

# **ENDANGERED SPECIES**

## **U.S. Army Corps of Engineers, J. Strom Thurmond Project**

### **2015 Middle School Eco-Meet Study Packet**

The Corps of Engineers' (USACE) station will focus on ecosystems and endangered species, particularly ecosystems and endangered species in the Central Savannah River Area. Students will be expected to understand what ecosystems are, how humans impact ecosystems, what invasive species are, what biodiversity means, what it means to be Endangered or Threatened, and how species become endangered and extinct.

Pay attention to all **bold** words. You should know the definitions and/or be able to answer questions about those words. Although you do not need to know details about each species, you will need to be able to identify unique characteristics discussed in bold print, as well as identify reasons why various groups of plants and animals are threatened or endangered.

## **Let's look at ecosystems around your home!**

You may be asking yourself “what exactly is an ecosystem?” Basically, an **ecosystem** is a web of living and nonliving parts that are connected and maintained by energy from the sun and nutrient flow. Ecosystems include not only biotic components, or those that are alive, such as plants, animals and people that live in an area, but also the abiotic, or non-living components that animals and plants depend on, such as soil, air, water, rocks, nutrients and sunlight. Ecosystems can range from very small to as large as the Earth. They can even be as small as a pond in your backyard, or a decaying log.

Think about a decaying log for a moment, and consider the components of an ecosystem that are present in that log. Many live organisms, or biota, will live in that log, including insects, worms, mosses, plants and lichens, spiders, maybe even some frogs, snakes or turtles. But they could not exist without the nutrients in that decaying log, the rain that occasionally falls, and the sunlight that allows the mosses and plants to grow.

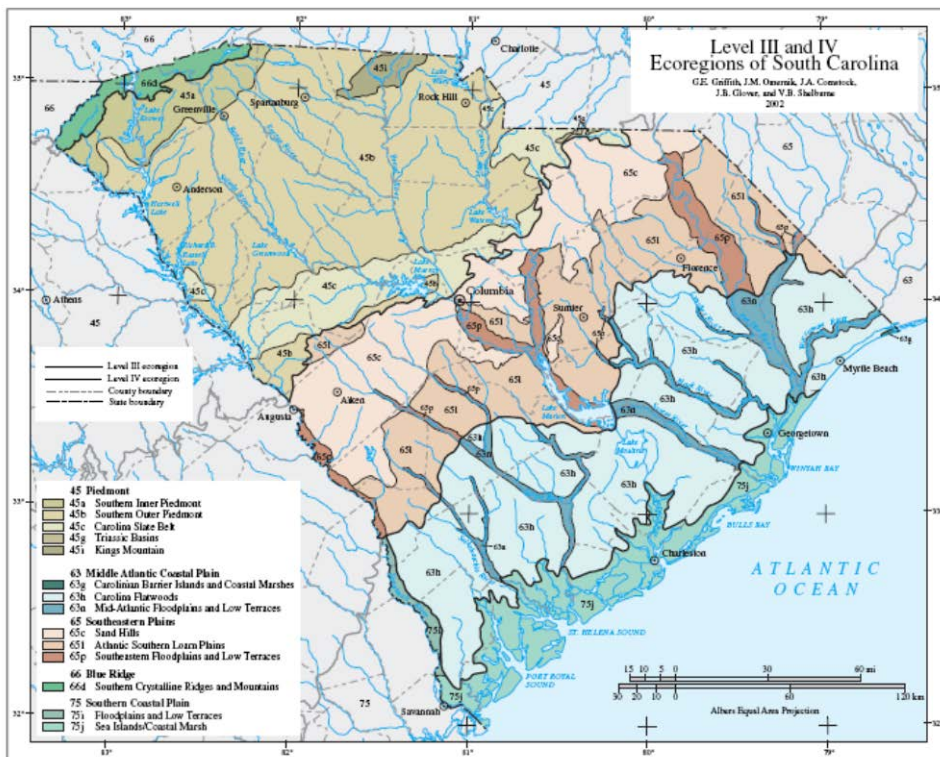
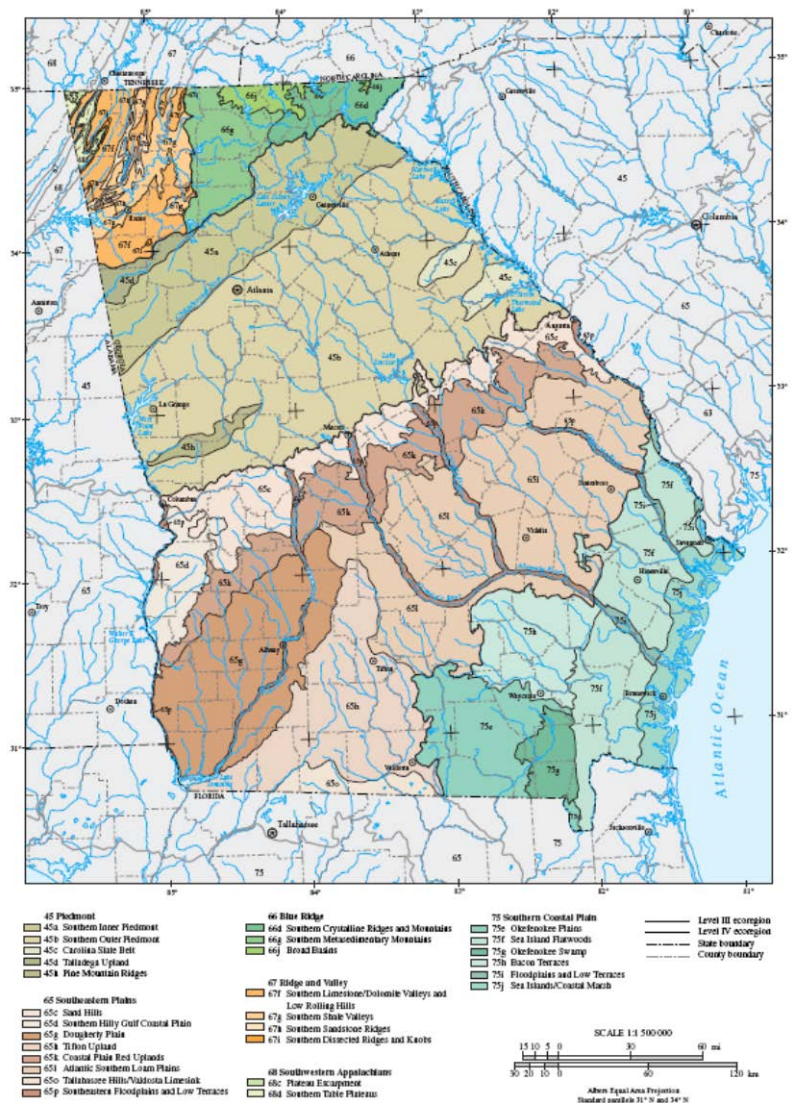
Although ecosystems can be small like the rotting log, they are often large-scale landscapes and include a patchwork of **habitats**, or places where organisms live that provide the basic needs for life – food, water, shelter and space. Ecosystems are often defined by the dominant plant communities present, and the animal communities dependant upon those plants.

**Communities** are the living organisms (e.g., plant and animal populations) that interact and live together within a certain area or habitat. **Populations** are simply groups of organisms of the same species living and interacting in the same area. For example, the wolf population living in Yellowstone National Park depends upon the elk population in Yellowstone for much of its food. All of the plants and animals in Yellowstone make up the Yellowstone community. Add the geology, hydrology and climate of the area, and you now have the Yellowstone ecosystem. Ecosystems are influenced by the climate, soil types, and flow of energy and nutrients through the system. The plant and animal communities found in dry climates with sandy soils, such as deserts, will be very different from those found in wet swamps with thick, clay soils. Ecosystems are often characterized by their physiographic region.

## Ecosystems in Georgia and South Carolina

Scientists have divided the states of Georgia and South Carolina into various **physiographic regions**. A physiographic region is an area or region of the state defined by its unique *physical geography* or *physiography*. That physical geography is often defined by topography, soil types, and plant communities.

The physiographic regions of Georgia include the Southwestern Appalachians, Ridge and Valley, and Blue Ridge regions in the mountains, the Piedmont in the middle portion of the state, and the Southeastern Plains in the lower half of the state, including the Coastal Plains and Sandhills of the CSRA.



Physiographic regions of South Carolina are similar to Georgia, including the Blue Ridge, Piedmont, Mid-Atlantic Coastal Plains and the Southeastern and Southern Coastal Plains.

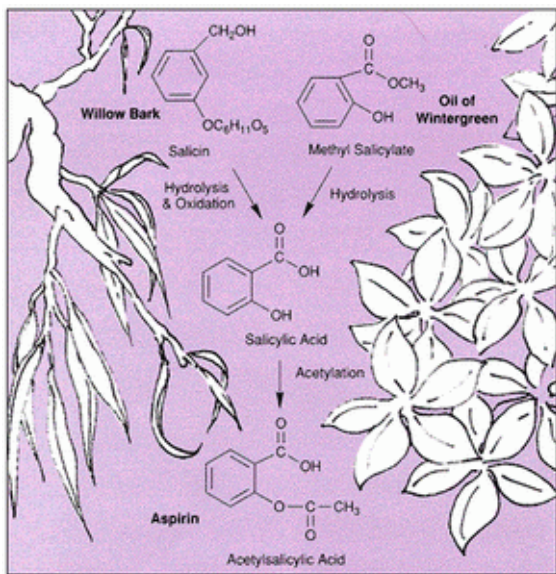
You can clearly see the role that topography plays in determining the physiographic regions of Georgia and South Carolina. The Central Savannah River Area includes both the Piedmont and the

Coastal Plains, divided by the Sandhills region, also called the Fall Line Sandhills. The ecosystems and associated plant and animal communities in these regions differ greatly due to the soil types. Coastal plain soils tend to be very sandy and do not retain moisture well. The plant communities that have adapted to live in those areas can tolerate **xeric**, or dry, conditions. Piedmont soils tend to be characterized by clay soils that are **mesic**, or retain more moisture. These soils are capable of supporting plants that need more water to thrive. The Sandhills region is a narrow area located along the transition between the Coastal Plain and Piedmont, and can exhibit features of both regions.

## BIODIVERSITY

**Biodiversity**, or biological diversity, is a name for the variety of life. The term biodiversity refers to the number of different organisms – plants, animals, microbes, & all life that exists in a geographical area. That area can be small, such as a pond, or very large, such as the Appalachian Mountains. Simply stated, biodiversity is the full array of life on Earth.

So, why is biodiversity important? First, think about all of the things in our daily lives for which we depend on nature. Food might be the first thing to come to mind. What about medicines? Although most of our medicines are chemically manufactured in laboratories, the origins of those chemicals are often found in nature, particularly in plants. Scientists estimate that the total number of species on Earth may be as high as 14 million. Many of those are plants. And many of those plants have yet to be discovered.



Have you ever taken aspirin for a headache? Aspirin was first developed from willow trees (Latin genus *Salix*). The active ingredient in aspirin that relieves pain is acetylsalicylic acid. In 1832, a German chemist extracted acetylsalicylic acid from salicin, an ingredient from willow tree bark. Even Hippocrates in ancient Greece prescribed willow bark to patients to relieve pain. The diagram to the left shows the chemistry behind extracting and making aspirin from willow bark, as well as from the wintergreen plant.

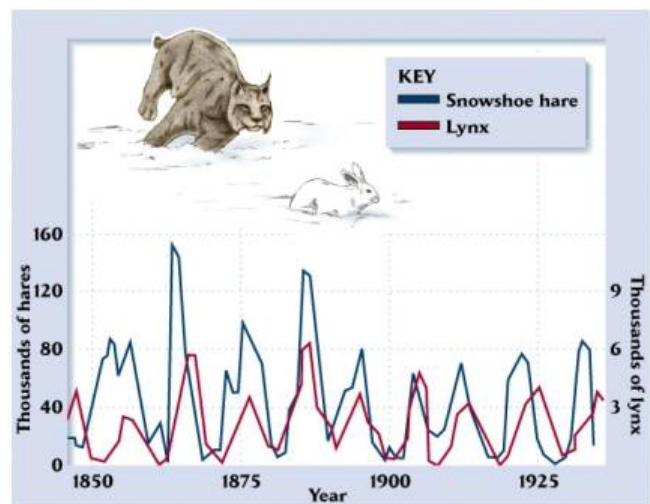
More recently, scientists have discovered that an ingredient in the yew tree, found in many parts of the world, contains a chemical that is effective for treating cancer. Horseshoe Crab blood is also being studied for its disease-fighting properties. These are just a few of the thousands of examples of medicines that come from nature.

Biodiversity is also important to healthy ecosystems. Think about the web of life, how organisms depend upon others for food. Take, for example, raptors and their prey. Birds of prey, otherwise known as **raptors**, have sharp, hooked bills that can grab and tear meat, and they form the top of their food web, principally eating larger animals which have in turn eaten smaller animals. Top predators like raptors need larger areas to live than smaller birds

like Blue Jays, because they need more area in order to find sufficient prey. Examples of raptors include eagles, hawks, and falcons. A population of hawks living in an area may depend upon the rodents and reptiles in that area as their primary source of food. Imagine an ecosystem where the hawks can feed on field mice, wood rats, moles, meadow voles, chipmunks, rat snakes, corn snakes and rattlesnakes. There is considerable biodiversity in the hawks' prey in that ecosystem. If a disease would infect the wood rats and eliminate the wood rat population, the hawks would still have other sources of food, and the food web, and associated flow of nutrients, in that ecosystem would not be greatly affected.

Consider, however, hawks living in an area with only wood rats and field mice on which to feed; an area with low biodiversity. If a disease outbreak wipes out the wood rat population, the hawks would only have the field mice to depend on for food. The hawks would quickly deplete the mouse population and would either starve or leave the ecosystem to look for better food sources in other areas.

This may seem extreme, but such relationships actually occur in nature. The classic example is the relationship between lynx and snowshoe hares. While the lynx population in North America may feed on other prey, the majority of their diet comes from hunting snowshoe hares, partly due to the extreme climate in which they both live. When snowshoe hare populations decline, from disease, lack of food, particularly harsh winters, or other reasons, lynx populations soon decline as well.



Now, imagine what would happen to the lynx if the snowshoe hare became extinct. Currently the lynx is a listed endangered species in most of the lower 48 states. And what about all of those species of plants that become extinct every year, especially those that we may have never even known existed? Each time we lose a species, its future benefits could be lost forever.

## EXTINCTION AND ENDANGERED SPECIES

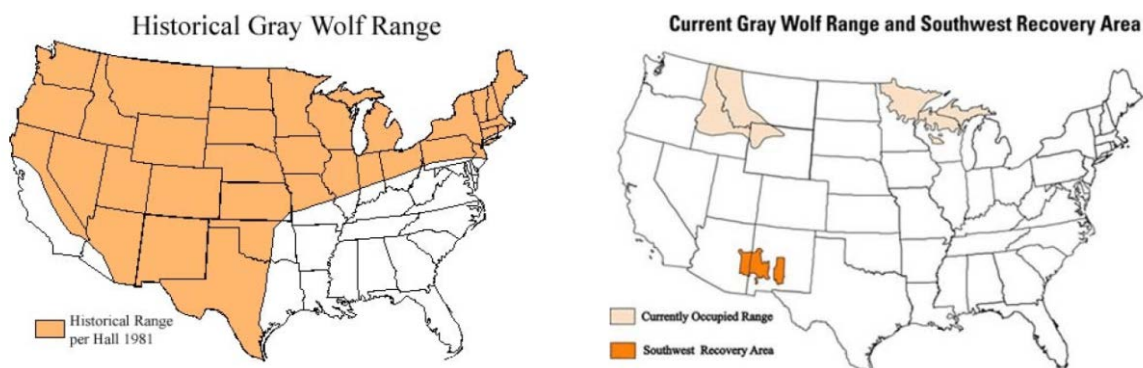
So, what does it mean to become **extinct** or **endangered**? **Extinction** means that a species no longer exists anywhere on Earth. As we saw above, species are linked and depend upon each other within their ecosystems. The loss of just one species can cause many others to disappear with it. Many species are on the brink of extinction. These are the species we refer to as **endangered**, or in immediate danger of becoming extinct.

Scientists estimate that the natural extinction rate is one species lost in every 100 years. Can you guess how many species have become extinct in North America since the Pilgrims landed in 1620? More than 500 species in North America have disappeared since 1620, just over 390 years. That is an average of 1.3 species becoming extinct every year, or 130 species every 100 years. While extinction is a natural process, human activities are hastening the rate of extinction.

Scientists, government officials and the American public have recognized the role that humans are playing in the loss of species and increased rates of extinction worldwide. To help prevent further extinctions, Congress passed the **Endangered Species Act** in 1973. This law identified those species that are considered endangered and made it illegal to take certain actions that harm or could lead to a species becoming extinct, including prohibiting hunting of endangered species and destruction of their habitat. This law also made it illegal to keep these species as pets, or to import, export or sell these species. In addition to defining and listing endangered species, the Endangered Species Act also defines and lists species that are **threatened**, or likely to become endangered if not protected. Many states soon followed with similar laws for their individual states.

## CAUSES FOR SPECIES BECOMING ENDANGERED OR EXTINCT

**Hunting/Collecting** – While hunting is a natural process in all ecosystems, important for maintaining balance between predators and prey and ensuring populations of animals remain healthy, excessive hunting can lead to severe losses within a species, and even extinction. The primary reason for the American Alligator to be placed on the first endangered species list was from overhunting, and as you may know, Alligators staged a remarkable comeback and were taken off the list in 1987. One of the most well-known examples of extinction resulting from hunting is the **Passenger Pigeon**. Once numbering in the hundreds of millions and possibly the most common birds in North America including Georgia and South Carolina, passenger pigeons were hunted for food and seen as a danger to farmers' crops, and were exterminated. The last Passenger Pigeon died at the Cincinnati Zoo in 1914. Other species hunted to extinction include the **Carolina Parakeet**, **Great Auk**, and the **Atlantic Gray Whale**. A well-known example of a species in North America that became endangered due to hunting is the Gray Wolf, which was hunted almost into extinction by ranchers and others who thought wolves



posed a threat to livestock. Thanks to the protections of the Endangered Species Act, wolf populations in some northern states have recovered and have resumed their role as an important predator in the natural ecosystems of such places as Yellowstone and Glacier National Parks.

In addition to hunting, species can become endangered due to collecting for the pet and garden trade. The Spotted Turtle, and Wild Ginseng, both found in the eastern U.S., are listed as threatened, due in part to the loss of habitat, and also due to illegal collection for the pet trade and herb trade. Other species declining from illegal trade include many snakes.



**Pollution/Contamination** – Many of the chemicals that we use daily contribute to pollution in both our air and waterways. Species that live in aquatic habitats can be severely impacted by water pollution. Extreme water pollution in China has led to the probable extinction documented in 2006 of the Yangtze River Dolphin. Water pollution, coupled with heavy siltation, has also led many species of freshwater mussels, which filter food from water, to become extinct or endangered, including the Carolina Heelsplitter and the Atlantic Pigtoe mussels in the Georgia/South Carolina area.

Pollution not only affects those species that come in direct contact with the chemical, but also affects others that live in the polluted habitat and feed on the victims of the pollution. As you will read below, one of the most harmful pollutants in U.S. history that nearly wiped out numerous species of birds was the pesticide DDT. This pesticide almost led to the extinction of the Bald Eagle and the Peregrine Falcon, as well as others.

**Habitat loss and changes** – Habitat loss and change is the most common reason species become endangered and extinct. The **Ivory-billed Woodpecker** (1930s) and **Bachman’s Warbler** (1988), found in Georgia and South Carolina until the years shown in parentheses, are now assumed to be extinct due to destruction of their swamp habitat. Deforestation and wetland loss result in millions of acres of habitat lost each year. The loss of over 80% of US wetlands due to draining and filling has impacted waterfowl populations that depend on wetland and habitats for food, shelter and resting spots seasonal migrations.



A well-known example of a species becoming endangered due to habitat loss in the southeastern U.S. is the **Red-cockaded Woodpecker**. These small birds depend upon old pine trees for both nesting sites and food. At one time, as many as 250,000 family groups of red-cockaded woodpeckers lived on over 90 million acres of Longleaf Pine in the southeast. Due to deforestation and fire suppression, there are an estimated 4,700 family groups on just under 1 million acres of habitat.



aquatic during

**Non-native species introduction** – You may ask, exactly what is a **non-native species**? Non-native species are those species that do not naturally occur in a habitat or even a specific region of the world, but have been introduced or brought into the area, either intentionally or accidentally, by humans. The non-native species you may think of first around here is kudzu, which was introduced intentionally from Asia in 1876 to help prevent soil erosion. It, however, has no natural predators in the southeastern U.S., and became **invasive**, shading out vegetation in large areas and being called “the plant that ate the South.” Some non-native species are invasive escapes introduced as ornamental plants in gardens (Japanese honeysuckle) or in the aquarium and pond trade (water hyacinth, hydrilla, water milfoil). Even invasive birds have been introduced by people. The European starling was brought to New York City from Europe in the early 1890s. It was introduced into Central Park and adapted to local environments. They have spread throughout the eastern U.S. and out-compete native birds, such as bluebirds and sparrows, for food and nests. The House Sparrow was also introduced from Europe. But the most damaging species are those we often don’t think of as non-native, which are our pets. Cats, originally from North Africa, kill more native birds every year in the US than hunters, wind turbines, and pollution combined. **Feral** (non-native animals that have escaped and become naturalized in an area) dogs, pigs, and horses destroy habitat and kill native species directly or through competition for habitat.



Other species, however, have been introduced accidentally, often through international shipments. One of the most notable of these is the gypsy moth, which is an Asian and European moth that was accidentally introduced in Boston in the 1860s, and has killed many oak trees throughout the eastern U.S. The Black Rat, Norway Rat, and House Mouse were all brought unintentionally on explorer and settler ships from Europe around the world, where they have been particularly destructive to ground-nesting island animals. No matter how they are introduced, non-native species often have devastating impacts on native species. They have no natural predators or diseases to keep their populations in control. They quickly outnumber native species, out-competing them for food and resources, often smothering native species and pushing them to the brink of extinction.

Although there are many causes of extinction, rarely does one cause alone push a species to extinction. It is often a combination of multiple factors. Did you know that recent estimates by the International Union for the Conservation of Nature list half of the world’s mammals as in decline, and 25% of the world’s mammals as endangered? Some of the most important causes for this include loss of habitat, over-hunting and collection for the exotic pet trade.

## RARE, THREATENED AND ENDANGERED SPECIES OF THE CENTRAL SAVANNAH RIVER AREA OF GEORGIA AND SOUTH CAROLINA

Did you know that some of these species we've read about occur right here in the Central Savannah River Area (CSRA)?

The CSRA has been defined as the 13-county area centering on Augusta, Georgia. It is very likely that you live in one of these counties. This area includes the Piedmont, Coastal Plains and Fall Line Sandhills regions. Many state and federal government agencies monitor and enforce laws to protect endangered species. In the CSRA, that includes the U.S. Fish and Wildlife Service, Georgia Department of Natural Resources, and South Carolina Department of Natural Resources. These agencies also determine which species are designated as rare, threatened or endangered. These agencies have designated 46 species that occur within the CSRA as rare, threatened or endangered. Additionally, dozens of other species are monitored because their populations are declining. Below are some of the rare, threatened and endangered species in the CSRA, with information about why their populations are declining.

### ANIMALS



Photo courtesy U.S. Fish and Wildlife Service

**Rafinesque's Big-eared Bat (*Corynorhinus rafinesquii*)** – The Rafinesque's Big-eared Bat is a small bat that is found throughout the southeastern U.S. This species' original range coincided with the original range of old-growth cypress swamps, where they relied on the swamps for roosting sites and foraging areas for food. As the swamps and wetlands have been drained and filled, these bats have adapted to using buildings for roost sites. Due to the loss of its natural habitat, the disturbance that occurs at man-made roost sites, and disturbance to nursery and hibernation colonies from recreational use of caves, this species has declined drastically and is protected in both Georgia and South Carolina.



**Southern Bald Eagle (*Haliaeetus leucocephalus*)** - The Bald Eagle has suffered from the impact of chemical pesticides, habitat degradation, and illegal hunting. A large raptor once found throughout the U.S., this bird was abundant along waterways, lakes and coastlines. It was declared an endangered species in 1967, prior to passage of the Endangered Species Act, but was extinct as a nesting bird in Georgia by 1970. Due to efforts to protect and recover this species, bald eagle populations have rebounded and it was removed from the US Endangered Species List in 2007, but in our area is now declining from Avian Vacuolar Myelinopathy (AVM), a fatal disease apparently caused when eagles eat native Coots which have been infected by eating non-native **hydrilla** vegetation. Since 1998, 62 dead bald eagles have been found from on or near Strom Thurmond Lake. The Eagle is still protected by the Bald and Golden Eagle Protection Act



and the Migratory Bird Protection Act, and is considered Threatened in Georgia and South Carolina.



**Wood Stork (*Mycteria americana*)** – This is the only member of the stork family known to nest in the U.S. This Southeastern bird stands up to 45” tall with a wingspan up to 71”, has a sensitive bill it can use to feel its food, and nests in rookeries in low-lying wetlands with trees, both inland and along the coast. Wood Stork populations have declined throughout their range, mostly due to the loss of wetland feeding and nesting habitat. This species also breeds in Central and South America, where much of its habitat has been lost as well. As a result of habitat loss, this species is protected by both federal and state governments. Due to recovery of the population, in 2014 the US Government lowered the protected status of the Wood

Stork from Endangered to Threatened.

**Red-cockaded Woodpecker (*Picoides borealis*)** – As discussed previously, this small



woodpecker once ranged throughout the Southeastern U.S., inhabiting 90 million acres of longleaf pine habitat. With just 1 million acres of longleaf pine habitat now existing in the southeast, this species has declined significantly. Another factor in the decline of this species has been the management of its remaining habitat. The Red-cockaded Woodpecker thrives in habitats that burn frequently, inhibiting the growth of a thick, hardwood forest. Due to efforts in the past to suppress and extinguish forest fires, forests in the southeast developed thick vegetation, creating unsuitable habitat for these birds. As a result of these two factors, this species was placed on the federal endangered species list. However, due to the efforts of many agencies and land managers to preserve habitat and reintroduce fire into their habitats through prescribed burning, this species numbers have been steadily increasing throughout the southeast.



Photo courtesy Richard Gant

**Gopher Tortoise (*Gopherus polyphemus*)**– The State Reptile of Georgia is found primarily in Longleaf Pine communities in Florida, Georgia, South Carolina, Alabama, Mississippi and Louisiana. It lives in deep burrows dug into the sandy soils found in the Coastal Plain and Sandhills regions. Gopher Tortoises are a federal Candidate Endangered Species protected as Rare in Georgia and Threatened in South Carolina, due primarily to habitat loss. This species is known as a **keystone species**. Many other species depend upon and live in the burrows that the

tortoises create. If this species is removed from the ecosystem, many other species will be negatively impacted.

A **keystone species** is a species whose very presence contributes to a diversity of life and whose extinction would consequently lead to the extinction of other forms of life.



Photo courtesy Savannah River Ecology Laboratory Univ. of Georgia

**Gopher Frog (*Rana capito*)** – These nocturnal frogs are found in the Coastal Plain, where they spend their days in burrows, frequently the burrows of gopher tortoise. Their primary habitat is dry, sandy uplands, except when they seek out isolated ponds and wetlands, as well as wet pine flatwoods, to breed. Due to the same habitat loss that has affected the gopher tortoise and flatwoods salamander, this frog species is protected as “rare” in Georgia and Endangered in South Carolina.

***cingulatum*)** – This species of inhabitated wet common in 90 habitat throughout million acres of species has declined U.S., 34 of which has been the resulted in this the US as Threatened, and both state governments as Endangered.



Photo courtesy John B. Jensen, Georgia Dept. of Natural Resources

**Frosted Flatwoods Salamander (*Ambystoma***

small salamander once pine, or flatwoods habitat million acres of longleaf pine the southeast. With less than 1 longleaf pine habitat left, this to only 47 populations left in the are in Florida. Habitat loss primary factor that has species being protected by



Photo courtesy U.S. Environmental Protection Agency

**Spotted Turtle (*Clemmys guttata*)**– While Spotted Turtles can use a variety of habitats across their range in the eastern U.S., they are found primarily in shallow, vegetated wetlands. Due to the loss of wetlands throughout their range, as well as considerable illegal collection for the pet trade, this species is protected as Threatened in South Carolina and protected as an Unusual species in Georgia.



Photo courtesy N.C. Sandhills Conservation Partnership

**Southern Hognose Snake (*Heterodon simus*)**– This small, docile snake is commonly found in dry, sandy upland forests on the Coastal Plains throughout the southeast. Like many snakes, the southern hognose snake is often mistaken for venomous snakes and killed.

Can you tell this snake from a **venomous** Rattlesnake, Copperhead or Water Moccasin? The key is in the head shape. The venomous viper family has a diamond-shaped head with vertical pupils in its eyes, while other US snakes have rounded heads and round pupils. The Hognose Snake is currently protected as a Threatened species in Georgia.



**Webster's Salamander (*Plethodon websteri*)** – This small woodland salamander is typically found in moist hardwood forests on steep slopes in the Piedmont. The loss of habitat due to forestry practices, conversion of habitat to agriculture and development have resulted in a decline in salamander populations. As a result, this species is protected as Endangered in South Carolina.

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Current efforts to raise the fish in hatcheries are helping its recovery.



Image courtesy Univ. of Georgia

**Robust Redhorse (*Ptychostomus robustus*)** – Once thought to have the southeast, this species of sucker the Savannah River in 1980 and soon populations were found in other rivers combination of habitat loss due to dams, degrading water quality from pollution, and predation by non-native contributed to this species decline.



Photo courtesy Virginia Living Museum

**Shortnose Sturgeon (*Acipenser brevirostrum*)** – The Shortnose Sturgeon is the smallest of the sturgeon species found in the eastern U.S. The sturgeon family is one of the most primitive of all bony fish species. This anadromous fish inhabits slow-moving rivers and estuaries, except when it ventures into fast-moving freshwater pools to spawn. Although not a game fish, this species is often caught incidentally in commercial fishing operations. Overfishing, combined with water pollution and habitat loss from altered rivers, has led to this fish being federally Endangered.

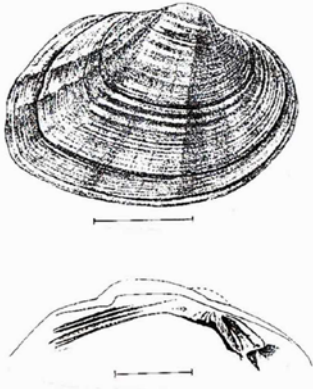
**Sandbar Shiner (*Notropis***  
This small species of fish is primarily in flowing, sandy-pools in creeks and small to rivers of the Coastal Plains. fish species, the combination quality from pollution and coupled with non-native predators and the loss of habitat through construction of impoundments have resulted in a population decline. This species is protected as a Rare species in Georgia.



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**Carolina Heelsplitter (*Lasmigona decorata*)** – This large freshwater mussel species was once found throughout rivers in North Carolina, South Carolina and Georgia. It is now found in fragmented, isolated populations scattered throughout its original range. Like other mussels, it feeds by filtering particles such as detritus, phytoplankton and zooplankton from water. Siltation and sedimentation resulting from poorly managed agricultural, forestry and development practices, coupled with water pollution, are the primary causes for the decline of this species. As a result, it is protected as Endangered by both the federal government and state of South Carolina.



**Atlantic Pigtoe Mussel (*Fusconaia masoni*)**– If you’ve never found a baby freshwater mussel, you may have been looking for the wrong thing. Larval freshwater mussels, call glochidia, are free-swimming parasites that must parasitize the gills of their particular host fish before they can be secreted and grow into adults. This large freshwater mussel is found in unpolluted, fast flowing streams and rivers in the Coastal Plains. It prefers rivers with coarse sand or gravel substrates. As a result, siltation and sedimentation, as well as water pollution in the water column are causes for the decline of this species, and it is thought to be extinct in Georgia. The Atlantic Pigtoe Mussel it is protected as Endangered by Georgia and

South Carolina.

**Savannah Liliput (*Toxolasma pullus*)** – Found below Savannah Bluff Lock & Dam on the Savannah River, preferring mud and sand near the banks of ponds, lakes, and slow-flowing streams. This species is rare for similar reasons as other freshwater mussels, namely water pollution and sedimentation. ATVs also pose a threat in parts of its Georgia range, where it is listed as Rare.



**Oconee Burrowing Crayfish (*Cambarus truncatus*)**– Although little is known about this crayfish species, it is known to inhabit small and moderate size streams in the upper Piedmont and mountains. It apparently favors fast-flowing streams with rocky substrates. Like many aquatic invertebrates, it has suffered the impact of pollution and

sedimentation/siltation from poorly managed lands adjacent to streams. As a result of declining populations, it is considered Threatened in Georgia.

## Plants



**Canby's Dropwort (*Oxypolis canbyi*)** – Ranging from Maryland to Georgia, this **perennial** plant grows in wet meadows, wet pine savannahs, ditches and Cypress-pine ponds of the Coastal Plains. **Perennial** plants are those that have a life cycle lasting more than two years. Only 25 populations of this plant are known to still exist. Due to the loss of habitat, primarily the loss of wetlands resulting from draining and filling wetlands, this species is protected as Endangered by the federal government as well as Georgia and South Carolina.

### Smooth

This perennial herb cedar barrens, right-of-ways Originally ranging open the tree to the suppression of highways, residential and commercial development, and collecting for horticulture and medicinal uses, this species is protected as Endangered by the federal government as well as Georgia and South Carolina.



**Coneflower (*Echinacea laevigata*)** – is typically found in xeric open fields, roadsides, clearcuts and power line ranging from Virginia to Georgia. from Pennsylvania to Arkansas, this upon fire to reduce competition and canopy, allowing ample sunlight. Due fire, as well as construction for



**Harperella (*Ptilimnium nodosum*)** – This **annual** herb occurs in only 12 populations within its range from West Virginia and Maryland to Georgia. **Annual** plants live for only one growing season, starting new from seed each year. Found largely along rivers, this species prefers rocky or gravel shoals and river banks with clear, swift-flowing water. It is also found along the edges of intermittent pineland ponds in the Coastal Plains. Water pollution and sedimentation has been a primary factor in this species decline. As a result, it is protected and Endangered by the federal government as well as Georgia and South Carolina.

Photo courtesy U.S. Fish and Wildlife Service



**Sandhill Milk-vetch (*Astragalus michauxii*)** - This tall perennial herb is a member of the pea family that is endemic to the Fall Line Sandhills region of Florida, Georgia, South Carolina and North Carolina. This species prefers dry, sandy habitats such as longleaf pine-wiregrass savannas and mixed pine-turkey oak woodlands.

Like many Fall Line Sandhills plant species, this plant is dependent upon periodic wildfires to remove understory and midstory vegetation that may crowd out this species. The suppression of wildfire over time has altered this plant's habitat, making it unsuitable. Habitat changes coupled with habitat loss due to development, this species has declined and is now protected as Threatened in Georgia.



Photo credit Joel McNeal

**Harper's Dodder (*Cuscuta harperi*)** – This annual orange vine is found on granite outcrops in Georgia and Alabama. This plant is unusual in not having green chlorophyll to make its own food like other plants. Instead, Dodders parasitize specific plant hosts by extracting nutrients from them. Granite outcrops typically occur in small, isolate pockets in the Piedmont and mountain regions. These outcrops have been impacted by development. In addition to development, many of the granite outcrops have been lost to quarry operations, removing the granite for use in construction and other industries. Due to this loss of granite outcrop habitat, this species is protected as endangered by the State of Georgia.



**Bay Star-vine (*Schisandra glabra*)** – This **deciduous** vine is protected as Threatened in Georgia, where it is found in the Coastal Plains and Piedmont Plateau. **Deciduous** plants shed their leaves after each growing season, whereas **evergreen** plants retain their foliage year-round. It prefers rich, forested bottomlands where it is typically found climbing understory trees and shrubs. This species is threatened by both the loss of habitat to clearing and development, as well as competition by non-native species such as Japanese honeysuckle.



Photo credit Patrick Coin

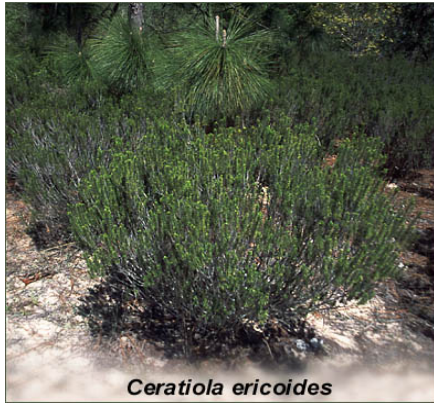
**Barbara Buttons (*Marshallia ramosa*)** – This group of perennial herbs consist of seven species found in the eastern U.S. **Pineland Barbara's Buttons** are known to occur in the southeastern U.S. primarily in open woods of mixed oak-pine forests on or near granite outcrops. This plant is typically found in the Coastal Plains, but has also been identified in the Piedmont in Columbia County, GA. Because this species prefers open understory habitat, it is threatened by dense vegetation that shades and out-competes the plant for resources. Naturally-occurring fires once kept the understory open. Wildfire suppression has altered the habitat and allowed dense understory growth, to the disadvantage of many native species. This species is Rare in Georgia and a Federal Candidate Species.



Photo credit Hugh & Carol Nourse

**Cutleaf Beardtongue (*Penstemon dissectus*)** – A perennial herb found primarily in the Coastal Plain of Georgia and South Carolina. Much like Pineland Barbara's Buttons, it prefers open oak-pine forests near granite outcrops. It, too, is threatened by

changes to its habitat from the lack of fire and growth of a dense understory. This species is Rare in Georgia.



*Ceratiola ericoides*

Photo courtesy Univ. of Florida

**Sandhill Rosemary (*Ceratiola ericoides*)** – This fragrant, woody shrub is found in some of the driest xeric scrub habitat in the Coastal Plain and Sandhills regions of Georgia and Florida. Although it resembles the rosemary commonly used in cooking, it is not in the same genus and is not considered edible. Due to habitat loss and conversion of these dry sandy sites to pine plantations and pastures, this shrub is considered Threatened in Georgia.



species, occurring only in small populations in what was once a large habitat range. This species is protected as Threatened in Georgia and is a Federal Candidate Species.

**Georgia Aster (*Symphyotricum georgianum*)** – This tall perennial herb can be found primarily in the Piedmont region from Alabama to North Carolina. Georgia aster prefers dry open sites, such as oak-pine woodlands and disturbed roadsides and utility corridors. This species has migrated to disturbed sites in favor of an open canopy with ample sunlight. The suppression of wildfires have allowed dense understory and midstory vegetation to grow, making native habitats for the Georgia aster unsuitable. As a result, this species has become a relict



**Georgia Plume (*Elliottia racemosa*)** – This small, deciduous tree or shrub was once found in the Coastal Plain of Georgia and South Carolina. Considered Threatened in Georgia, this plant is no longer found in South Carolina. Found on dry sand and oak ridges, it is threatened throughout its range by habitat loss due to forest clearing for agriculture and pine plantations.



**Hooded Pitcher Plant (*Sarracenia minor*)** – This perennial plant belongs to a unique group of carnivorous plants. Unlike Dodder, it uses animals rather than other plants as a nutrition supplement. While it takes some of its nutrients from the acidic soil, it is also able to capture and digest insects for food. Both this species and the **Sweet Pitcher Plant (*Sarracenia rubra*)**, are found in acidic bogs, wetlands and pond margins throughout the southeastern U.S. These species are vulnerable to habitat changes and loss due to wetland drainage and development. They are also susceptible to being overtaken by woody vegetation when wildfires are

Photo courtesy Florida State Parks,  
Dept. of Environmental Protection

suppressed. In addition to these threats, these plants are often illegally collected for use by gardeners. While the Hooded Pitcher Plant is considered Unusual in Georgia, the Sweet Pitcher Plant is Endangered in both Georgia and South Carolina.



Photo courtesy Georgia State Parks, Dept. of Natural Resources

**Silky Camellia (*Stewartia malacodendron*)** – This deciduous shrub is a member of the tea family. This species ranges from the Coastal Plains and Piedmont foothills of Virginia to eastern Texas. Found in wooded bluffs and steep slopes bordering ridges and streams, this species prefers moist habitats and is sensitive to changes in moisture and the water table. Like many other species, it is threatened by habitat loss due to forest clearing and is considered Rare in Georgia.



**Mat-forming Quillwort (*Isoetes tegetiformans*)** – This plant is considered a CSRA **endemic**, or restricted to a specific, confined habitat occurring in a few small areas. This perennial plant is protected as both Federally Endangered and Endangered in Georgia because it has only been found in 7 populations, of which 3 have been destroyed by quarrying since its discovery in 1976. The first place it was discovered was at Heggie’s Rock in Columbia County, where it is now protected by the Nature Conservancy.

Related to ferns, this plant is found in the Piedmont region, exclusively on shallow, flat-bottomed depressions and pools on granite outcrops. These pools are typically less than one foot deep and may be dry during the summer. These shallow depressions are formed over millions of years by erosion. Because it cannot survive in other habitats, this species is vulnerable to habitat changes and loss, such as the mining of granite for construction uses.





**Granite Stonecrop (*Sedum pusillum*)** – This annual plant, like the Mat-forming Quillwort, is found on granite outcrops on the Piedmont of Georgia and South Carolina. Due to the fact that this plant grows in a habitat which may experience very dry periods, this plant has the ability to hold water in its tissues, much like a cactus or aloe plant. These plants are known as **succulents**. Much like the quillwort, this plant is vulnerable to habitat loss due to granite mining at quarries. The granite stonecrop is protected as Threatened in Georgia.



**Pool Sprite or Snorkelwort (*Gratiola amphanthus*)** – This little annual herb is a floating plant found in about 30 populations only in depressions and pools on granite outcrops. Like the Granite Stonecrop and Mat-forming Quillwort, they are vulnerable to habitat changes and habitat loss through mining granite, as well as pollution of their pools by livestock. Found in the Piedmont plateau of Alabama, Georgia and South Carolina, this species is protected as a federally Threatened species, as well as Threatened in Georgia

and South Carolina.



**Dwarf Hatpins (*Eriocaulon koernickianum*)** – This small perennial herb occurs in scattered populations in only four states: Georgia, Texas, Oklahoma and Arkansas. In Georgia, this plant is endemic to moist depressions on granite outcrops. Like many of the granite outcrop plant species, dwarf hatpins do not adapt readily to habitat changes. Their populations have declined largely due to the mining of granite for the construction industry. As a result, this species is protected as Endangered in Georgia.



**Ocmulgee Skullcap (*Scutellaria ocmulgee*)** – This perennial herb is found along hardwood slopes and riverbanks in the Fall Line Sandhills region of Georgia and South Carolina. Today, it is found in only 6 counties in Georgia. Known populations are scattered in isolated populations in the Sandhills region. Biologists consider it to be a **relict species**, a species that was once abundant in a large area, but now occurs in a few small areas, characterized as **endemic**. This is a Federal Candidate Species protected as Threatened in Georgia. The primary threat to this species is loss of habitat to forest clearing and residential development, as well as being overgrown by non-native species.



**Relict Trillium (*Trillium reliquum*)** – This perennial herb can be found in hardwood forests along ravines and steep slopes in the Fall Line Sandhills area of Alabama, Georgia and South Carolina. Difficult to see much of the year, this species blooms in spring and dies back completely by mid-summer. Relict trillium is in danger due the spread of non-native plants such a Japanese honeysuckle, as well as loss of habitat for conversion to pine plantation and agriculture. As a result, this species is protected as Endangered by the federal government, as well as both Georgia and South Carolina.



**Shoals Spiderlily (*Hymenocallis coronaria*)** – This perennial lily, while rooted in soil, grows in aquatic habitats. It is classified as an **emergent wetland species** – one whose leaves stand out of the water, as opposed to submerged or floating plants. The shoals spiderlily lives in large streams, rocky river shoals, and even grows out of cracks in exposed bedrock along rivers. Found primarily in the Fall Line Sandhills of Alabama, Georgia and South Carolina, the Shoals Spiderlily has declined due to changes in water flow, such as flooding from impoundments, as well as poor water quality and siltation from upstream development. This species is classified as a Federal Candidate Species, and is Endangered in Georgia



**Upland Privet (*Forestiera ligustrina*)** – This small shrub is found throughout the southeastern U.S., from Texas to South Carolina. It prefers dry, open sites such as rocky outcrops and is often found with red cedar and sparkleberry. Upland Privet is protected as Rare in Georgia, primarily due to habitat loss and forest clearing for agriculture and development.



**Whitlow Grass (*Draba aprica*)** – Also known as Sun-loving Draba, this annual herb is ranges from the Ozark Plateau in Arkansas and Missouri to the Piedmont Plateau in Georgia and South Carolina. This species prefers to grow on granite outcrops, where it is often found under old-growth eastern red cedar trees. Like many other species found on granite outcrops, it is vulnerable to habitat loss from granite mining. As a result, this species is protected as Endangered in Georgia.



**Indian Olive (*Nestronia umbellula*)** – This small, deciduous shrub occurs in the Piedmont and Coastal Plain, ranging from Alabama to southern Virginia. It prefers dry, open, upland mixed forests of hardwood and pine where it is hemi-parasitic. This means that while it contains chlorophyll and can make its own food, it is also capable of parasitizing the roots of other trees and plants when the opportunity presents itself. This plant, like many others, is **dioecious**, meaning that a plant has either male or female reproductive organs in the flowers, and must be pollinated by a plant of the opposite gender. Habitat loss resulting in isolated, fragmented populations reduces the likelihood of these plants being pollinated and reproducing. Habitat loss and fragmentation is the primary reason this plant is protected as Threatened in Georgia.



**Oglethorpe Oak (*Quercus oglethorpensis*)** – Oglethorpe Oak, named for Oglethorpe County, Georgia where it was first recorded, is a medium-sized tree with bark resembling a white oak. Although its range includes the Piedmont of Georgia and South Carolina to the Coastal Plain of Louisiana, it is rare throughout its range and is considered a relict species. It prefers seasonally wet seepage swamps, and has been impacted by habitat loss through forest clearing for agriculture and pine plantations. This species is also susceptible to the chestnut blight disease that devastated American chestnut populations in the U.S. This tree is protected as Threatened in Georgia.



**Miccosukee Gooseberry (*Ribes echinellum*)** – This very rare plant is a low-growing thorny shrub that grows in thickets along hardwood slopes and bottomlands. Only three populations of this species still exist; two in Florida and one in McCormick County, SC. Due to threats from forest clearing and habitat loss, as well as non-native species such as Japanese honeysuckle and Chinese privet, this plant is protected as Threatened by both federal and state government in Florida and South Carolina.



**Pink Ladyslipper (*Cypripedium acaule*)** – Pink ladyslipper, also called moccasin flower, is an orchid native to the eastern U.S. While it is typically found in the mountains and foothills ranging from Alabama and Georgia to Canada, scattered populations are found in the Piedmont of Georgia and South Carolina. Like many orchids, this plant is vulnerable to illegal collection for the garden and nursery trade. For that reason, this species is currently protected as Unusual in Georgia.



**American Ginseng (*Panax quinquefolius*)** – Also known as wild ginseng, American ginseng is a fragrant perennial herb that was once found in rich, mesic woods throughout the eastern U.S. Due to the medical uses in the plant for increasing energy, relieving anxiety, and calming nausea, this plant has been over-harvested for commercial use in the herbal remedy market. As a result of over-harvesting, this plant is now rare in the wild and many states have prohibited the collection of wild plants. This plant is protected as Threatened in South Carolina.

## THERE IS HOPE

Extinction is avoidable. Being named endangered does not mean that there is no hope for a species. 51 species placed on the Endangered Species list have since been de-listed as their populations were restored, most recently the Virginia Flying Squirrel. Perhaps the best recovery example in North America is our national bird, the Bald Eagle. In 1962, Rachel Carson, a well known scientist and natural historian, wrote a book titled *Silent Spring*. In that book, she presented evidence that the use of some chemical pesticides were dangerous to humans and the environment. Particularly, she discussed the impact on birds of **DDT**, a pesticide commonly used to control mosquitoes. She discussed the role of DDT in the food chain, how as animals preyed on other animals, especially fish, that were contaminated with DDT, the pesticide accumulated up the food chain. In other words, as animals consumed other animals contaminated with DDT, they stored the chemical in the tissues, a process called bioaccumulation. This continued up the food chain, until the top predator often had large amounts of DDT stored in its muscle and tissues.

The most striking effects of DDT were seen in predatory birds at the top of the food web, notably Bald Eagles and Peregrine Falcons, but also Brown Pelicans. The DDT caused the eggshells of these birds to be very thin. As birds laid eggs and tried to incubate the eggs, the eggs often broke and the young birds never hatched. As a result, raptor populations declined sharply. The effect of DDT, combined with the loss of habitat and hunting, brought the Bald Eagle to the brink of extinction.

As a result of Rachel Carson's book and the attention it drew to the pesticide industry, DDT was banned in the U.S. 1972. The U.S. Fish and Wildlife Service had previously listed the Bald Eagle as Endangered in 1967. Other birds that were also affected by DDT and were added to the endangered species list were the Peregrine Falcon and the Brown Pelican. Doing so protected these birds from hunting and protected their habitat and nests from destruction. Due to these combined efforts, the Bald Eagle and Peregrine Falcon recovered and were removed from the Endangered Species List in 2007 and 1999, respectively.





At least 15 listed species have increased populations, often as a result of conservation and habitat restoration programs started because of their Endangered status. The Bald Eagle is only one of the endangered species in the CSRA that has or is recovering. Due to the efforts of state and federal agencies, the Red-cockaded Woodpecker and Wood Stork population sizes are increasing. In other parts of the country, populations of such species as the gray wolf and

black-tailed prairie dog have increased. And consider the numbers of American Bison that can now be seen out west. This species, once numbering 20-30 million, were reduced to less than 1,200 due to massive hunting pressure. Today, up to 30,000 bison are managed in conservation herds, and up to 5,000 range free in such places as Yellowstone National Park. This is all the result of efforts to protect the animals and their habitats and prohibit illegal hunting.

### **What can you do?**

Government officials and land managers put a great deal of effort every year into studying all of these species, protecting, preserving and restoring their habitats, and helping these species to recover. They are not the only ones who have a role. Each of us can help protect and restore threatened and endangered species, and restore the ecosystems in which they play an important role.

So how can you help? Think about the main causes why species become extinct. When your family buys new plants for the aquarium or garden, or if you are getting a new pet, check to find out if that species is invasive in our area. Never set pets loose in the wild if you can't care for them, or let non-native plants spread outside your home. Feral cats, dogs, and pigs kill millions of birds annually in the US around our neighborhoods, and on islands like Hawaii, they are the leading cause of animal extinction.

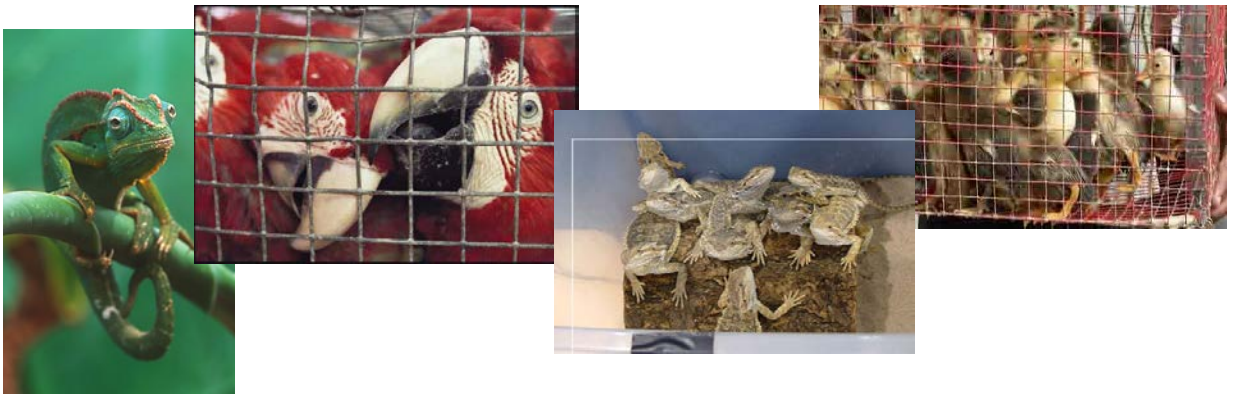
You can do something about pollution by paying attention to the chemicals you and your family use around the house and in your yard. There are many environmentally-friendly and safe chemicals available for everything from cleaning supplies to pesticides. Encourage everyone to use these safer chemicals when possible, and NEVER dispose of unwanted chemicals by pouring them down the sink, storm drain, or onto the ground. That is how many chemicals enter our waterways and poison the environment. It is not only safer for the wildlife, but safer for all of us.

What about habitat loss and degradation? Pay attention to development that is going on around your neighborhood. Are trees and vegetation being cleared in a manner that allows soil to run off into nearby streams, harming the fish and invertebrates in those streams? Are developers filling wetlands? The law requires that people obtain permits to drain and fill wetlands. Unfortunately, not everyone is diligent about getting the proper permits, or even

knows they are required. If you see something that doesn't look right, report it to someone. Your local state natural resources agencies can take action to fix the problem.



Have you ever seen that really cool snake or other animal in the pet store that you just have to buy? Think about where it came from. Ask the store owner if it was bred in captivity. Often, wild animals are caught illegally and sold in the pet trade. Although we might like to have some beautiful snake, bird, fish or unusual mammal for a pet, if it is a wild animal, not only is it cruel to the animal to keep it in captivity, but buying it promotes the illegal pet trade, which jeopardizes the survival of the species.



These are just a few of the ways that we can help protect rare, threatened and endangered species with our everyday actions. And of course, there are a multitude of careers focused on protecting and conserving all wildlife including endangered species, whether you like research, writing, teaching, or even working in the field, hands-on with wildlife.

## USEFUL WEBSITES

Although all test questions will come directly from this study packet, below is a list of some websites that may be useful in studying for this test station.

[www.fws.gov/endangered](http://www.fws.gov/endangered)

[www.dnr.sc.gov/conservation.html](http://www.dnr.sc.gov/conservation.html)

[www.georgiawildlife.com](http://www.georgiawildlife.com)

**Standards addressed in this study packet –**

Georgia S7L1	Diversity of living organisms
Georgia S7L4	Dependence of organisms to one another and their environment
South Carolina 7-4	Ecology: The Biotic and Abiotic Environment 7-4.1, 7-4.3
South Carolina 8-2	Earth's Biological History 8-2.1, 8-2.7