SPECIAL FEATURE

Return of the Eastern Indigo

June 16, 2010, was simply another hot summer day to many, but for Eastern indigo snake conservation, this day marked a point in time when the indigo snake could once again be seen in Alabama. On this day 17 Eastern indigo snakes left their small confining tubs, in which they had been reared over the previous two years, and entered the wilds of southern Alabama. These 17 snakes, with their newly found freedom, brought Eastern indigo snake conservation back to Alabama in a very tangible manner. The simple act of placing the snakes in the wild was of monumental importance in the effort to establish a self-sufficient population of the Eastern indigo snake in Conecuh National Forest.

By

Jim Godwin, Alabama Natural Heritage Program, Environmental Institute, Auburn University

and

Mark Sasser, Nongame Wildlife Coordinator, Alabama Division of Wildlife and Freshwater Fisheries

BILLY POPE

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The **Eastern indigo snake** *(Drymarchon couperi)* was once more widespread across the Southeast but disappeared from the landscape of Alabama, Mississippi and South Carolina as the longleaf pine forests were felled, converted and fire suppressed. As the forests declined, so did the numbers of gopher tortoises. A localized threat of unknown impact is the "gassing" of gopher tortoise burrows to drive out Eastern diamondback rattlesnakes. This is a technique employed by rattlesnake hunters; gasoline is introduced into the tortoise burrow and the fumes force out the rattlesnake. Gasoline introduced into gopher burrows is known to debilitate and kill any inhabitants. What effect this had upon the numbers of indigo snakes across south Alabama is unknown, but what is unquestionable is the fact that indigo snakes would have been killed if they were present in a gassed burrow. This practice has since been outlawed by the Alabama Department of Conservation and Natural Resources.

WHY ARE INDIGOS IMPORTANT?

Because the indigo is the largest snake in North America, the sight of one of these majestic blue-black serpents leaves one with a memorable experience. Also, filling the role of top snake predator, the indigo snake dominates other snake species. Where indigo snakes are seen in great numbers, the landscape is an expansive mosaic of longleaf pine forests, wetlands, and sandhills. Thus, a thriving population of the Eastern indigo snake is symbolic of wilderness and an ecologically sound longleaf pine ecosystem. This stately forest dweller has been missing now from Alabama for over 50 years. Returning the snake to Alabama is an investment in the future of our natural heritage, offering our descendants the opportunity to see first-hand a piece of Alabama natural history unavailable to recent generations. Finally, as a federally threatened species, a successful reintroduction leading to a viable, growing population is one more step in the recovery of the snake.

Indigo snakes are well known as predators upon other snakes, including rattlesnakes and copperheads, as well as rodents, birds, frogs, turtles and fish. The indigo snake will eat almost any other animal that it can catch and overpower. The young indigo snake is vulnerable to becoming the prey, but because it grows quickly, with adults often exceeding 6 feet in length, the animals that can attack an indigo become fewer and fewer. Hawks, coyotes, raccoons and foxes are some, if not most, of the predators of adult indigo snakes, but long-term, man has proven to be the most dangerous.

One very interesting aspect of the biology of the indigo snake is that it is often active during winter at times when other snakes are not. Their use of gopher tortoise burrows, stump holes and underground root holes aids in explaining this behavior somewhat as indigo snakes are often seen basking near tortoise burrows on warm, clear winter days. Oddly enough, these snakes also breed during the winter and early spring months.

REINTRODUCTION PROJECT

Since Alabama has no populations of wild indigo snakes, what is the source of the snakes that were released in 2010? The short answer is that they came from Georgia in an area that lies about 350 miles due east of Conecuh National Forest. However, we're not going to Georgia and "harvesting" snakes, hauling them back to Alabama, and simply putting them out. The process is a bit more complicated and done with scientific scrutiny.

Gravid female snakes, those carrying eggs, are captured in Georgia and brought back to a lab at Auburn University. Once the females


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Left: At approximately two years of age, each indigo snake is implanted with a radio transmitter.

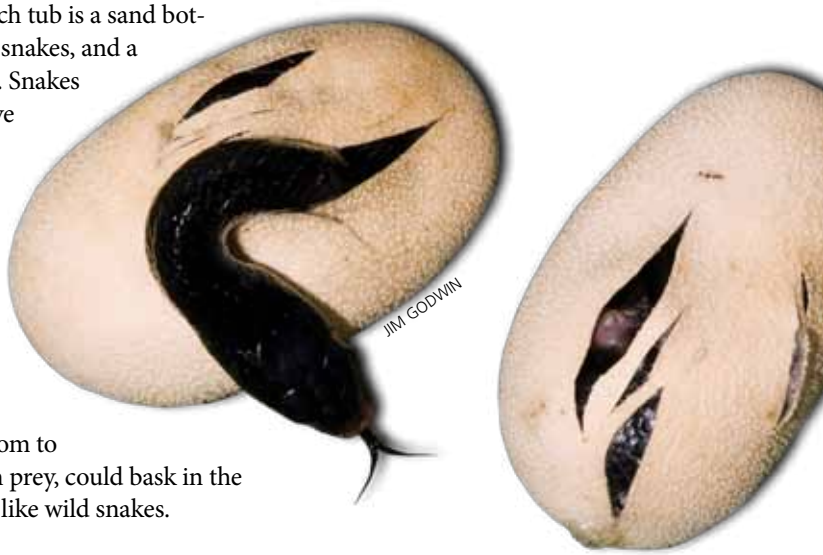
Top: A team of scientists at Auburn University anesthetizes the snakes and then implants the radio transmitter.

have laid their eggs they are then transported back to their site of capture and released .While at Auburn, great care is taken to ensure they remain healthy. Eggs are incubated and hatched in the lab and the young are then raised in captivity for almost two years. At that age, they are large enough to have a small radio transmitter surgically implanted.

Indigo snakes in the wild are difficult to find but the use of radio transmitters allows tracking of snakes to assess movements and survivorship. Our approach to introducing the snakes into the wild is being done through two methods – a hard release and a soft release. The hard release is merely locating a spot in the forest that we think is suitable for the snake, placing it on the ground, and allowing it to crawl away. The soft release method is identical except that it's being done within a large pen. Why the two methods? This is to test for the best way to keep snakes in an area and limit their movements. The idea is that snakes placed in the pens will have higher survivorship than those roaming the forests uncontained.

One additional technique is being employed to provide snakes with outside experience before being released and that is with snake tubs. The snake tubs are large fiberglass containers about 5 feet deep and 10 feet across set in a field. In each tub is a sand bottom, cover for the snakes, and a container of water. Snakes were allowed to live in these tubs for a few weeks and this gave them an opportunity to experience outside environmental conditions before being released. They had more room to roam, had to catch prey, could bask in the sun, and act more like wild snakes.

Females lay a single clutch of eggs of 4 to 12 eggs. The eggs are large, nearly 3 inches in length, are elongate-oval, cream-colored, with a granular surface. The large eggs produce large hatchling snakes that are about 16 inches long, and weigh about 1.5 ounces.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Wildlife biologists Jim Godwin, left, and Mark Sasser release an Eastern indigo snake into the wild on the Conecuh National Forest in south Alabama.

RELEASE DATE

Over the course of a few hours on that hot June day, 17 snakes, each carrying a radio transmitter within its body, were set free. Up to this point all their needs were taken care of with a secure place to live, plenty of food, and no threat from predators. But once turned loose, all that changed. Now the snakes had to find a safe home, locate and capture food, and do their best to avoid being eaten.

The big question on everyone's mind was, "Will they survive?" Other questions were, "What will they eat?" "Can they avoid being eaten?" "Will they eat each other?" Cannibalism has been reported with indigos.

Answers began to emerge the following morning when one of the snakes was seen eating a copperhead. So, for at least one snake, the answer to what will they eat was "copperhead." Later that answer could be expanded to "rat snake" and "black racer." Indigo snakes are known to be strongly ophiophagus, which means one of their preferred food items is other snakes, and as far as we know that means any other snake.

A TIME TO BURN

The longleaf pine forests of the southeastern United States are known as a fire climax community. These forests must periodically burn or hardwood tree and mid-story shrub species will encroach and crowd out the longleaf and understory species of forbs and grasses. Gopher tortoises and indigo snakes became adapted to living within the longleaf forests to the extent that a dramatic change of the forest leads to a loss of the tortoise and snake, so not only does the forest need fire but so do the tortoise and snake. Before widespread human settlement, fires occurred naturally, but now fires are set under manageable conditions with a stated goal in mind.

For Conecuh National Forest the goal is restoration of the longleaf pine forest. Heavy fuel loads, or combustible organic material, on forest floors may not allow for a safe burn at a time that would be most ecologically useful. Thus to reduce forest floor fuel levels, a burn will be done to establish a level of safety for future burns. This was the case in January 2011 when a prescribed burn was set around the snake pens. The burn outside of the pens was done during the dormant season, but with this accomplished a growing season burn can be set within the pens with the purpose of killing encroaching hardwoods and shrubs.

Five snakes, possibly six, were known to be in the area that was burned, thus raising another rather important question: "Can the snakes survive a fire?"

The indigo snake uses gopher tortoise burrows, mammal burrows, stump holes, and root channels, which are all underground refugia. Where do you think a snake adapted to living in a forest that often burns will be when the fire is raging overhead? We learned immediately after the fire that every surviving snake was underground as the flames scorched the forest above.

Prescribed fire is a necessary management tool for longleaf pine forests. Eastern indigos will commonly use underground burrows as refuge from fire. After a prescribed fire on the Conecuh National Forest, an Eastern indigo snake was seen, unharmed, traveling through the burned area.

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INDIGO UPDATE

On March 14, 2011, six indigo snakes that had been released in Conecuh National Forest the previous summer underwent a second round of surgery to have their radio transmitters replaced. The transmitters first used in the snakes had to be small because the snakes were small, but with a small transmitter comes a shorter battery life. The replacement transmitters are larger and will provide about two years of service before a replacement is needed.

Initially seven snakes from the Conecuh release were expected for a transmitter replacement, as these seven were being located on a regular basis. (The total number of snakes released back in June was 17, but due to a few deaths and a loss of transmitter signal with others only seven were known to be alive.) As the time to recapture the snakes drew near, two unexpected snakes were captured bringing the snake total up to nine. Radio signals could not be received on these snakes because one snake had lost the transmitter and the batteries had died in the other, thus these were fortuitous captures. But before all snakes could be captured and returned to Auburn three died, one from a predator and two from an unknown cause.

These snakes have been taken back to Conecuh and released at the exact site from which they'd been captured. With their fresh transmitters we'll be able to follow these snakes over the next two years.

A most interesting side note is that during the surgery we learned that the two female snakes were carrying eggs. So not only have we seen that released snakes can survive the south Alabama winter, they've also been able to find mates and breed.

Snakes hatched in 2009 were housed at Zoo Atlanta for over a year and on March 18, 2011, 21 of these snakes underwent surgery and were implanted with a transmitter. Surgeries for the Conecuh snakes were done at the Auburn University College of Veterinary Medicine while the surgeries for the 2009 snakes took place at Zoo Atlanta. Thanks to the vet crew of Drs. Marie Rush, Sam Rivera, Brad Lock and John Roberts for successful surgeries.

On May 16, 1011, these 32 young snakes joined the older snakes in Conecuh National Forest and the indigo project passed a second snake-release milestone.

PARTNERSHIP IN CONSERVATION

The eastern indigo snake reintroduction project is a collaborative effort among the Alabama Department of Conservation and Natural Resources (ADCNR), Auburn University (AU), and The Orianne Society. This project has been funded through the State Wildlife Grant program administered by the Alabama Department of Conservation and Natural Resources Division of Wildlife and Freshwater Fisheries with a grant to AU. The Orianne Society, a private conservation organization, joined AU and ADCNR thus completing the three-way partnership with additional funds, expertise, and assistance in acquiring female snakes.

As the project has progressed the list of partners has grown. With the indigo snake being a federally threatened species, the U.S. Fish and Wildlife Service has played a role since the beginning. Identifying Conecuh National Forest as the best site in the state for the release of snakes brought in the U.S. Forest Service. Acquiring female snakes from Georgia required permission from the Georgia Department of Natural Resources. Zoo Atlanta stepped forward with an offer to house and rear young snakes.

All who have contributed to this important phase of Eastern indigo snake conservation in Alabama deserve thanks and credit as the success of the first release has been built upon the foundations of this partnership.