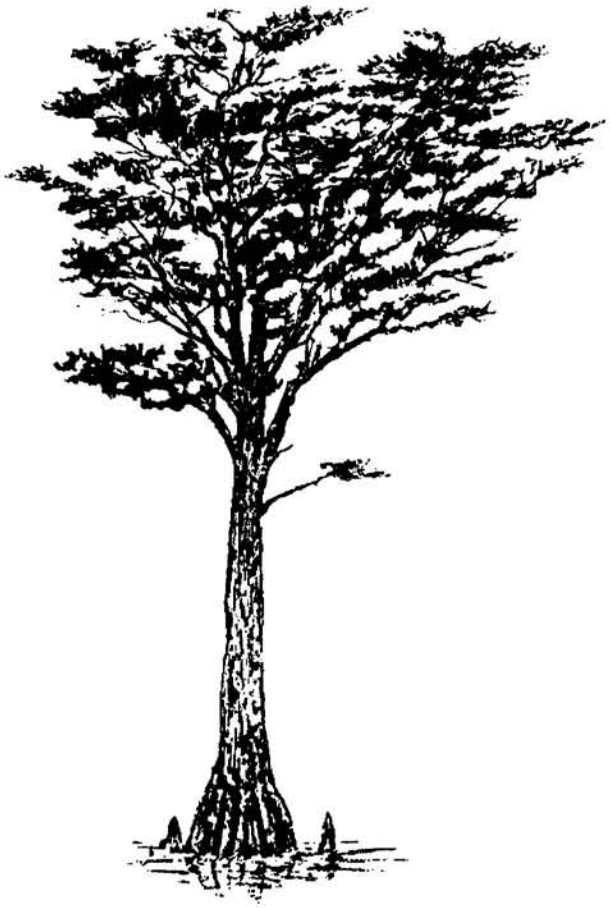
Species Status

By definition, a **species** is *a group of genetically related organisms that reproduce with one another to produce fertile offspring.* Typically, members of a species are very similar in physical structure and behavior. Members of one species will not reproduce with members of other species due to differences in a variety of things, including behavior, physical appearance, odor, songs/vocalization, habitat preference, and the timing of their reproductive cycle. Each species has different needs and habits that set it apart and make it unique, and today, many species are in jeopardy.

Each individual plant or animal within a species contains a different mix of genes, a variation known as **genetic diversity**. This diversity allows a species to adapt to local environmental conditions and changes in the climate over time. A **population** is *the number of a particular species that exists in a defined area.* When a population loses too many individuals, the species is at risk of becoming more genetically uniform and therefore less adaptable. A species that has been reduced to a fraction of its original population loses much of what once made it unique. As populations decline, the threat of extinction increases. **Extinction** *occurs when a species is no longer in existence anywhere in the world.* It is important to monitor wildlife populations to determine their health and to ensure that a species does not become extinct.

Extirpation *occurs when a species is eliminated from a significant portion of its range but still survives in other areas.* Some species may no longer be found in certain areas of their original range. Such species may be believed to be extirpated from a specific area. For example, the peregrine falcon, *Falco peregrinus*, was completely absent or extirpated from Tennessee and other parts of the country for many years. Reintroduction projects conducted by the U.S. Fish and Wildlife Service (Service) and other conservation agencies have established populations of this species back into many areas of its historical range, including parts of Tennessee.

The federal government defines an **endangered species** as *any species that is in danger of extinction throughout all or a significant portion of its range.* A **threatened species** is defined as *any species that is likely to become an endangered species within the near future.* Designating a species as endangered or threatened means there is still time, time to reverse the decline of populations and prevent the species from becoming extinct. If appropriate actions are taken, threatened and endangered species can thrive once again. Threatened and endangered both receive the same amount of protection. The terms are simply a measure of how imperiled the species are for prioritizing recovery work.



Habitat

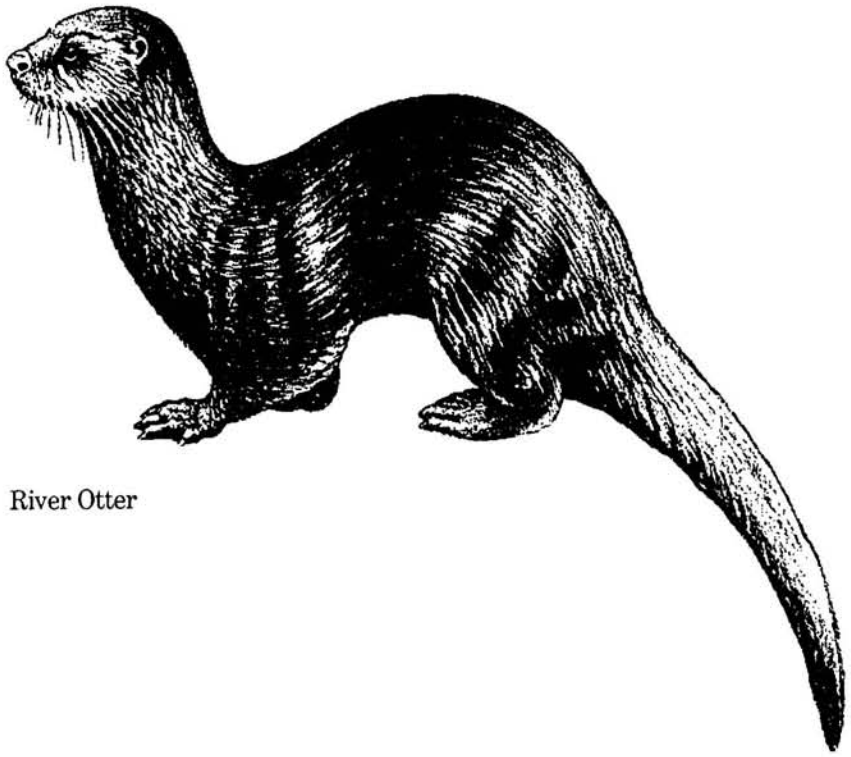
Habitat is defined as *the place where a plant or animal lives or the place one would go to find it.* The health of a species depends largely on the health of its habitat. A healthy habitat consists of food, water, shelter (or cover), and space in an arrangement that meets the species' needs. An example of a habitat suitable for humans is a house, complete with sinks, beds, and a refrigerator stocked with food. Everything a human basically needs is in this house. Within the natural world many of us are familiar with the habitat of the Northern river otter, *Lutra canadensis.* This Tennessee resident lives in rivers and bottomland hardwood forests. Its habitat is suitable and healthy when the rivers are clean and can provide fish to eat and appropriate places for constructing den homes along the riverbanks. Just as human health is linked to a healthy, clean home, a healthy otter population is dependent on clean, healthy rivers.

Ecosystems

Tennessee has an amazing variety of different ecosystems, from mountaintop high-elevation forests to mysterious underground caves. An **ecosystem** *consists of all the living parts (plants and animals) and nonliving parts (such as soil, air, and water) in any size area, interacting and linked together by energy and nutrient flow.* The unique combinations of these interactions make each ecosystem distinctive. For example, cave ecosystems include the cave and its geological make-up, the water, lack of sunlight, and organic matter entering the cave, as well as all the plants and animals that inhabit the cave. A change in any one part of the cave ecosystem will affect all the other parts.

Ecosystems vary greatly in size – from a small 1/2 acre mountain bog to the large watershed the bog is part of. Ecosystems exist wherever plants, animals, and people have an interdependent relationship within the context of their physical environment. It is important to remember that small ecosystems are located within larger ecosystems. This means that what happens within one system affects what happens in every other system, with varying degrees of impact.

Today, natural resources managers practice **ecosystem management** for *long term, sustainable natural resource conservation.* This means looking at the big picture, beyond boundaries, and working closely with all land managers, both public and private. It means thinking of various resources as inter-relating parts of systems rather than as individual components to be managed separately. We all live in ecosystems and are part of the interdependent web of life. Everyone has a stake in working for diverse, healthy, sustainable ecosystems.



River Otter

Why Should We Work to Protect Wildlife?

"These species are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."
— Endangered Species Act

Wild creatures and places have inspired human creativity for centuries. From paintings to poems and books to songs, we have always been deeply affected by the beauty of nature. Yet few of us realize how useful and necessary the living network around us really is. While a poet may compare the beauty of a flower to a loved one, a scientist may isolate a life-saving chemical from that very same plant. Read on and learn about some of the many ways wild creatures and plants are part of our lives.

Medicinal Values

Many of us are familiar with the periwinkle, *Vinca minor*. This pretty ground cover decorates many landscaped lawns. Components of this plant's close relative, *Vinca rosea*, are used in chemotherapy medicines for leukemia and other types of cancer. Few people realize that the endangered Tennessee coneflower, *Echinacea tennesseensis*, is one of a variety of plants known simply as "Echinacea," well known for their ability to bolster the immune system. Coneflowers of the genus Echinacea have provided over 200 pharmaceutical products. More than 300 of Tennessee's 1,500 plants are used for medicinal purposes, and about 100 have commercial value. The fact is, over 40 percent of the prescription drugs available in the United States contain at least one ingredient found in nature. We have tapped only 5 percent of the earth's plant species for their possible value as medicines. Remember, aspirin originated from the willow tree; penicillin, from a mold. From antibiotics to toothpaste, the ingredients that help keep us healthy often were not developed in a laboratory; they came from the natural world!

Industry

Humans do not rely on natural ingredients for health purposes alone. Carageenan, a thickening agent found in ice cream and candy bars, is commonly derived from a type of seaweed called Irish moss, *Chorpus crispus*. Consider all the "natural" shampoos and beauty items available today. Many products contain jojoba seed oil, derived from the jojoba plant, *Simmondsia chinensis*, a relatively obscure desert plant found in the Southwest. The unique properties of this oil closely resemble those of the natural oils secreted by human skin. Such qualities have made jojoba oil useful not only in skin care products but also in synthetic motor and transmission oils. Jojoba seed oil has helped take the pressure off the over-harvested sperm whale, *Physeter macrocephalus*, as similar lubricants were historically obtained from this now-endangered species.

Agriculture

Wild species play a crucial role in the world of agriculture. Many farmers now use integrated pest management, which views the farm and garden as an ecosystem. This method uses natural predators as a "biological control" to reduce crop damage caused by insects, without the use of pesticides. Some gardeners, for example, introduce lady bugs to gardens infested with aphids, as lady bugs are known predators of these tiny pests.

Wild creatures often play a quiet, yet substantial, role in pest management. Tennessee farmers are unknowingly aided by many species of bats, one of which is the endangered gray bat, *Myotis griscesens*. One bat can eat up to 3,000 insects a night! Biologists estimate that insect-eating birds saved farmers and timber owners $44 million in losses in the year 1921. Imagine the economic impact these birds have on modern-day agriculture! In Minnesota alone, the Department of Natural Resources estimates that forest birds could be providing more than $100 million per year in economic benefits to Minnesota forests and timber production.

Wild resources also play an important role in the development of our common food crops. Humans have bred high-yielding crops for thousands of years, limiting the genetic diversity in our food crops. The genetic make-up of our main food items is therefore essentially identical. Such lack of diversity can result in disaster, as just one pest or disease that becomes unmanageable can wipe out an entire crop. Some wild species are inherently more resistant to diseases and pests. Scientists are seeking out wild strains of many common food sources, such as the endangered Texas wild-rice, *Zizania texana*, to use in the development of disease- and pest-resistant crops.

Many of the food crops we rely on today are not suited to diverse conditions and climates. To ensure the success of a crop in a particular region, geneticists can use plants native to the region to create suitable hybrids. For example, disease-resistant and highly productive hybrids that now dominate the sunflower industry were produced through breeding with wild species of sunflower, *Helianthus spp.*, several of which are in danger of extinction, such as Tennessee's own Eggert's sunflower, *Helianthus eggertii*. Seabeach amaranth, *Amaranthus pumilus*, is an endangered plant found along the coast of North Carolina and New York. This plant is known to contain high levels of lysine, an amino acid essential to the human diet. Because of its tolerance to arid, salty conditions, this plant may provide a valuable new food source for many parts of the world.

Economic Value

We cannot have a healthy economy without a healthy environment. Industry, health, and agriculture are not the only facets of our economy to benefit from wild resources. Wildlife-related recreation activities make a significant contribution as well. According to the Service's 1996 nationwide survey, nearly 40 percent of adults in the United States spent $101 billion on wildlife-related pursuits. More than 29 percent of this amount was spent on activities such as bird watching and wildlife photography. The commercial value of medicines that originate from wild organisms amounts to some $10 billion a year. The industry surrounding one plant alone—American ginseng, *Panax quinquefolius*—contributes $4 million annually to Tennessee's economy. The harvesting of common species of freshwater mussels for the pearl trade has become a multi-million-dollar industry in Tennessee. Can we really afford to lose our wild resources?

Imagine the Possibilities

Biodiversity is *the variety of life in an area, including the different genes, species, plant and animal communities, ecosystems, and their interactions.* The diverse life on our planet provides the basis for future life on earth. When we lose species, the benefits they could have provided are lost forever. Imagine the possibilities contained within the earth's diverse resources. We have investigated less than 5 percent of our plant species for their possible medicinal value. Because of the destruction of habitat, hidden values may be lost before scientists can even discover them. Life on the earth is interrelated and interdependent. We cannot predict how the loss of even one species will affect an ecosystem and the organisms that rely on that ecosystem, including humans. We are connected to what happens to our environment and its wild inhabitants. We drink the same water; we breathe the same air. By preserving biodiversity, saving endangered species, and improving the quality of our environment, we are saving ourselves.

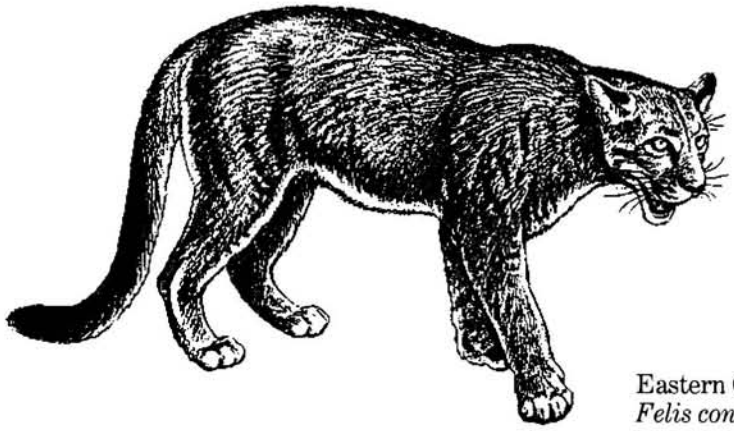
What about Tennessee? Is the loss of diversity a local issue? Yes. Years ago, Tennessee was home to a variety of plants and animals that are now extirpated from the area. The Florida panther, *Felis concolor coryi*, once roamed the hills and valleys of the state. The palezone shiner, *Notropis albizonatus*, a unique fish, once swam and hid in the rivers of Tennessee. Both species have been lost from our Tennessee ecosystems, perhaps never to return. Any species now endangered or threatened in the state could become extirpated, or even extinct. It is important to ensure that healthy habitats are available for all species throughout their ranges. When a local population is lost, the entire species is one step closer to extinction.

Causes of Declining Populations and Extinction

Profile of an Endangered Species

Most threatened and endangered species typically possess several of the following characteristics:

- **Specialized Habitat**
- **Naturally Rare**
- **Long-distance Migration**
- **Low Number of Offspring**
- **Long Gestation Period**
- **Increased Sensitivity to Environmental Changes**
- **Competition with Humans for Habitat**



Eastern Cougar
Felis concolor couguar

Many species of wildlife are **generalists**; *capable of changing their habits and diets as necessary, their needs are not very specific.* The ring-billed gull, *Larus delawarensis*, although typically a sea and river forager, has adapted to "fishing" garbage out of landfills and picking up scraps from parking lots. Most endangered and threatened species, however, are **specialists**; *they often have very particular needs and may require a specialized habitat.* Some species may be naturally rare. For example, Ruth's golden aster, *Pityopsis ruthii*, an endangered plant, lives only near the Hiwassee and Ocoee Rivers in Polk County, Tennessee. Living on boulders in and along the riverbanks, it requires full sunlight and regular flooding. This plant occurs nowhere else in the world, and changes in these rivers (caused, in part, by road and dam construction) have threatened it with extinction.

Animals that migrate long distances, like peregrine falcons, can be more susceptible to negative changes in the environment. They are exposed to a variety of threats during their journey, they need high energy fuel to sustain their migration, and they rely on multiple habitats, not just one.

Many endangered species have long gestation periods and have few offspring, like bats. Such characteristics make it difficult for the species to recover from environmental changes. Because the population is smaller and slow to reproduce, they become even more vulnerable to other environmental changes and are more effected by predation and other natural disasters. Plants and animals located in areas popular for development and recreation are at greater risk due to human activities. Species viewed as a threat to humans, such as the endangered red wolf, are also at high risk.

In summary, one or any number of these characteristics in combination can increase sensitivity to environmental changes. For instance, muskrats which feed on freshwater mussels can severely impact small, isolated populations of endangered and threatened mussel species, while having little effect on healthy, large populations. In the past, thousands of mussels paved our rivers. Today, because of habitat loss and water pollution, rare mussel populations are restricted in number and size. Thus, one dining muskrat could potentially wipe out an entire population of rare mussels.

Extinction is not a new phenomenon. For thousands of years new species have been evolving, slowly taking the place of those that have become extinct. **Speciation**, *the natural*

process by which new species are formed, is always occurring. Those species unable to adapt or evolve will become extinct. Natural occurrences, such as climate changes and volcanic eruptions, are known to have caused extinctions. However, the rate at which species are currently becoming extinct, or the number of species lost per year, is the highest it has been in over 65 million years. During the Ice Age, only about three species were lost every 100 years. Since the Pilgrims arrived almost 400 years ago, more than 500 species from North America alone have become extinct. That is more than one species per year!

Human Disturbance

Unfortunately, many of the causes of declining wildlife populations can be directly linked to human activities. The various components of our natural communities interact in many ways to maintain a healthy ecosystem. All around us the signs of habitat degradation and environmental pollution tell the same story—our wildlife species are running out of healthy, safe habitats. Even in Tennessee, fragile ecosystems are disappearing at an alarming rate; wetlands, caves, grasslands, and forests are being replaced with buildings, parking lots, and roads. Habitat destruction is currently the greatest threat to wildlife. Another form of human disturbance is poaching. **Poaching** is *the illegal hunting or taking of fish and wildlife.* Although legal hunting can be an effective management tool, poaching and the collection and trade of rare wildlife for profit further jeopardize species all over the world.

Nonnative Species

One of the fastest-growing threats to endangered and threatened species is the spread of nonnative species. A **nonnative** species is *one that evolved in and is native to another region or country.* Without natural enemies to keep these populations in check, nonnative species can become invasive, monopolizing the resources of native species and further threatening already fragile ecosystems. Kudzu, *Pueraria thenbergiana*, a vine native to China, can grow up to a foot a day, overtaking and killing native plants. Scientists now estimate that Kudzu covers 7 million acres in the southeast. European starlings, *Sturnus vulgaris*, use valuable nesting cavities needed by native bird species, such as the Eastern bluebird, *Sialia sialis*, and many woodpecker species.

Nonnative zebra mussels, *Dreissena polymorpha*, were first discovered in Lake St. Clair, near Detroit, Michigan, in 1988. Believed to have arrived in the ballast waters of Eurasian tankers bound for the Great Lakes, these small black-and-white-striped mussels are the only freshwater mollusks, or mussels, that can firmly attach themselves to solid objects. Since their arrival in the United States, they have attached themselves to rocks, dock pilings, boat hulls, water intake pipes, and, sadly, native freshwater mussels, as far south as Louisiana. They now inhabit 20 states in this country and two Canadian provinces, having been carried from place to place on the hulls of fishing boats. The exotic mussels cover the shells of freshwater mussels, including several endangered species. They interfere with their ability to open their shells to feed and breath, effectively suffocating them. Zebra mussels reduce the amount of food available for native species, and they also cause millions of dollars in damage as they attach to and clog water intake structures.

What's Being Done?

There are a variety of different state, federal, and international laws in place today that serve to protect and restore wildlife in our world. One of the best ways to help endangered and threatened species is to have an accurate understanding of these laws. By knowing these laws, we can help the people who work to enforce and implement them. We can spread the word by educating those around us so that they, too, can understand.

Federal Protection

The **Endangered Species Act (Act)** was signed into law by Congress and President Nixon in 1973. The purpose of the Act is to provide a means *"whereby the ecosystems upon which endangered and threatened species depend may be conserved, and to provide a program for the conservation of such endangered species and threatened species."* Ultimately, the goal of the Act is to achieve the recovery of endangered and threatened species to the point where they are no longer in danger of extinction. The Act offers protection to those species that are on the Service's list of *Endangered and Threatened Wildlife and Plants.*

The Act sets forth specific procedures, known as the **listing process**, which describe *guidelines for designating a species as endangered or threatened.* The process involves an extensive review of the species' historical and current distribution, and threats to its continued existence are determined. This process takes up to a year or more and encourages the participation of the general public, the scientific community, other government agencies, and foreign governments. Only after this process is complete can a species be placed on the Service's list of *Endangered and Threatened Wildlife and Plants.* Plants and animals from the United States and other countries are eligible for listing.

The Act protects endangered and threatened species and their habitats through several measures. Under the authority of the Act, all federal agencies are prohibited from funding or carrying out any program or action that would jeopardize a listed species or its habitat. The Act also enables the Service to develop and carry out recovery plans. **Recovery plans** are *documents prepared for listed species that detail the specific tasks needed to recover those species.* Citizens are not held responsible for the actions outlined in a recovery plan. Federal, state, and nongovernmental conservation agencies have access to recovery plans to help them manage for the protection of endangered and threatened species. A recovery plan may involve the creation or restoration of suitable habitat for a listed species. The plan could callfor the captive breeding and reintroduction of a listed species back into the wild as well as other actions deemed necessary for the species' recovery.

The Act regulates a variety of activities that affect endangered and threatened species. Importing and exporting listed species from the United States is unlawful without a permit. It is unlawful to "take" a listed species. To **take** is *to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct toward, any threatened or endangered species.* It is also unlawful to sell or transport an endangered or threatened species without a permit.

Under the Act, the Service is responsible for birds, land mammals, amphibians, reptiles (including sea turtles on land), freshwater fishes, invertebrates, and plants. The National Marine Fisheries Service is responsible for marine mammals, sea turtles in the water, and certain anadromous fishes (fish species that utilize both freshwater and saltwater systems).

Worldwide Protection

Several pieces of legislation operate on an international level to conserve endangered and threatened species. These laws focus primarily on the illegal trade of endangered and threatened species. Illegal hunting, or poaching, occurs worldwide, and many endangered and threatened

species are killed and sold. Sea turtles are killed, and their shells are used to make jewelry. Crocodiles and other reptiles are killed and used in the production of watchbands, shoes, purses, etc. The bog turtle, is threatened by collection for the pet trade. Endangered and threatened species and the products made from them are also imported and exported unlawfully throughout the world.

The Act prohibits the import and export of federally listed species from the United States. In addition, more than 115 nations are now *regulating international trade to prevent the decline of species threatened with extinction* under the **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).** The **Migratory Bird Treaty Act** *protects birds that migrate across international borders.* Furthermore, the **Lacey Act** *outlaws the import, export, and sale, both interstate and international, of wildlife and wild plants taken in violation of international as well as state law.* Marine mammals, such as seals, whales, porpoises, walruses, and sea otters, are also protected by the **Marine Mammal Protection Act,** which *prohibits the import and export of marine mammals and products made from them without authorization.*

An important fact to remember is that legislation is not set in stone. Every few years various laws and acts are brought before Congress for review. The Act has been reviewed and modified several times. Wildlife laws will always need public support in order to conserve and protect our endangered and threatened wildlife.

State Protection

State wildlife agencies work cooperatively with the Service to protect and conserve wildlife. Tennessee has its own endangered and threatened species legislation in addition to the Act. The Tennessee Wildlife Resources Agency maintains lists of species that are endangered and threatened on both a state and federal level. The Tennessee Department of Environment and Conservation's Division of Natural Heritage works to protect Tennessee's "natural biological diversity through identification, conservation, and communication for the enhancement of the quality of life and economy in Tennessee." State organizations such as these and many local environmental education centers offer outreach programs that afford us opportunities to help our endangered and threatened wildlife, starting in our own communities.

You Can Make a Difference

The reality of the decline of wildlife and plant species can seem quite overwhelming. With so many species in trouble all over the world, how can anyone make a difference? There are many ways in which people of all ages can help protect our wildlife, plants and wild places, and every little bit helps. Here's what you can do:

- **Explore Tennessee's diverse ecosystems!** Using the *Tennessee Wildlife Viewing Guide*, take field trips to see the species and wild places that are near you, some of which are described in the ecosystem fact sheets.

- **Avoid actions that could harm wildlife.** Never litter or disturb plants, wildlife or their habitats. Always stay on trails and boardwalks in order to avoid trampling plants. Always watch wildlife from a respectful distance. Move slowly, quietly, and carefully when you are in a wild place.

- **Learn more about agencies working to protect endangered and threatened species.** Check out the World Wide Web sites found at the end of this guide for the U.S. Fish and Wildlife Service, the Tennessee Wildlife Resources Agency, the Tennessee Department of Environment and Conservation (and their Division of Natural Heritage), and the U.S. Forest Service, as well as other helpful sites.

- **Conduct research with regard to environmental and wildlife laws.** Use the list of World Wide Web sites to find links to legislative indexes and home pages. The more you know about the laws that protect plants and wildlife, the better able you will be to follow them and help friends and family do the same.

- **Reduce, reuse, and recycle.** If we become more responsible with our resources, there will be more undisturbed, healthy habitat available for plants and wildlife. Participate in cleaning up local rivers, forests, or cities. Help keep the habitats that support us and our plants and wildlife clean and healthy.

- **Think globally; act locally.** Keep worldwide biodiversity in mind as you work to support your local ecosystems and wildlife.

- **Enjoy the natural world!** As you go about from day to day, remember the wonderful and unique wildlife and wild places around you. Enjoy, and share enjoyment with others!