NC STATE UNIVERSITY

Reptiles and Amphibians in your backyard

On a warm North Carolina spring night, after a refreshing rain, you are likely to be serenaded by the most boisterous of symphonies. Northern and southern cricket frogs make up the percussion section, and Cope's gray treefrogs add their melodic, soprano trills. Green frogs pluck banjo strings while Fowler's toads add their rhythmic singsong. It is a wildlife chorus unequaled outside of the southeastern United States, which boasts more than half of the country's reptile and amphibian species. Indeed, more than 100 species of reptiles and amphibians found in this region occur nowhere else in the world.

Amphibians and reptiles are an important part of the rich ecological heritage of North Carolina, and they play important roles in North Carolina's ecosystems. As urban development continues to expand across the state, it is important that North Carolina's citizens recognize the value of reptile and amphibian populations and learn how to conserve their habitats.

The Lives of Amphibians and Reptiles

Scientists combine amphibians and reptiles in a group called *herpetofauna*, or *herps* for short. This name comes from the word *herpetology*, which is the scientific study of reptiles and amphibians. Why combine reptiles and amphibians in the same group? Because they share some common characteristics. Unlike mammals and birds, all herps (along with fish) are ectotherms. Ectotherms (commonly called "cold-blooded animals") do not rely on their metabolism or other physiological processes (such as sweating and shivering) to maintain a constant body temperature. Instead, ectotherms use behavior and the environment to regulate body heat. For instance, some of the more easily seen herps are pond turtles basking on logs and lizards sunning on fence posts or porch railings to raise their body temperatures. Conversely, a reptile or amphibian might slip into a shady pond to cool down.

Although basking turtles and lizards are fairly common sights, some behaviors associated with ectothermy can make herps more difficult to locate. Some hibernate during cold weather, drastically slowing down their body processes and remaining dormant and hidden until temperatures rise. Some herps aestivate (a behavior much like hibernation) during hot, dry times when moving about might cause them to overheat.

Even when temperatures are favorable, reptiles and amphibians often remain hidden from view. Frogs like the American bullfrog (Figure 1) spend much time in the water, where they quickly submerge when startled. Many snakes, such as the eastern hognose snake (Figure 2), box turtles, and toads are well camouflaged and blend easily into the colors of the forest floor. Salamanders dwell under logs, leaves, and rocks. And because ectothermic animals do not expend energy to regulate their body temperatures, they eat less often than endotherms, so they are less likely to be seen foraging for food.

Jeff Hall

Figure 1. The American bullfrog *(Rana catesbeiana [Lithobates catesbeianus])* is the largest frog found in North Carolina.

Herps in the Ecosystem

Herps play important roles in the ecosystems where they live. Some are predators that keep numbers of their prey in check. Examples include salamanders that eat insect larvae, or snakes that eat mice and other rodents. Herps are found on the other end of the food chain as well: frogs are important prey for many species of fishes, birds, mammals, and reptiles.

Herps can serve as good indicators of environmental health. A healthy, diverse herp community indicates that an area can support the plants and insects herps need for food and that the area has a variety of habitats available for

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Figure 2. The eastern hognose snake (*Heterodon platirhinos*) uses its upturned snout to dig in sandy soil. It will play dead if threatened.

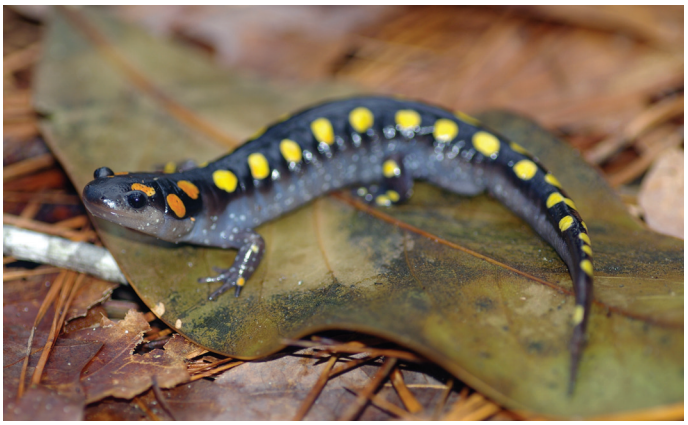

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Figure 3. The spotted salamander (*Ambystoma maculatum*) can be found in forests through much of the eastern United States.

wildlife. Herp absence from an area where one would expect to find them can indicate that there is an environmental problem.

Amphibians and reptiles have many similarities, but they also have some big differences. Let's explore those now.

Amphibians

Amphibians include salamanders, frogs, and toads. Typically, amphibians eat insects and other small invertebrates. Some larger species can eat small vertebrates, including fish, other amphibians, and small birds. Many tadpoles (the fully aquatic larval form of frogs and toads) eat mostly plants.

Amphibians' skin is permeable, which means it is not a solid barrier between the environment and the insides of their bodies. Permeable skin allows amphibians to absorb oxygen and release carbon dioxide (in other words, respire) through their skin. The skin must remain moist for this process to work. Permeable skin is not the only way that amphibians breathe. They might have lungs similar to those of mammals or birds, gills similar to those of fish, or a combination of permeable skin, lungs, or gills for breathing. Many amphibians use different methods of breathing throughout their lives, depending on their stage of development.

The drawback of having permeable skin is that toxins and pollutants from the environment can pass through the skin and into an animal's body. These toxins and pollutants might disrupt development or reproduction, or even kill the animal. This is one reason the presence of amphibians is an important indicator of environmental health—many species cannot survive and reproduce in polluted water.

As a group, amphibians have complex and varied life histories. Frogs and some salamanders like this spotted salamander (Figure 3) lay eggs in water, and their young hatch as aquatic larvae but live their adult lives on land or a combination of land and water. Some amphibians (especially some salamander species) lay eggs on land in moist places. Amphibians' eggs do not have shells, and, like adult amphibians, they are vulnerable to pollutants.

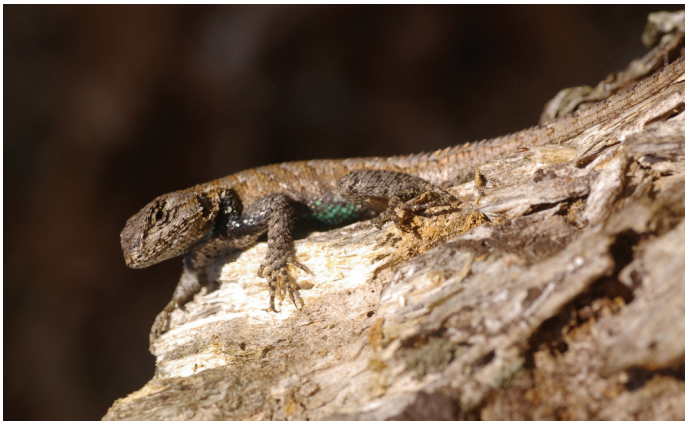

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Figure 4. An eastern fence lizard (*Sceloporus undulatus*) basks on a log to warm its body.

Different species of amphibians need specific habitats based on their own life histories. Generally speaking, for amphibians to survive in an area they need:

- Access to aquatic or wet sites (pools, ponds, streams, seeps, or marshes) to lay eggs, and in some cases, to live as adults.
- Access to terrestrial sites (dry land) for adult life, breeding, and movement between aquatic habitats.
- Access to shelter (damp, rotting logs and stump holes) to protect them from predators and weather and to keep their skin moist.

Reptiles

Reptiles include snakes, lizards, turtles, and crocodilians. Unlike amphibians, reptiles have scaly, impermeable skin that does not need to stay moist. All reptiles use lungs to breathe.

Reptilian diet varies widely between groups and species and can include small vertebrates (such as birds, mice, and frogs), invertebrates (insects and crustaceans), and plants.

Most reptiles lay leathery-shelled eggs on dry land, while some snakes (especially aquatic and semi-aquatic species) give birth to live young.

In general, for reptiles to survive in an area, they need:

- Access to basking sites to warm in the sun or absorb heat from a surface that has been warmed by the sun (such as a log) (Figure 4).
- Access to shelter, such as trees, leaf litter, shrubs, downed logs, or snags (standing dead trees) to cool off, to hide from predators, and to ambush prey.
- Access to hibernacula, often stump holes or crevices under rocks or stones, to hibernate through the winter.
- For aquatic turtles, alligators, and some aquatic snakes: access to a safe, dry, land buffer along the water's edge to lay eggs.

Amphibians Common to Urban/Suburban Areas

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Figure 5. A green treefrog *(Hyla cinerea)* is well camouflaged as it rests on a green stem.

Frogs and Toads

American toad *Bufo [Anaxyrus] americanus*
Fowler's toad *Bufo [Anaxyrus] fowleri*
Southern toad *Bufo [Anaxyrus] terrestris*
Northern cricket frog *Acris crepitans*
Southern cricket frog *Acris gryllus*
Cope's gray treefrog *Hyla chrysoscelis*
Green treefrog *Hyla cinerea* (Figure 5)
Squirrel treefrog *Hyla squirella*
Spring peeper *Pseudacris crucifer*
Upland chorus frog *Pseudacris feriarum*
Eastern narrowmouth toad *Gastrophryne carolinensis*
American bullfrog *Rana catesbeiana [Lithobates catesbeianus]*
Green frog *Rana [Lithobates] clamitans*
Pickerel frog *Rana [Lithobates] palustris*
Southern leopard frog *Rana sphenocephala [Lithobates sphenocephalus]*

Salamanders

Marbled salamander *Ambystoma opacum*
Spotted salamander *Ambystoma maculatum*
Eastern newt *Notophthalmus viridescens* (Figure 6)
Southern two-lined salamander *Eurycea cirrigera*
Blue Ridge two-lined salamander *Eurycea wilderae*
Northern dusky salamander *Desmognathus fuscus*
White-spotted slimy salamander *Plethodon cylindraceus*
Atlantic Coast slimy salamander *Plethodon chlorobryonis*

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Figure 6. Eastern newt *(Notophthalmus viridescens)*, as an eft (a terrestrial juvenile). This is the red-spotted form of the eastern newt.

Reptiles Common to Urban/Suburban Areas

Snakes

Worm snake *Carphophis amoenus*
Black racer *Coluber constrictor*
Ringneck snake *Diadophis punctatus*
Corn snake *Elaphe guttata [Pantherophis guttatus]*
Rat snake *Elaphe obsoleta [Pantherophis alleghaniensis]*
Eastern hognose snake *Heterodon platirhinos*
Eastern kingsnake *Lampropeltis getula*
Rough green snake *Opheodrys aestivus* (Figure 7)
Eastern garter snake *Thamnophis sirtalis*
Copperhead *Agkistrodon contortrix*
Rough earth snake *Virginia striatula*

Turtles

Common snapping turtle *Chelydra serpentina*
Painted turtle *Chrysemys picta*
Eastern box turtle *Terrapene carolina* (Figure 8)
Yellowbelly slider *Trachemys scripta*

Lizards

Green anole *Anolis carolinensis*
Eastern fence lizard *Sceloporus undulatus*
Five-lined skink *Eumeces [Plestiodon] fasciatus*
Broadhead skink *Eumeces [Plestiodon] laticeps*
Southeastern five-lined skink *Eumeces [Plestiodon] inexpectatus* (Figure 9)

Figures 7-9. Left to right: rough green snake *(Opheodrys aestivus)*, eastern box turtle *(Terrepene carolina)*, southeastern five-lined skink *(Eumeces [Plestiodon] inexpectatus).*

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Herps in Developed Areas

Before considering how to share our land with reptiles and amphibians and protect them, we must understand how human activities might threaten their populations. Once armed with this information, we can manage and use the land in harmony with wildlife's needs.

North Carolina's human population is rapidly expanding, especially in urban and suburban areas. The biggest threats to herps from development include habitat loss and fragmentation, traffic hazards, and pollution (Figures 10 – 12).

Habitat loss and fragmentation

Habitat is lost when a natural area is converted into a developed area that herps no longer can use. Filling in low-lying areas to level the land eliminates pools used to breed, hide, or cool off. Clearing forests removes sheltering trees, leaves, shrubs, and access to hibernacula that protect animals and provide safe nesting and hibernation sites.

Habitats are fragmented when roads, neighborhoods, shopping centers, or other developments divide them, risking exposure to predators, vehicles, and the weather as herps move between the smaller habitat patches. If development isolates a lake, pond, or stream from drier areas or disturbs a particularly sensitive habitat, it will be especially likely to increase mortality rates for herps.

Traffic hazards

Nearly everyone has seen an eastern box turtle whose shell was crushed as it tried to cross a highway. Snakes basking on roads and frogs dispersing from their birth ponds also are frequent victims of vehicles. Herps have nearly no chance of surviving a trip across a heavily traveled (15,000 vehicles/day) road.

Sedimentation and Pollution

Sedimentation occurs when rain washes sediment such as dirt or silt into streams or other wetlands. Sedimentation increases during construction because exposed dirt erodes easily during rainstorms. After construction is complete, rainwater runs quickly across impervious surfaces such as concrete, asphalt, or buildings, carrying sediment and debris into nearby bodies of water. Sedimentation clouds the water and fills hiding places between rocks. Animals cannot get the oxygen and food they need from the muddy water, and the plants they eat cannot survive.

In addition to washing sediment into streams, rainwater washes toxins, including insecticides, herbicides, fertilizers, and petroleum products, into waterways and low-lying wetlands. Toxins poison amphibians directly through their permeable skin or eggs; herps that eat contaminated prey become sick. Fertilizers washed into ponds and streams can cause algal blooms that make laying eggs impossible for amphibians, reduce the amount of oxygen in the water, and kill the invertebrates that amphibians eat. Insecticides reduce herps' food supply, as insects make up much of the prey for both reptiles and amphibians.

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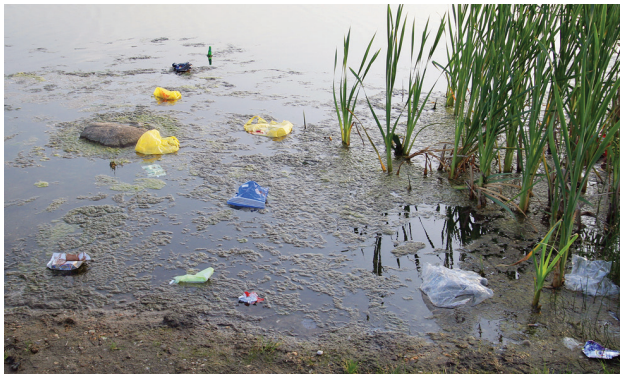


Figures10-12. Threats to reptiles in developed areas include habitat loss and fragmentation, traffic hazards, pollution, and increased sedimentation due to construction.

Sharing the Land with Amphibians and Reptiles

Creating a Backyard Habitat

People can do a lot to help conserve herp populations right in their own backyards. You can help by planning for wildlife when you decide how to manage your lawn and garden. Many of the same practices that will make your backyard attractive to herps also will attract other wildlife such as birds and butterflies.

Part of managing your yard for herps requires creating or improving habitat. To help provide for herps' habitat needs, you can:

- Add a pool or pond (see sidebar). Include native plants such as pickerelweed (*Pontederia cordata*), but do not add fish, as they will eat amphibian eggs and larvae. If you are concerned about mosquitoes, you can use treatments available at gardening stores that contain a chemical named *Bt-israelensis* (*Bt-i*) and marketed under the name *Mosquito Dunks*. These tablets are added to pools or other standing water and prevent mosquito larvae from surviving, but they do not harm other wildlife. Dragonflies are predators of mosquitoes, so planting underwater vegetation where dragonfly nymphs can hide and plants where adult dragonflies can perch and lay eggs will help attract them to your pool. Additionally, some salamander larvae prey upon mosquito larvae.
- Select native species for your garden. Native wildlife species survive best when surrounded by plants that are native to the region in which they live. Exotic plants, especially those that grow uncontrolled, can disrupt the natural ecosystem in your yard. For information on native plant species in the Southeast, visit the Going Native website at http://ncsu.edu/goingnative.
- Provide shelter (see sidebar). Providing shelter for herps can mean building a structure or simply not removing shelter that already is present. Dead trees, stumps, and taller grass all provide good protection for herps. Consider building rock piles or walls near a pond, pool, or wet area to provide both shelter and basking sites. Brush piles placed on dry land near a tree, bush, or thicket are readily used by herps—just be sure not to include chemically-treated wood.

Good habitat is wasted if your yard is otherwise unsafe for herps. To reduce hazards to herps, you should:

- Limit chemical use. Remember that storm drains lead directly to streams. Apply herbicides, insecticides, and fertilizers only in the smallest amounts necessary and only when absolutely needed. Always follow the instructions on the labels. Avoid using any chemicals near water sources and storm drains, unless labeled for such use. Rinse excess or spilled fertilizer off your driveway onto the lawn so it does not wash into storm drains when it rains. If your car is leaking oil, repair it and clean up the spill so that the oil does not wash into streams.
- Control household pets that might harm herps or their habitats. Outdoor cats and dogs prey on lizards and a variety of other wildlife. Studies have shown that up to 90 percent of outdoor domestic cats' diet can be wild animals. Dogs trample leaves and disturb garden pools. Keep your

Adding a Water Feature

Mike Dunn

Figure 13.

A water feature like the one in Figure 13 is one is an excellent habitat for herps. It provides aquatic habitat, and a rock wall for shelter. Keep in mind, however, that an elaborate water feature is not necessary. A large trashcan filled with rain water will attract treefrogs in the spring. If you do choose to build a minipond, keep these ideas in mind:

- Try to choose a location within ½ mile of another pond or pool, and in a place where animals can move safely back and forth between them.
- Position the pool so that it has sunny and shady areas. This way it will not get too warm, but will provide basking sites on exposed logs, floating plants, or rocks.
- Use a flexible liner or a plastic pre-formed pool to prevent the water from soaking into the ground.
- Deeper (30 inches or more) water may be necessary to ensure the entire pond does not freeze in the winter, killing dormant animals.
- Provide wide, shallow areas for easy entrance and exit by animals, and deep areas for hiding places and aestivation.
- Include native plants, rocks, and branches that are placed in or along the edge of the water.
- Place aquatic plants in underwater pots so that their growth can be confined.
- Algae may bloom in a newly established pool or pond. In a month or two, the ecosystem should come into balance. Be sure to keep all nutrients and fertilizers out of the water to prevent excessive algae.
- Allow some dead leaves and other debris to settle in the bottom of the pool to provide shelter and breeding sites.
- Native plants and other natural features (e.g., dead vegetation, snags, and logs) provide great cover for wildlife. Other features you can add include brush piles, rock piles, and amphibian houses.

cat indoors and restrict your dog from wildlife habitats to maintain healthy herp populations in your yard.

Once you have created a healthy habitat for amphibians and reptiles, wait for them to arrive naturally. Never move herps from a wild habitat to your yard. It may take several months for them to start appearing—longer if you are farther away from other natural habitat.

You can view your new backyard inhabitants with binoculars, especially close-focusing binoculars, and you may notice signs of herps such as shed skins or eggshells. Most of the time you can learn a lot by viewing from a distance, but a close-up look is very interesting, especially for children. If you choose to handle herps you find in your yard, do so minimally and with great care. Handling an animal risks injuring it or, in the case of amphibians, exposing it to any chemicals you might have on your hands from soap, lotion, or insect repellant. Some species can inflict injuries from bites or scratches if carelessly handled.

A note about venomous snakes: North Carolina is home to six venomous snake species (Figure 17). Copperheads are the most commonly found backyard venomous snake in North Carolina. They are secretive and typically are not aggressive, and pose a threat only if provoked. If you find a venomous snake in your yard, keep pets and small children who might disturb the snake away from the area where it was seen and leave it alone.

Thinking Beyond Your Backyard: Neighborhood and Greenspace Development

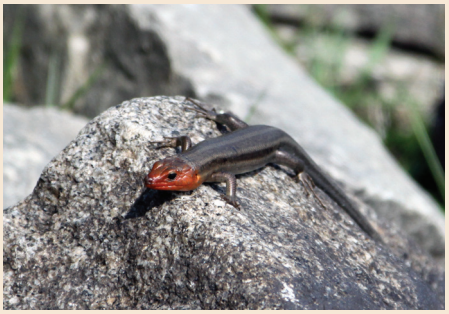
You don't have to limit your desire to share the land with herps to your own backyard. Encourage your neighborhood, community, or town to engage in responsible, wildlife-sensitive development. Urge developers to limit chemical use and landscape with native plants. Other wildlife-friendly practices developers can incorporate into their plans include:

- Protect seasonal wetlands during construction. Undisturbed, low-lying areas that are seasonally wet are particularly important for herps. These temporary, or ephemeral, pools often stay wet just long enough for aquatic larvae of many frogs, toads, and salamanders to hatch and metamorphose into terrestrial adults. There are no fish in them that might eat amphibian eggs, so they are relatively safe places to lay eggs. These pools provide a good prey base of insects and vegetation.
- Do not disturb buffer zones adjacent to wetlands. Protecting upland habitats is important so that many turtles and other pond-dwelling herps can safely lay their eggs out of the water. Many salamanders that lay their eggs in ephemeral pools live in the adjacent uplands during most of the year.
- Leave or create safe corridors between habitats. Amphibians need both wet and dry sites, and they need to be able

Providing Shelter for Herps

Figure 14 . Log/Brush Piles

- Firewood or logs stacked in an organized arrangement provide shelter.
- Brush piles consist of a variety of sizes of sticks and limbs and are not as orderly as log piles.
- Put larger diameter logs on the bottom to create bigger hiding places. Criss-cross smaller branches on top, and add a native flowering vine such as Carolina jessamine *(Gelsemium sempervirens)* to cover the pile.
- A finished dome-shaped brush pile about 5 feet wide at the base provides effective shelter for a variety of wildlife species.



Michael Smith

Figure 15. Rock Piles

- Place larger stones on the bottom to create pockets and caves. PVC pipe can be added to the interior to create tunnels.
- Making a rock wall (essentially a long, narrow rock pile) provides shelter and a protected corridor for travel.
- Placing rocks in a sunny area will provide basking sites for turtles, snakes, lizards, and butterflies.

Note: Pictured above is a five-lined skink *(Eumeces [Plestiodon] fasciatus)*.

Jeff Hall

Figure 16. Amphibian houses

- Children may enjoy creating houses for amphibians out of upside-down clay flower pots that have a small section of the lip cracked off for a door. Place these in a shady section of the yard for toads and salamanders to find.
- A larger shelter can be constructed by digging a 2-inch-deep depression in a shady area and covering it with a piece of untreated plywood. Prop one side of the plywood up with fist-sized rocks to provide an entrance. You can cover the plywood with mulch or old leaves, and plant native wildflowers around it.

Note: Pictured above is a Fowler's toad *(Bufo [Anaxyrus] fowleri)*.

to move back and forth between these areas freely. Reptiles need to be able to disperse to mate and breed. Corridors between habitats should not be intersected by roads, should have adequate cover, and are most effective if they are at least 300 feet wide.

- Reduce potential for road kill. Community planners should reduce speed limits, install speed bumps, and put up signs alerting drivers where herps and other wildlife are likely to cross roads. Installing fences and culverts or amphibian tunnels can help route reptiles and amphibians safely under a roadway. Avoid new road construction around critical herp breeding wetlands.
- Minimize sedimentation. During development, construction workers should leave the soil as undisturbed as possible. Disturbed and compacted soil disrupts habitat for fossorial species (species that live underground) and increases erosion. If installed properly, sediment-catching silt fences can be helpful during construction.
- Protect streamside vegetation during development. Leaving streams intact and stream banks un-mowed provides cover and helps filter sediment and toxins out of the water before they enter streams and other wetlands.

The next time you hear the symphony of frogs greet you on a warm evening, you will have a better appreciation for the amazing lives of the diverse amphibians and reptiles that live in North Carolina. Even more importantly, you will know some simple, enjoyable, and effective steps that you can take to ensure the symphony continues year after year.

All photos in this grouping by Jeff Hall

Figure 17. North Carolina's six native venomous snake species. Clockwise from upper left: timber rattlesnake (*Crotalus horridus*); copperhead (*Agkistrodon contortrix*); pigmy rattlesnake (*Sistrurus miliarius*); cottonmouth (*Agkistrodon piscivorus*); eastern diamondback rattlesnake (*Crotalus adamanteus*); eastern coral snake (*Micrurus fulvius*).

For more information

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PARC — Partners in Amphibian and Reptile Conservation. http://www.parcplace.org/.

Prepared by

Jill Anderson, NC Certified Environmental Educator and Academic Advisor, Department of Biology, NCSU

Jeffrey C. Beane, Collection Manager for Herpetology, North Carolina Museum of Natural Sciences

Jeffrey G. Hall, Partners in Amphibian & Reptile Conservation Biologist, NC Wildlife Resources Commission

Christopher Moorman, Associate Professor and Coordinator of the Fisheries, Wildlife, and Conservation Biology Program, NCSU

In the publication banner are pictured an eastern box turtle *(Terrapene carolina)*, (photo by Trip Lamb); a marbled salamander *(Ambystoma opacum)*, (photo by Trip Lamb); and an eastern garter snake *(Thamnophis sirtalis)*.

Some animals in this document have recently been assigned new scientific names.
For animals that have had recent name changes, their scientific names are listed in the format, *'Previous name [new name]'.*

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