

# Wildlife

## Topics

- I. Birds and Mammals of Tennessee
- II. Principles of Wildlife Management
- III. Tennessee's Wetlands
- IV. Tennessee's Rare and Endangered Wildlife
- V. Tennessee Wildlife Resources Agency

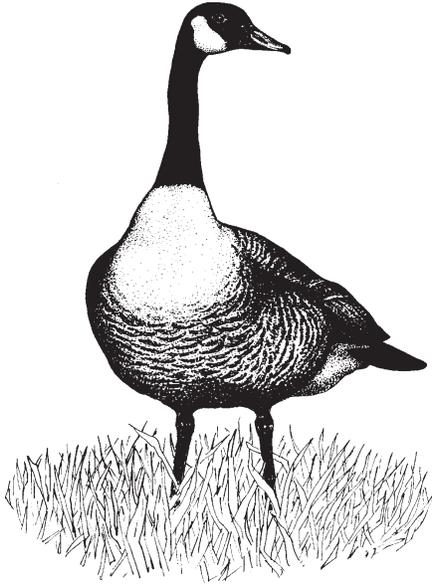
## Learning Objectives

1. Identify common wildlife species from silhouettes, mounted specimens or pictures
2. Identify common wildlife from animal signs:  
fur, hair, feathers, gnawings, rubbings, pellets, scat
3. Answer questions about natural history of bird and mammal species
4. Identify birds and mammals from given natural history information
5. Understand the roles of wildlife in an ecosystem
6. Understand human uses of and/or influences on wildlife

Appreciation is extended to Outdoor Empire Publishing Inc. for permission to use the Principles of Wildlife Management section of the Tennessee Hunter Education Handbook (pages 69-75).

Special thanks to Bob Hatcher, Tennessee Wildlife Resources Agency former Chief of Nongame, for information concerning Tennessee's rare and endangered wildlife.

# Birds and Mammals of Tennessee



## Canada Goose, *Branta canadensis*

### Average Adult Size

Length: 24-48 in.  
Weight: 2.5-18 lbs.  
Wingspan: 52-75 in.

### Breeding

Monogamous: typically the male and female bond for life  
Male: gander, Female: goose  
Reach sexual maturity between 2-3 years of age

### Young

Called goslings  
Clutches range from 1-23 eggs but 5 eggs is average  
Incubation period: 25-30 days  
Adults raise one clutch a year

### Food

Herbivores: Clover, variety of grasses, cultivated grains

The Canada goose is the largest waterfowl game species found in Tennessee. It is considered a migratory species but the creation of large lakes has made a winter home for the birds. There are numerous residential geese found throughout the state.

## Mourning Dove, *Zenaida macroura*

### Average Adult Size

Length: 12 in.  
Wing Spread: 17-19 in.  
Tail: 6 in.

### Breeding

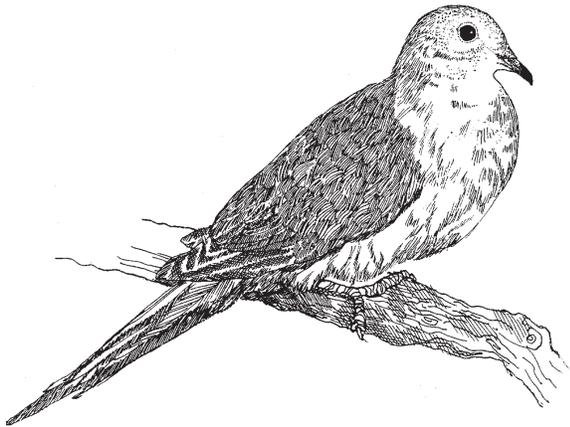
2-5 clutches a breeding season  
Monogamous: paired for life

### Young

Called squabs  
Both sexes incubate and feed young  
Average 2 eggs per clutch

### Food

Grains, seeds, nuts,  
Drinks without raising its head like other birds



The mourning dove is a migratory game species that is named for its long tail and melancholy call. There is probably no other game species that brings as many hunters together at one time. Doves are typically found in fields, orchards, or other open areas where seeds are available. The life expectancy for juveniles is low with only 20% surviving the first year. Adult mortality is about 55% a year.

## **Mallard Duck, *Anas platyrhynchos***

### **Average Adult Size**

Length: 19.8-27.5 in.

Weight: 2.5 lbs.

Wing: 10-11.5 in.

### **Breeding**

Male: drake, Female: hen

Mating occurs in spring

Clutch averages 8 or 9 eggs, 1 laid per day

Sexually mature between 5-9 months of age

### **Young**

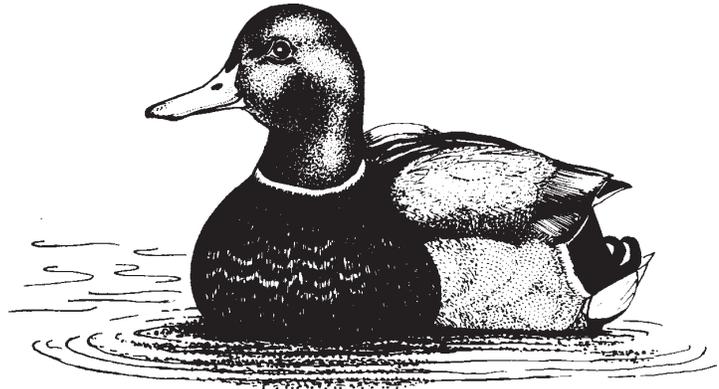
1 clutch typical but 2 clutches possible

Incubation 28 days

Able to swim just a few hours after birth

### **Food**

Grain crops, acorns, aquatic plants, bulrushes



The mallard is the most popular bird for duck hunters in Tennessee and the most often found waterfowl throughout the world. It belongs to the group of ducks known as dabblers or surface feeding ducks, which feed in shallow water by tipping down with only the tail showing above the water. These ducks take flight almost vertically into the air. A second group of ducks are known as diving ducks, which dive completely underwater for aquatic plants, snails, and insects to feed upon. Their flight pattern also differs from dabblers in that they patter along the water's surface before lift off. Examples of divers are as follows: red head, canvasback, ring-neck, scaup.

## **Wild Turkey, *Meleagris gallopavo***

### **Average Adult Size**

Height: 3-4 ft.

Wingspread: 4-5 ft.

Weight: 10 lbs. female, 17.5 lbs. male

### **Breeding**

Male: gobblers, females: hens

Males have several mates in their harems

Males attract females in the spring by gobbling and strutting

### **Young**

Very young called poults

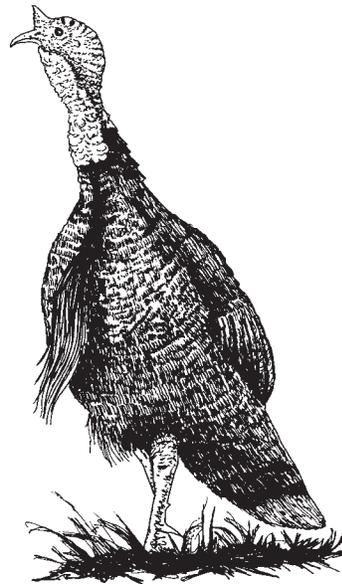
Juvenile males: jakes, juvenile females: jennies

1 clutch a year with 8 -15 eggs

Incubation: 28 days

### **Food**

Variety of fruits, nuts, grasses, wheat, corn, snails, insects, small reptiles



Primarily due to unregulated market hunting and loss of habitat, the wild turkey almost vanished from Tennessee by the early 1900s. Thanks to an aggressive restoration program and modern management practices, the wild turkey can be found throughout the state in huntable numbers. Turkeys were trapped and relocated by the use of cannon nets and today's modern version, the rocket net.

The eastern wild turkey is a bird of the forest but can be found feeding and strutting open fields. The males have pointed growths on the inside of their legs known as spurs, which are used for battling other males during mating season. Males also have bristle like feathers that grow from the chest that are called beards. Occasionally hens will have long thin beards.



## **Raccoon, *Procaine lotor***

### **Average Adult Size**

Length: 2.5-3.5 ft.

Height: 1 ft. at shoulder

Weight: 12-30 lbs.

### **Breeding**

Promiscuous: Male has several mates

Gestation: 63-65 days

Breed February through June

### **Young**

Called cubs

1 litter annually

Usually 2 or 3 per litter

### **Food**

Omnivorous: fruits, nuts, frogs, insects, grains, crayfish, bird eggs, mice, wild berries. Often seen "washing their food"

With its familiar black mask and mischievous nature, the raccoon has been named as the official animal of Tennessee. They are good climbers and swimmers and are generally found in habitats associated with water such as hardwood swamps, marshes, and bottom land forests. All too often raccoons occur in urban areas in which they scavenge for food during the night.



## **Black Bear, *Ursus americanus***

### **Average Adult Size**

Length: 5-6 ft.

Height: 2-3 ft. on all fours

Weight: Males: 150-590 lbs., Females: 100-300 lbs.

### **Breeding**

Males: boars, females: sows

Gestation: 7 months

1 litter a year

Males have several mates

### **Young**

Called cubs

Altricial (helpless at birth)

2-3 cubs per litter

Weigh less than 8 oz. at birth

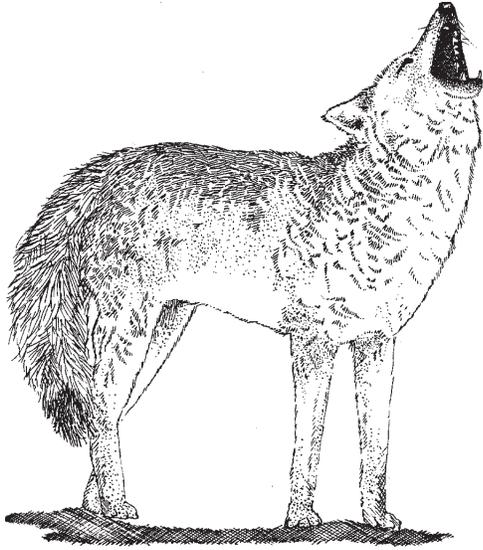
### **Food**

Omnivorous: fish, carrion, fruits, berries, insects, nuts, honey, leaves, frogs, reptiles, small mammals

The black bear is a solitary and primarily a nocturnal animal. They are typically very shy, nonaggressive animals that avoid humans but occasionally wander into towns in search of food. They are not true hibernators but enter a state of deep sleep in which their breathing is slowed and their heartbeat is reduced from 40 beats a minute to 10 beats a minute. The bears prepare for denning in autumn by building a layer of fat. In mid to late December, bears usually move in their winter dens. They will not eat, drink or excrete body waste but can be fully alert in minutes if aroused.

The black bear is found in large, undisturbed areas primarily forest, swamps and mountains. They range 15 miles or more for food.

(This study material will be used for Envirothon Competitions in Tennessee through 2006.)



## **Coyote, *Canis latrans***

### **Average Adult Size**

Length: 3-4 ft.

Height: 2 ft. at shoulder

Weight: 20-50 lbs.

### **Breeding**

Mate for life

Gestation period: 60-63 days

### **Young**

Called pups

Altricial (helpless at birth)

5-10 per litter

Born April-May

### **Food**

Small mammals, insects, occasional deer, fruit

A scavenger that will eat almost anything

The coyote is a predator that is arguably the most adaptable and hardiest species in North America. To describe the coyote's habitat would be anywhere that its prey can survive. It can be found in brush country, woodlands, farmlands and even in urban areas. A coyote's territory is usually 2 to 3 square miles but can roam up to 10 miles a day for food. They are chiefly nocturnal but are often active by day.

## **Striped Skunk, *Mephitis mephitis***

### **Average Adult Size**

Length: 1.7-2.6 ft.

Height: 6-9 in.

Weight: Males 6-14 lbs., Females 4-10 lbs.

### **Breeding**

Promiscuous

Gestation: 66-75 days

### **Young**

Called kittens

4-8 in litter

Develop scent when 6-8 weeks old

### **Food**

Omnivore

Fruits, seeds, nuts, insects, worms, small rodents, eggs, reptiles



The black and white coloration and its unique ability to spray a smelly secretion has made the striped skunk well known. Skunks prefer to live in timbered areas and pastures with good water sources. They spend most of their days in dens and venture out at night to hunt. In addition to the striped skunk, Tennessee is home also to the spotted skunk.

## **Mink, *Mustela vison***

### **Average Adult Size**

Length: 19-36 in., including a 6-8 in. tail

Weight: 1-3 lbs.

### **Breeding**

Gestation: 39-76 days

Mates January-March

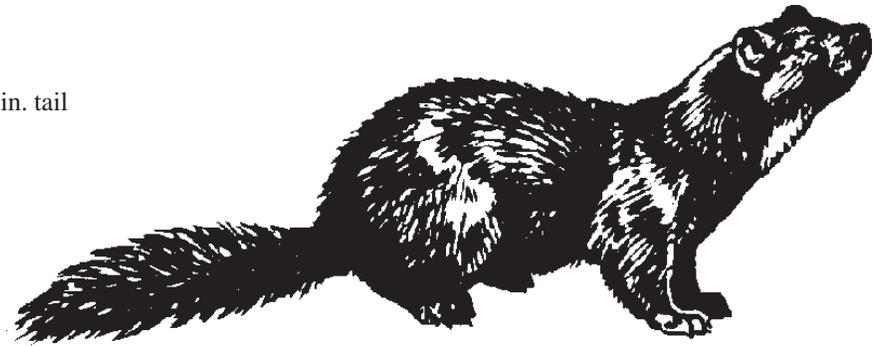
### **Young**

Born April-May

Litter size 2-6

### **Food**

Small mammals, birds, eggs, frogs, crayfish, fish, reptiles, and amphibians



The mink is one of the most valuable fur animals in Tennessee. They are chiefly nocturnal and solitary except when in family groups. The mink is an excellent swimmer and is typically found along stream banks and lake shores.

## **Eastern Cottontail Rabbit, *Sylvilagus floridanus***

### **Average Adult Size**

Length: 14-17 in.

Weight: 2-4 lbs.

### **Breeding**

Gestation: 26 - 30 days

Promiscuous

### **Young**

Altricial (helpless at birth)

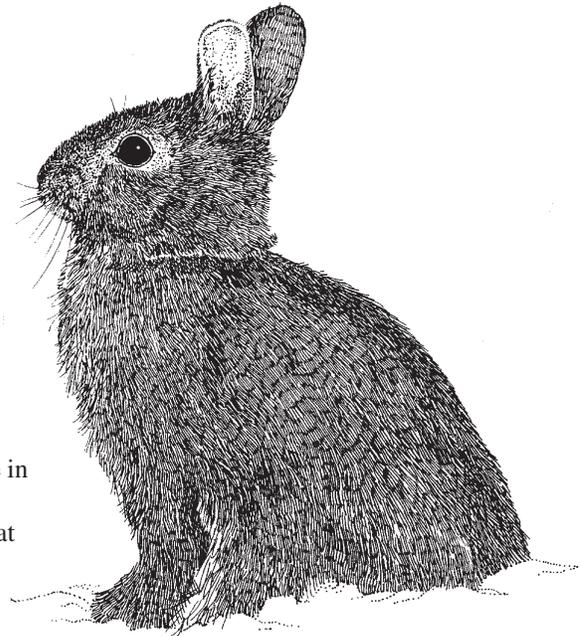
4 - 5 per litter

3 - 4 litters a year

Born in fur-lined nest in the ground

### **Food**

Green vegetation, twigs, bark, wild plants



The cottontail rabbit is active early in the evening until late in the morning. During the days it spends its time concealed beneath brush piles or in burrows in the ground. Typical habitat includes swampy woods to farmlands and upland thickets. Rabbits are often seen in the summer months feeding on the tender grasses of manicured lawns. Two other rabbits are also found in Tennessee. The swamp rabbit is a larger rabbit that is found in the swamp lands of western portions of the state. The Appalachian cottontail lives in the high mountains of East Tennessee. All three species are game animals.

## Gray Fox, *Urocyon cinereoargenteus*

### Average Adult Size

Length: 32 - 55 in.

Weight: 7 - 13 lbs.

### Breeding

Gestation: 51 days

### Young

Called pups

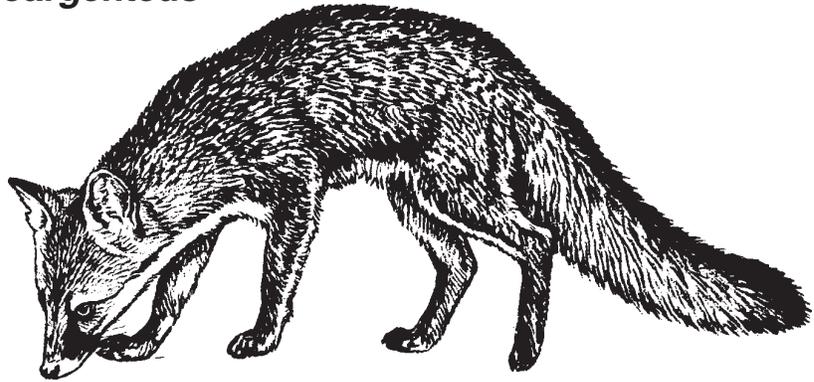
Altricial (helpless at birth)

3 - 5 per litter

### Food

Omnivorous

Mainly small mammals, but includes insects, fruits, acorns, birds, and eggs



The gray fox is solitary and typically nocturnal animal that will climb trees to escape from its enemies such as the coyote. It dens in ground burrows, hollow logs or beneath boulders. They call the open forest areas of Tennessee home. The gray fox is capable of speeds of 28 mph for short distances.

## Red Fox, *Vulpes vulpes*

### Average Adult Size

Length: 36 - 42 in.

Weight: 7.5 - 15 lbs.

### Breeding

Females called vixens

Gestation: 52 days

### Young

Called pups

Altricial (helpless at birth)

4 - 9 per litter, usually 5

Learn to hunt at 3 months

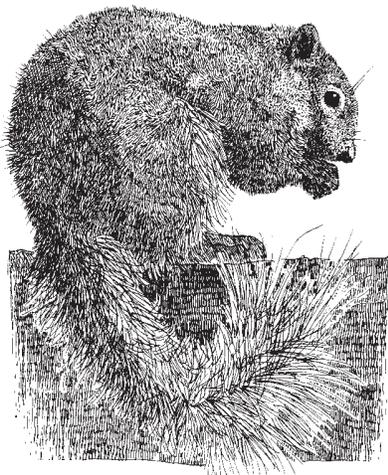
### Food

Omnivorous

Rabbits and other small mammals, rodents, reptiles, insects, berries, fruit



The red fox is primarily nocturnal but can often be seen active during the day. The red fox dens are much like those of the gray fox. However, unlike the gray fox, the red prefers a mixture of forest and open country. It frequently hunts the edges of these open habitats. The red fox is extremely adaptable and able to live in close proximity to humans.



## Gray Squirrel, *Sciurus carolinensis*

### Average Adult Size

Length: 16 - 20 in. from nose to tip of tail

Weight: 12 oz. - 1.5 lbs.

### Breeding

Gestation: 44 days

### Young

Altricial (helpless at birth)

2 litters annually

3 - 5 per litter

### Food

Variety of nuts, seeds, fungi, and fruits

Stores nuts in small holes in the ground, which usually are not found and later sprout trees

The gray squirrel inhabits hardwood forests with nut trees and river bottoms but can often also be seen in parks and other urban areas. They are highly arboreal in that they rarely leave the security of the tree tops. Nests are built normally at least 25 feet in the air and are constructed out of leaves in tree branches or holes in trees. Tennessee is also home to six other species of squirrels. Only four are game species; the gray, fox, and red squirrel and the largest member of the family, the groundhog. The two nongame species are the southern and northern flying squirrel.

## Bobcat, *Felis rufus*

### Average Adult Size

Length: 24 - 40 in. including tail

Weight: 10 - 40 lbs. Male about 1/3 larger

### Breeding

Gestation: 62 days

Can breed year around, usually late winter or early spring

### Young

Called kittens

Altricial (helpless at birth)

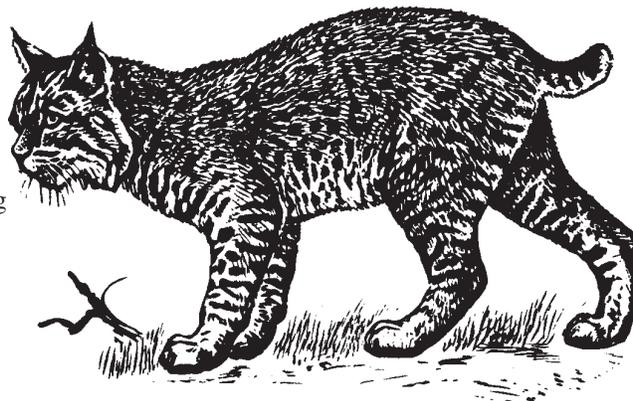
2 - 4 per litter

Weigh 10 - 12 oz. at birth

### Food

Carnivore

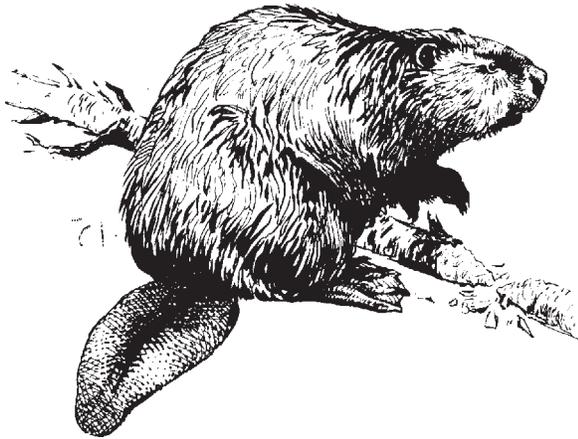
Rabbits, small mammals, birds, raccoons, opossums, small deer, and snakes



The bobcat gets its name from its short tail, which is about five inches in length. Bobcats are excellent runners, climbers and swimmers. Their paws are equipped with four razor-sharp retractable claws. In addition to these hunting features, the bobcat also has wonderful vision and hearing, along with a good sense of smell. This total package makes the bobcat an excellent predator.

They are found in a wide range of habitats but seem to prefer forest and swamps. Much like the fox, the bobcat dens in hollow logs, beneath downfalls and in rock crevices. Bobcats are territorial and have large home ranges. Depending on the quality of the habitat, they may cover from half a mile to 30 square miles.

## Beaver, *Castor canadensis*



**Average Adult Size**

Length: 35 - 40 in. from nose to tip of tail

Weight: 30 - 60 lbs.

**Breeding**

Gestation: about 128 days

**Young**

Called kits

Altricial (helpless at birth)

1 litter per year

2 - 4 kits per litter

**Food**

Bark and twigs from trees, prefers maple, willow, alder and birch

Stores branches underwater near lodge

The beaver is a true Tennessee water conservationist, which has caused problems in some of the state's bottom land areas. It builds watertight dams of sticks and mud across streams and cone shaped houses in ponds that are known as lodges. Trees that are gnawed a foot from the ground are a sure sign that a beaver is in the area. The pelt of the beaver is of economic importance to the fur trade.

**Opossum, *Didelphis virginiana***

**Average Adult Size**

Length: 25 - 40 in.

Weight: 9 - 13 lbs.

**Breeding**

Gestation: about 13 days

**Young**

Altricial (helpless at birth)

2 litters per year

8 - 18 per litter

Do most development in mother's pouch

**Food**

Omnivorous

Fruit, vegetables, nuts, meat, eggs, insects, carrion



Tennessee's only marsupial or pouched animal is the opossum. It is highly adaptable and prefers farming areas, woodlands and along stream banks. The opossum has a prehensile tail that aids in its ability to climb. When cornered, it may fake its death or "play possum."

**White-tailed deer, *Odocoileus virginianus***

**Average Adult Size**

Length: 3 feet

Height: 3 feet to the shoulder

Weight: buck 100-200+ lbs.  
doe 80-160+lbs.

**Breeding**

Gestation: 196 days

Promiscuous, bucks breed with several does

Breeding occurs every year for females

**Young**

Fawns: litter size 1-3, usually 2 fawns,

Born in May or June weighing 3-5 lbs.

**Food**

Herbivore: browses on acorns, agricultural crops, twigs, shrubs, grasses, green leaves

Tennessee's most popular big game animal is the white-tail or Virginia deer. The white-tail deer population has made a dramatic turnaround. Due to wise management practices the deer is more numerous today than it was 100 years ago. White-tails are very adaptable, living in a variety of habitats such as forested or semi-forested areas, swamps, and brushy areas. They can be found throughout the state with higher populations usually in the middle and western portions.

Male adult deer are called bucks, the females are called does. Usually only the bucks have antlers, but females with antlers have been sighted. The antlers are shed annually.

# Interesting Wildlife Facts

1. There are seven species of squirrels in Tennessee, only four are game species; the gray, fox, and red squirrel and the largest member of the family, the groundhog. There are two species of flying squirrels, the southern and northern. The northern flying squirrel is an endangered species only found in three Tennessee counties.
2. Eight species of owls are known in Tennessee. The great horned owl, the barred owl, and the eastern screech owl are the most often heard or seen. The barn owl is a state listed Threatened species and is known as the world's best mouse trap.
3. The most commonly seen hawk in our state is the red-tailed hawk. These large daytime predators are often seen perched in trees or soaring high above the ground in search of small mammals. Other hawks found in Tennessee include: broad-winged, Cooper's and sharp-shinned, and three species of falcons: peregrine, American kestrel, and merlin. In addition to these birds of prey, Tennessee is also home to the bald eagle, golden eagle, and osprey.
4. Possum Trivia: The opossum is Tennessee's only marsupial and is the only mammal with 50 teeth. There has never been a documented case of rabies found in the opossum. The opossum has a prehensile tail and the young do most of their development inside the marsupium (pouch).
5. The pileated woodpecker, also known as the Indian woodhen, is Tennessee's largest woodpecker. A close look-alike cousin to the pileated, the ivory-billed woodpecker, has not been seen in Tennessee since 1820. There are nine species of woodpeckers still left in the Volunteer State. Only one, the red-cockaded, is endangered.
6. The eastern bluebird is a year round resident in Tennessee. Many Tennesseans go to extra efforts in attracting these birds to their backyards because of their insect eating abilities and their beauty. The eastern bluebird has been featured as the symbol for the Watchable Wildlife license plates. The extra money derived from these plates benefits many programs that help conserve Tennessee's diverse wildlife.
7. The white-tailed deer is the most sought after game animal in Tennessee. The male, called a buck, has antlers, not horns. The term "buck" for money is derived from "buckskin," which was used as money during the colonial settlement of North America.
8. The raccoon is Tennessee's state mammal. The coonskin cap of Davy Crockett has always been a symbol of Tennessee.
9. The male wood duck, like all male ducks, is called a drake. When in their "nuptial" plumage few critters can rival their beauty. Wood ducks, as the name implies, nest in trees, or more recently, artificial nest boxes.
10. Tennessee is home to 15 turtle species. The official state reptile, the eastern box turtle, is the only turtle that is not aquatic. The largest freshwater turtle in the world is the alligator snapping turtle. How large is it? Well, one from the Stones River weighed 105 pounds, but in captivity they are known to reach over 200 pounds!
11. Twenty-one species of frogs and toads live in Tennessee. Only the bullfrog is a game animal. A hunting license is needed to hunt these tasty amphibians during their year-round season.
12. Butterflies are dainty insects when they are adults. The herbivorous larvae (caterpillars) are often times just as colorful. Tennessee recently named the Zebra Swallowtail as the state butterfly.
13. Tennessee has been called the "rain forest" of mussel diversity. Thirteen of our 132 species of freshwater bivalves contribute \$13 million annually to Tennessee's economy because of the commercial value of these animals in the pearl industry.

(This study material will be used for Envirothon Competitions in Tennessee through 2006.)

14. Would you believe that 73 species of crayfish are native to Tennessee? Most live in surface water streams, lakes, ponds, caves and the floodplains. The mud chimneys, the hiding places of those species which live underground, are often visible.
15. Look here! We have found another squirrel....the ground squirrel, or chipmunk, is a nongame species which is common in many parts of Tennessee. This little rodent has cheek pouches which it will fill with nuts and seeds, some of which will sprout into trees and plants when the chipmunk forgets where it has hidden them over the winter.
16. Is it a lizard or a salamander? A lizard is a reptile with claws on its toes, scales on its skin, and external ear openings. Tennessee has nine species of lizards. A salamander is an amphibian that does not have the physical features described above. We have 45 species of salamanders in Tennessee, including the official state amphibian, the endangered Tennessee cave salamander.
17. The northern bobwhite quail is a small game animal, which many Tennesseans pursue with vigor during the open season. Male quail, or roosters, have a white mask. The females, called hens, have a chestnut-colored mask. These ground-nesting birds can be heard in the summer and fall with the familiar "BOB WHITE" whistle, trying to group their units, called coveys, together.
18. How many snakes are native to Tennessee? It may surprise you to know only 34. Of those, four are venomous. Snakes are beneficial predators that have been persecuted throughout time. Two snakes are threatened in Tennessee, the northern pine snake and the pygmy rattlesnake.
19. The largemouth bass is one of 313 fish species that lurk in the aquatic habitats of Tennessee. Whether fishing creeks, rivers, farm ponds or lakes, chances are good that you may latch onto one of these big predators.
20. Yuck! A slug! Approximately 460 species of mollusks are found in Tennessee, only 13 of these are slugs. About 250 are terrestrial gastropods (land snails). Slugs have no external shell.
21. A mole lives here. Three species of moles are native to Tennessee: the eastern mole, the hairy-tailed mole, and the star-nosed mole. All moles are insectivores, not rodents. The star-nosed mole is the only mammal in Tennessee that finds its prey (earthworms and crayfish) by electrolocation!
22. Earthworms are beneficial critters that help keep the soil healthy by decomposing vegetative material. They are food for robins, moles, shrews, and even make good bait to catch a catfish or bass.
23. Did you see that rabbit? Three cottontails are found in Tennessee. The eastern cottontail is the most common rabbit in the state. The swamp rabbit lives in wetlands in West Tennessee and populations may be declining. The Appalachian cottontail lives in the high mountains of East Tennessee, western North Carolina, and southwest Virginia. All three species are game animals in Tennessee.
24. The red fox, gray fox, coyote, and a few red wolves are the only wild canines left in Tennessee. Once the timber wolf roamed our wild areas. The foxes and coyotes are game animals in this state.
25. Seventy-three species of birds live in Tennessee during the spring and summer, then migrate to South America, Central America, and the southern coast of the U.S. Many of these birds, such as the wood thrush, whip-poor-will, and several species of warblers are declining because of a variety of problems. The TWRA has made these neotropical migrants a priority issue in its nongame program.

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# Principles of Wildlife Management

Wildlife management is the science of managing wildlife and its habitats, including man, for the benefit of all the plants and animals in an environment. There are several important concepts basic to the wise management of wildlife.

1. The amount and condition of its habitat is the most important factor determining how many animals of a species survive in a particular area.
2. Normal populations can replenish themselves annually, replacing animals that die with new individuals born into the population.
3. Hunting and trapping are important activities, and when properly regulated, they can replace some or most of the natural deaths that would otherwise occur.
4. Management of habitat benefits all wildlife, even those not hunted.

## Habitat

Habitat is the place where wildlife lives. It includes food, cover and water. When these habitat factors are in good supply, they contribute to the well-being of wildlife. If any of the habitat factors are in short supply, it limits the number and distribution of wildlife and is called a *limiting factor*.

**Food:** Each wildlife species eats specific foods, regardless of other foods that may be available. In addition, some plants have more nutritional value than others and this may vary according to the time of year. For this reason, both the quantity and the quality of the food are important.

**Cover:** Wildlife needs cover to protect it while feeding, sleeping, loafing, breeding, roosting, nesting and traveling. Cover can take many forms, such as vegetation, burrows, rocks or other natural features.

**Water:** All wildlife needs water. Sources of water are surface water, dew, snow and succulent (juicy) vegetation. Some animals can also use metabolic water (water produced by chemical processes in the body).

**Dispersion:** The arrangement of food, cover and water in an area determines the wildlife numbers and their distribution. The best arrangement is when these habitat factors occur in combinations of small blocks that are close together.

Many species of wildlife benefit when two important elements of habitat are brought together, such as a wooded area and a field. There is a tendency for wildlife to concentrate in the narrow overlap between these two types of vegetation, and the area created is commonly called *edge*. If there is good arrangement of food, cover and water, it creates more edge area for wildlife to live in.

## Carrying Capacity

Carrying capacity is the number of each wildlife species the habitat can support throughout the year without damage to either the animals or the habitat.

When wildlife numbers exceed the carrying capacity of the habitat, the excess animals die from starvation or other causes. When wildlife are too numerous, competition for food and cover increases, sometimes destroying the vegetation that serves as a source of food and cover. If habitat is damaged or eliminated, it decreases the carrying capacity of the area.

The only way to increase wildlife numbers in an area is to increase the carrying capacity. That can be done by improving existing habitat or by creating new habitat.

## Succession

Each species of wildlife lives in habitat that best meets its needs. Some species may live in several types, others may spend their entire life on one type of habitat.

Habitat in an area is subject to gradual change due to the effects of weather, plant growth and other factors. This change is called *succession*. During each stage of succession, the plants and animals change, gradually replaced by other species of plants and animals that are better able to survive in the type of habitat that has developed.

A good example of succession is a pasture, which unmowed or ungrazed is allowed to progress to an overgrown field with tall grasses and shrubs. These plants give way to woodier vegetation such as cedar trees, pines and hardwood saplings. Eventually, as the pines and hardwoods grow to tall trees, the undergrowth is shaded out and a mature forest will stand where the open pasture once lay. This is not a quick change but happens over a number of years.

Of course, the animal life that occurs during each stage of succession will be compatible with the various types of

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habitat. The small rodents and some ground nesting birds found in the pasture will be replaced by rabbits, quail and various song birds when the denser vegetation is allowed to grow. The woody plants, such as cedar and pine, serve as nesting and escape cover for a variety of wildlife from small game to deer. The mature forest eventually will house turkey, deer and squirrel which depend on the mast (nuts) from various hardwoods. Many predatory animals, such as foxes, coyotes, hawks and owls, will also be found there.

Succession can be set back to earlier stages by disturbances such as controlled burning, lumbering, drainage projects or brush removal. In fact, wildlife managers routinely alter succession to create habitat suitable for a particular species of wildlife.

## Population Dynamics

A *population* is group of animals of the same species that occupy a particular area. *Dynamics* refers to motion or change. *Population dynamics*, therefore, means the changes that occur in a population over time.

Two major factors affect the population dynamics of wildlife - the birth rate and the death rate.

**Birth rate:** the number of animals born in a population per adult female each year. Many wildlife species have a high birth rate. The most important factors that affect birth rate are:

- the number of young per litter or clutch
- the number of litters or clutches per year
- the age at which breeding begins

**Death rate:** the percentage of animals in a population which die each year. Animals with high birth rates generally have correspondingly high death rates. The most important factors causing death are:

- starvation
- severe weather
- predation
- diseases and parasites
- accidents
- hunting

If the birth rate is greater than the death rate, wildlife numbers increase. If the death rate is greater than the birth rate, wildlife numbers decrease. When the birth and death rates are equal, population numbers do not change.

**Population growth and decline:** Some wildlife species have a tremendous capacity for reproduction and increasing their numbers, but this growth cannot continue indefinitely. There is always some factor, usually food or cover, that becomes limiting.

Let's look at a situation that occurs each year in wildlife populations.

In the spring, the breeding stock (animals needed for breeding to replenish the population) begin having their young. The population reaches its peak in the summer. At that time, the population numbers have become greater than the carrying capacity of the habitat. The population then begins to decline because the habitat cannot support the excess animals. The decline continues through the spring of the following year. This cycle occurs every year. It is in late spring, just before the first young of the year are produced, that habitat is most limited. It is the amount of habitat available at this time that determines the carrying capacity.

The wildlife manager's task is to control the numbers of animals at or below the carrying capacity so that no damage is done to the animals or their habitat.

## Wildlife Management Tools

Management programs must be flexible since wildlife populations and habitat factors may change from year to year. A good wildlife management program includes managing and protecting habitat and regulating death and birth rates by managing hunting and, when possible, other causes of death. Wildlife managers collect information on habitat and wildlife numbers throughout the year to determine the type of management program needed.

## Laws

Laws regulating the harvest of wild game came into use to halt or reduce the thoughtless slaughter that was contributing to the decline or extinction of many species of wildlife. These early laws were established to restrict the number that could be killed and to prevent hunting during the breeding seasons. As our knowledge of wildlife increased through careful study, so did our ability to improve our wildlife laws to protect wildlife while allowing safe and enjoyable hunting. Today, with proper protection of game laws, our wildlife species are rarely threatened by

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excessive hunting. And when research shows that existing laws are not sufficient, modern wildlife management agencies quickly adjust laws to benefit wildlife.

Hunting regulations also serve to protect hunters and others who live near wildlife habitat. Many regulations, such as requiring deer hunters to wear blaze orange, are designed to keep hunters safe from injury during the hunt.

If wildlife management is to be effective, hunters must understand and obey wildlife laws.

## Predator Control

A predator is an animal that lives by killing other animals for food. Long ago, predators were tagged as bad animals and bounties (money rewards) were offered to control them. It was thought that control of predators would result in more wildlife. However, the bounty system was ineffective in controlling predators or increasing wildlife numbers.

The extent and effect of predation in a wildlife species depends on:

- the quantity, quality and distribution of cover
- abundance of the wildlife species
- abundance of predators
- other food available to predators (Animals that are alternate foods for predators are called buffers.)

Predation is a common and natural event. Predators usually capture and feed on prey animals, which represent surplus individuals (animals in excess of the available food or cover which the prey species need to survive.) Many of the animals used for food by predators likely would starve or die of exposure at some later time. Thus predation rarely acts as a limiting factor on prey populations. In fact, hunting is a special type of predation which wildlife managers use to help keep certain species of wildlife (such as deer) within the carrying capacity of their habitat.

In certain circumstances, predation can be detrimental to wildlife and predator control may be necessary or helpful. When a wildlife species is introduced into a new area to restore a population that was eliminated, the newly transplanted individuals are in unfamiliar surroundings. Their numbers are few and they may be unusually vulnerable to predators native to this area. Some short-term predator control may help this new population get started.

Another special case occurs when one or more individual predator(s) develop a habit of preying on livestock. Predator control directed specifically toward the individual(s) causing harm is necessary to preserve the economic interest of the farmer.

## Refuges

Refuges provide wildlife with protection from disturbance and suitable habitat for the purpose of increasing wildlife numbers. There are three general types of refuges: big game, waterfowl and nongame.

The goal of a big game refuge is to protect the breeding stock so the population can increase but the refuge can defeat its own purpose. Deer and elk, for example, may increase in numbers to the point where they exhaust the available food supply. Damage to the habitat and to the animals then occurs. If a big game refuge is to be successful, the laws must be flexible so that wildlife managers can open special hunting seasons to keep the animals at or below the carrying capacity of the habitat.

A waterfowl refuge may be a breeding area, a wintering area or a flyway refuge. Breeding areas provide nesting habitat for producing young. Wintering areas shelter the birds so they can survive until the next breeding season. Flyway refuges provide rest, food and safety during long migration flights.

Nongame refuges are often established to protect the habitat of some wildlife, usually rare or endangered species. Some nongame species live in areas where habitat is limited. If this habitat were altered or destroyed, the species would probably not survive.

Wildlife refuges are very effective when correctly used in combination with other management tools.

## Stocking

A purpose of stocking is to re-establish a species of wildlife into areas with restored habitat, but where the native wildlife species has not replenished itself. Stocking is most effectively done by trapping wild animals from established populations and transplanting them into other areas.

Many of the early stocking programs did not consider the limitations of habitat. If man introduces wildlife beyond the carrying capacity of the habitat, the animals will disappear. Good habitat can support a large wildlife population; poor habitat only can support a small wildlife population.

Severe weather or other factors may decrease wildlife numbers in good habitat, but populations usually recover when conditions improve. If the habitat is in good condition, stocking is usually unnecessary.

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## Introduction of Exotic Wildlife

The introduction of exotic species of wildlife is another form of stocking. The purpose is to introduce an exotic wildlife species into a habitat similar to its native habitat without displacing native wildlife or damaging the habitat. Most introduced exotics find their habitats unsuitable and disappear soon after release, although some have become established.

The classic success story is the introduction of the ring-necked pheasant. Introduced from China, this exotic found things to its liking, increased its numbers, and is now a well-established game bird in many areas. The chukar is another exotic that has been successfully established in many semi-arid regions. However, in many cases, these species failed to become established because climate, habitat or other factors were not appropriate.

Not all successful introductions of exotics have been desirable. The introduction of the starling resulted in the establishment of a highly undesirable agricultural pest.

## Habitat Management

Habitat is the key to wildlife survival, but wildlife habitat is declining at an alarming rate in the United States. Much habitat has been lost to urbanization and other uses as the human populations demands more living space, food production and so on. Other wildlife habitat has been destroyed by drainage of marshes and elimination of forests. Without habitat, no wildlife can survive.

The main purpose of managing habitat is to prevent existing wildlife habitat that is in good condition from being destroyed or lost.

Perhaps the most important thing each of us can do is support programs to maintain or improve wildlife habitat. Habitat is the key to wildlife survival. Some things which landowners can do to provide wildlife habitat include:

- Avoid needless clearing of brush and other vegetation from fence rows, field corners and edges of woodlots.
- Protect wildlife areas from livestock. Fences prevent livestock damage to wildlife habitat.
- Plant food for wildlife. You can plant grains, fruit bearing bushes, grasses and legumes (plants that have pod-like fruit or seeds) along fence rows, ditch and row banks, field edges or other unused land areas. A few outside rows of grain left standing near cover also provide food.
- Establish woody thickets or other types of cover. Small tracts of land (field corners, power and telephone right-of-way) are good spots for planting shrubs and trees. You can also pile up limbs from pruned or thinned trees to create cover.
- Create a pond or wetland area.

## Hunting and Trapping

Hunting and trapping are valuable management tools for helping maintain healthy wildlife populations at or below the carrying capacity of the habitat. When animals exceed the carrying capacity, the habitat may be damaged, and the excess animals will die. Hunting and trapping are closely regulated so that some of the excess animals in a population are removed each year. Thus, hunting and trapping can be used to manage many wildlife populations effectively and protect their habitat from damage.

Much anti-hunting sentiment is based on bad experiences with hunters. Thus, it is more anti-hunter than anti-hunting sentiment. To help solve this problem, support training schools to upgrade the quality of hunters. Be a sportsman in name and action.

Sport hunting and trapping also provide needed funding for wildlife management programs. The major sources of revenue are:

- The Pittman-Robertson Act, which provides federal money to state wildlife agencies through taxes collected on the sale of sporting arms and ammunition. A portion of Pittman-Robertson monies, specifically the taxes collected from the sale of archery equipment and handguns, goes to support state hunter education programs.
- the sale of hunting and trapping licenses and stamps.
- donations to management-oriented conservation groups. These funds are used to manage game and nongame animals. Thus, hunters and trappers are a major source of revenue for state wildlife management programs.

## **Public Education**

Education is essential to gain public understanding and acceptance of wildlife management programs. When people know more about wildlife and its needs, they support management programs. For example, some people are strongly opposed to hunting. They mistakenly think that sport hunting is responsible for seriously endangering wildlife species. In reality, it is man's other activities that have destroyed valuable wildlife habitat resulting in the extinction of some wildlife species.

## **Funding**

Be willing to spend more money on wildlife resources. Support legislation that will ensure adequate funding, from both hunters and nonhunters, for game and nongame management programs.

## **The Future of Wildlife**

The future of wildlife depends upon people. What we do with the land and how well we establish and obey conservation laws and regulations will determine how well our wildlife survive and reproduce. For these reasons, it is important that we understand the biological facts and the principles of wildlife management.

Understanding the facts is the first step to intelligent wildlife management. And supporting wildlife management principles bases on these facts in an important way that you can help wildlife.

## **Principles of Wildlife Management**

1. Wildlife management is the science of managing wildlife and its habitat, including man, for the benefit of all plants and animals in an environment.
2. Conservation is wise use.
3. Habitat is the key to wildlife survival.
4. Carrying capacity is the number of animals the habitat can support throughout the year without damage to the animals or the habitat.
5. If wildlife numbers exceed the carrying capacity, the excess will die.
6. Setting back plant succession to intermediate stages improves the habitat for most wildlife.
7. The birth and death rates of most species of wildlife are high.
8. Understanding and obeying intelligent wildlife laws are important ways to help wildlife survive.
9. Predator control is seldom effective. In good habitat, predators rarely depress wildlife populations.
10. The goal of a refuge is to preserve wildlife and wildlife habitat.
11. Stocking is most productive for restoring wildlife in areas where restored habitat has not been naturally repopulated.
12. Most introduced exotics find their habitats unsuitable and disappear soon after release.
13. The most important thing you can do to help wildlife is to prevent the loss or destruction of their habitat.
14. Hunting and trapping are used as management tools to remove some of the excess animals in a population without damaging the breeding stock.
15. Wildlife management programs for game and nongame wildlife are financed almost entirely by sportsmen.
16. Properly regulated sport hunting is not likely to cause any species of game animal to become endangered or extinct.
17. If wildlife management programs are to benefit wildlife, they must have public support and funding from both hunters and non-hunters.
18. Wildlife biologists have the knowledge and skills necessary to manage wildlife - all they need is public support.
19. Everyone has a responsibility to see that wildlife is correctly managed.

# Tennessee's Wetlands

Water is one of our most valuable resources. Wildlife needs clean water just as humans do. One major area of water that is needed by both humans and wildlife is a wetland. Wetlands are areas that connect water and land.

There are many different types of wetlands and they may be fed by fresh or salt water depending on their geographic location.

The wildlife and vegetation that are suited to wetlands depends on where the wetlands are found and how much water is available throughout the seasons of the year.

Wetlands comprise six percent of the earth's land surface. Swamps, marshes, bogs, and seeps are the most familiar types of wetlands.

One of the greatest values in maintaining wetlands is the role they play in maintaining the quality of our water, in controlling floods, and in providing habitat for an incredible diversity of species. Excess nutrients and polluting chemicals are also filtered out through wetlands and the habitat they provide for wildlife and a diversity of other species is enormous.

Acre for acre they are the most productive non-tropical ecosystem! Besides, wetlands are a great place to observe wildlife.

## Wetland Facts

1. The presence of mussels and snails indicates that water is relatively clean and free of pollution.
2. Migrating birds use wetlands on a seasonal basis to rest, feed, and raise their young.
3. More plant material is produced in a marsh than a cornfield. Wetland plants can produce 25,000 pounds of dry plant matter per acre; an acre of corn yields an average of 12,500 pounds.
4. One-third of all threatened and endangered plants and animals in the United States rely on wetlands for their homes.
5. Sixty acres of wetlands are destroyed each hour in the United States.

The General Assembly of the State of Tennessee has defined wetlands and bottom land hardwood forests. Part of that definition follows.

(a) "Wetlands" mean lands which have hydric soils and a dominance (fifty percent or more of stem count based communities) of obligate hydrophytes (plants that grow in water, or very wet earth). They include the following generic types:

- Fresh water meadows
- Shallow fresh water marshes
- Shrub swamps with semi-permanent water regimes most of the year
- Wooded swamps or forested wetlands
- Open fresh water except farm ponds
- Bogs

(b) "Bottom land hardwood forest" means forest occurring on alluvial soils in floodplains in which tupelo, blackgum, sweetgum, oaks, southern cypress, elm, ash, cottonwood; singly or in combination comprise a plurality of the stocking except where pines comprise 25 percent in which case the stand would be classified as oak pine.

Highlights of the above include:

- Tennessee's 1986 wetland act was enacted to preserve wetlands and bottom land hardwood forests.
- A good indication of a wetland is the soil type; it must be hydric (poorly drained); and a majority of the plant community must be obligate hydrophytes.
- Farm ponds are not included.
- Bottom land hardwood forests must have a majority singly or in combination of eight species of trees.
- The forests must occur on alluvial soils in floodplains. Alluvial soils are soils gradually deposited by moving water, as along a river bed or the shore of a lake.

## Values and Functions of Wetlands

- Hunting:** Migratory birds and waterfowl use these ecosystems for food, shelter, breeding, and wintering grounds.
- Fishing:** Nearly all fish and shellfish depend on wetlands for food and habitat during part of their life cycle.
- Boating:** Canoeists and kayakers enjoy wetlands because they are some of our last natural wilderness areas.
- Habitat:** Fish and shellfish live in wetlands when they are young. Wildlife also migrate through wetlands and many endangered species live there.
- Erosion control:** Wetlands buffer shorelines against erosion and bind the soil with their roots.
- Flood control:** Like natural sponges, wetlands absorb flood waters during heavy rainfall.
- Water quality/ Availability:** Wetlands are like giant kidneys, purifying water, processing nutrients, absorbing suspended materials as well as removing pollutants. During dry seasons, the water in the wetlands is slowly released into surrounding areas.
- Recreation:** Wetlands provide opportunities to photograph, hike, hunt, fish, walk, and boat. They are some of our most fascinating natural areas.

# Tennessee's Rare and Endangered Wildlife

*We human beings have been the primary culprits in causing wildlife to become endangered. On the positive side, we are also the key to their future survival.*

## Definitions

When the entire population of a certain species is in danger of dying out completely or becoming extinct, it is classified as "Endangered." An animal is classified as "Threatened" when it could become Endangered unless downward population trends are reversed.

## Species that have already been lost

Between 1600 and 1850, only five wildlife species became extinct in the United States and Puerto Rico. Since 1850, however, when our Industrial Revolution began, the rate of extinction increased twentyfold.

**Woodland Bison:** Herds of woodland bison, for example, once roamed throughout Tennessee. But by about 1800, four years after we became a state, they were extinct. With no legal protection, all of these magnificent animals were slaughtered for food, hides and tallow for candles.

**Carolina Parakeet:** The Carolina parakeet was a colorful bird found primarily in West Tennessee. Because there was no law to prevent it, they were ruthlessly hunted for their feathers which were used in women's hats. The last of these beautiful birds was sighted in our state in 1874 in Lauderdale County, near the Mississippi River. The last world sighting was in Florida in 1904.

## Success and Challenges

**Giant Canada Goose:** But not all the news is grim. The giant Canada goose is an example of how an animal can be rescued from the verge of extinction. This subspecies was thought to be extinct from 1920 until about 1960, when a small population was found in the upper Midwest. Good management has prompted their recovery, including more than 35,000 now living year-round in Tennessee.

**White-Tailed Deer:** Hunters' dollars have increased Tennessee's deer population from fewer than 2,000 in 1949 to over 800,000 in 1997.

**Wood Duck:** The colorful wood duck is another success story. The loss of their preferred nesting cavities in dead and dying trees once threatened their existence. But with the installation of millions of nesting boxes, the population of this spectacular water bird is being restored.

**Bald Eagle:** The bald eagle has been our national symbol since 1782. In 1994, it was down listed from Endangered to Threatened in Tennessee because of the help from many people.

## Tennessee's Problems and Projects

**Listed Species:** Tennessee has 92 wildlife species listed as either Endangered (64) or Threatened (28). A third classification, "Wildlife in Need of Management," has 89 species listed in Tennessee that could become Threatened unless special care is taken. With the help of several agencies and many concerned citizens, however, we are diligently trying to conserve and enhance these species.

**DDT Impacts:** Certain chemicals can kill raptors outright, and some, like DDT, can make their eggs infertile, or the shells so thin, the eggs break before hatching. But since DDT was banned from use in the United States in 1972, some raptors have shown encouraging response to recovery efforts.

**Hacking:** The Tennessee Wildlife Resources Agency is trying to restore natural nesting of raptors through a process called "hacking." Young birds are either brought into Tennessee or taken from existing nests, fed and released when they are old enough to fly. At maturity the birds tend to return and nest in the general area of their first flight. This process has been successful with bald eagles, ospreys, peregrine falcons, and Mississippi kites.

**Bald Eagles:** In mid-winter, over 13,000 bald eagles are usually counted in the "lower 48" states, with 400 to 500 normally wintering in Tennessee. From 1980 through 1995, 253 young eaglets were released in Tennessee at seven statewide hack sites. Bald eagles successfully hatched young in 1983 for the first time in 22 years in the state. They have gradually increased to 15 nests fledging 28 young in 1995. By the year 2000, there is a potential of more than 40 successful statewide nests, provided they are given the privacy they need to avoid premature abandonment.

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**Osprey:** The osprey, or fish hawk, is also showing signs of a comeback from the effects of pesticides and illegal shooting. From 1980 through 1989, 165 young ospreys were hatched in Tennessee. Successful nests have increased from about three in 1980 to over 60 in 1995. During 1994, it was down listed from Endangered to Threatened in Tennessee.

**Peregrine Falcon:** The Endangered peregrine falcon is one of the world's fastest birds, reaching speeds of up to 180 miles per hour in a dive. Because of DDT and other pesticides, it last nested in Tennessee in 1947. From 1984 through 1989, however, 34 were hatched at two East Tennessee mountain sites. In 1993 volunteers hatched 10 more, half in downtown Memphis and half in downtown Chattanooga. Nest boxes have been installed in Tennessee's major cities. The ledges of skyscrapers are sometimes mistaken by peregrine falcons as bluff nest sites.

**Cavity Nesters:** Other problems that concerned citizens and various agencies have addressed are the lack of natural nesting cavities in dead and dying trees or nesting sites occupied by the non-native starling. In these cases, artificial nesting boxes have been used to help more than 30 bird species in Tennessee, including the red-headed woodpecker, wood duck, bluebird, and the rare barn owl.

**Rare Mussels:** Our state has 35 federally Endangered mussels that face the same threats as fish. Since mussels serve as filters of water pollution, they are good indicators of water quality. Several of the more common mussel species support a \$17 million artificial pearl culture industry in Tennessee. Mussels and snails contain mercenene, a substance which is said to prevent or delay two types of cancer.

**Endangered Bats:** Other species in need of help are gray and Indiana bats- both federally Endangered. They, and other bat species, are invaluable for the tremendous numbers of insects they eat. Gray and Indiana bats live only in a few unique caves and have suffered declines from disruption of habitat, human disturbance, and pesticides. The TWRA has cooperative agreements with several cave owners for mutual protection of these special environments. In addition, the Nature Conservancy has purchased Tennessee's most outstanding gray and Indiana bat cave. Many people, especially in Europe, construct bat houses to attract more common bat species for controlling insects. If you are interested, contact the TWRA for bat house plans.

**River Otter:** The river otter is listed as Threatened, except for West Tennessee, where it was removed from this category in 1989. The straightening and widening of streambeds, called *channelization*, has destroyed habitat for this and many other species, reducing the productivity of fish, the favorite food of otters. Accidental and illegal trapping have also taken a toll. During 1984-94, 487 otters were stocked in Middle and East Tennessee.

**Rare Fishes:** Tennessee's wide variety of stream habitats supports at least 313 fish species, of which 32 are listed by the TWRA as Endangered or Threatened. Major threats include: soil erosion, coal mine run off, acid pollution, channelization, and impoundment of vital stream habitat.

# The Tennessee Wildlife Resources Agency

## Who we are

The Tennessee Wildlife Resources Agency is an organization of more than 500 professionals dedicated to the preservation, conservation, and enhancement of Tennessee's fish and wildlife for the enjoyment of this and future generations.

Established in the early 1900s and reorganized in 1974, the modern Tennessee Wildlife Resources Agency is funded primarily by sportsmen and plays a major, though often unseen, role touching many aspects of life for today's Tennesseans.

The agency's operations are directed by a 13-member commission of private citizens appointed by the governor.

## Hunting and Fishing License

The TWRA's License Division is one of the most familiar parts of the agency, handling the sale of hunting and fishing licenses, trapping licenses and the all-inclusive Sportsman License, as well as special permits.

## Law Enforcement

With at least one officer assigned to each of Tennessee's 95 counties, the TWRA's uniformed officers have the responsibility for enforcing Tennessee's hunting, fishing, and boating laws.

The agency also operates a covert law enforcement program designed to reduce poaching and illegal hunting practices, especially those involving such big-game species as black bear and deer.

## Endangered Species

Dedicated to the preservation of disappearing wildlife species, TWRA biologists work to both preserve and improve native populations of more than 70 endangered species ranging from eagles and peregrine falcons to several species of mussels and fish.

## Wetlands

Some 23,500 acres of Tennessee's rapidly vanishing wetlands are currently under the jurisdiction and protection of the TWRA, with an additional 25,000 acres under evaluation for the program.

Protection of these wetlands assures the continuation of the many wildlife species that depend on them for survival.

## Wildlife Management

The TWRA wildlife management programs have dramatically increased Tennessee's populations of white-tailed deer, wild turkey and other species favored by hunters by developing and improving habitats, and through release programs and/or reintroduction programs in areas where these species once thrived.

## Wildlife Management Areas

The TWRA has the responsibility for more than 85 areas containing some 1.3 million acres managed primarily for hunters and anglers.

With the addition of national wildlife refuges, approximately 1.5 million acres of Tennessee land and water are preserved for the benefit of wild residents.

## Forest Management

The TWRA has the responsibility for the management of some 195,000 acres of forest land within the agency's wildlife management areas. Many of these areas are intensely studied and analyzed by TWRA wildlife biologists gathering data for use in developing new and better habitat enhancement programs.

## **Hunter Education**

A required course for anyone born on or after January 1, 1969, before hunting in Tennessee, the Hunter Education program is designed to improve the knowledge and safety skills of participants as well as acquaint them with their responsibilities to landowners, fellow hunters, and the game they hunt. A schedule of courses may be obtained from any TWRA regional office.

## **Engineering and Construction**

The TWRA has its own engineering and construction staff capable of designing and building anything from a boat ramp to an access road. This division maintains some 165 boat launching ramps throughout the state.

## **Fish Management**

With more than 500,000 acres of surface water in large reservoirs, more than 100,000 farm ponds, 19,000 miles of warm-water streams and 2,000 miles of cold-water streams, Tennessee has long been famous for the variety and quality of its fishing.

TWRA biologists constantly monitor and evaluate game fish populations, as well as such nongame water species as mussels.

The agency also works closely with landowners assisting in such common farm pond problems as water quality and aquatic weed control.

The TWRA also manages 14 lakes ranging in size from 22 to 500 acres designed especially for anglers and family fishing.

## **Fish Hatcheries**

The TWRA operates eight fish hatcheries located in various parts of the state, raising such warm-water species as bass, crappie, bluegill, sauger, walleye, striped bass, and such cold-water species as rainbow, brown and brook trout in support of the agency's fish management efforts throughout the state.

## **Boating**

One of the TWRA's biggest responsibilities is the safe operation and registration of over a quarter of a million boats using Tennessee waters. Under federal or state laws all sailboats and mechanically powered boats are required to obtain a certificate of number. TWRA officers also annually check some 55,000 boats for compliance with the boating safety laws.

## **Boating Education**

Like the Hunter Education program, Boating Education is designed to improve both the knowledge and safety skills of the thousands of recreational boaters using Tennessee's vast water resources.

A home study course complete with a special video and manual is available by contacting the TWRA Boating Division in Nashville.

## **Nongame Species**

TWRA wildlife management programs have improved the habitat and population of many non-game species, ensuring that the public will always have the opportunity to appreciate and enjoy wildlife ranging from backyard songbirds to such small mammals as bats, and many species of reptiles and amphibians.

## **Wildlife and Aquatic Education**

The TWRA conducts wildlife and aquatic education workshops throughout the state providing teachers with both free materials and a basic background in wildlife biology, game identification and management. Each workshop is tailored with special emphasis on the wildlife native to the area in which it is conducted.

## Geographic Information System

A sophisticated computer program that stores, organizes, and analyzes natural resource information, G.I.S. provides detailed state-of-the-art survey information. An invaluable tool for developing and improving habitats, the system also provides information about boundaries, roads, access systems, water resources, forest stands, land types, wildlife openings, and regeneration cuts.

As a result of this system, accurate, updated maps of agency-managed properties are available to hunters and fishermen.

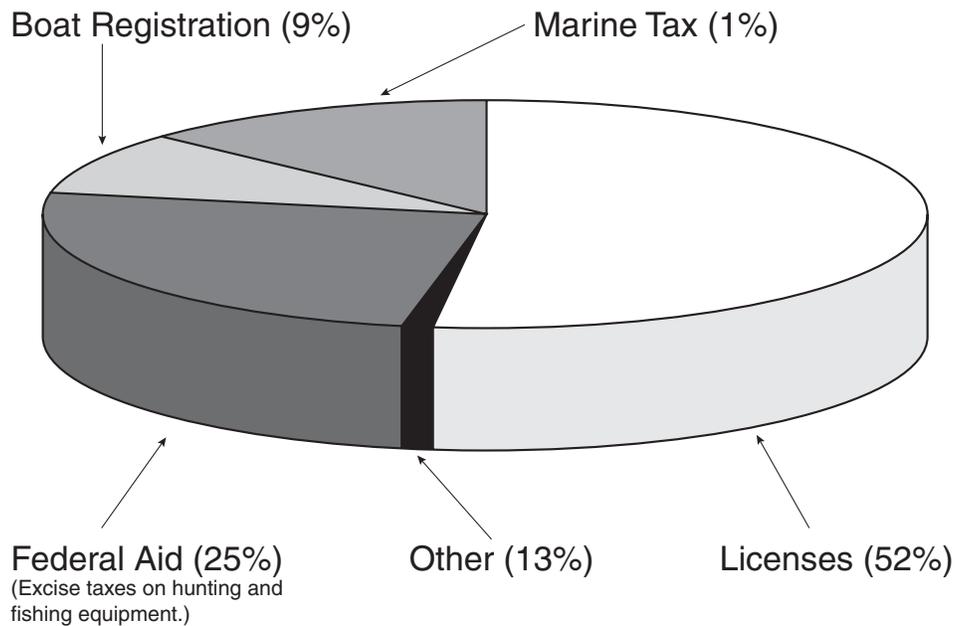
## Tennessee Wildlife Magazine

Published six times per year, this full-color, professional outdoor magazine is complimentary to purchasers of a Tennessee Sportsman License.

The magazine is also available through subscription by contacting the Information and Education Division in the agency's Nashville office.

## Who Pays the Bills?

The Tennessee Wildlife Resources Agency has six major sources of funding:



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