

The Member Magazine of The Orianne Society

Issue 7 • Summer 2017

INDIGO

magazine

WORKING LANDSCAPES

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issue

Life & Loss in the Long-leaved Pine
Chestnuts & Rattlesnakes
Restoring Wetlands
The South's Phoenix



Photo: Pete Oxford

A Future for the Gopher Tortoise 8



Photo: Cody Bliss

16

Life & Loss in the Long-Leaved Pine



Photo: Pete Oxford

26

Indigos & Gopher Tortoises: A New Beginning



Photo: Houston Chandler

34

Managing Wetlands Embedded within the Longleaf Pine Forests

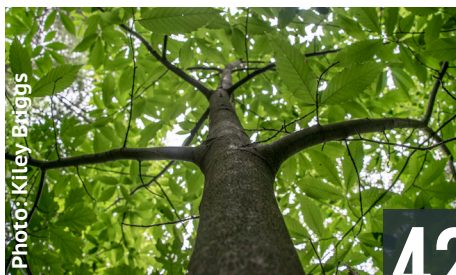


Photo: Kiley Briggs

42

Chestnuts & Rattlesnakes: An Unsuspecting Consequence



Photo: Kevin Stohlgren

4

Species Spotlight



Photo: Dirk Stevenson

6

Member Spotlight



Photo: Pixabay

48

The South's Phoenix



Photo: Marc Dubois

56

Upcoming Events



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The truth is, I went into this field because I was inspired by seeing wildlife in wild places. I have so many memories of wildlife encounters from my childhood all stored like photos and videos in my mind; a Northern Water Snake swimming across the creek, a moose staring at me from a stand of spruce, an island covered in puffins. But it was not until I was older that I really appreciated that those inspiring wildlife encounters were made possible because of the wild places where those animals lived. I also realized that many of these wild places were in need of restoration or long-term stewardship to continue supporting wildlife. I have taken that to heart, and as Orianne develops conservation programs for rare reptiles and amphibians, habitat restoration and management are nearly always at the core of the strategy.

Almost ten years ago, when we were developing our first programs for the conservation of Eastern Indigo Snakes, I sought out the advice of many experts and partners in our field for input. As we walked a variety of properties across the Southeast, the one thing I heard over and over on almost every property was “this land could use more fire.” I quickly learned that fire was the primary tool of conservation in the region, whether you were concerned with anything from plants to apex predators. We developed our program to have a significant prescribed fire component and over the last 9 years we have restored tens of thousands of acres for Eastern Indigo Snakes, Gopher Tortoises, and all the species that historically lived in the Longleaf Pine forest. Since those early days, we have added to the Longleaf Pine forest, planting over 500,000 trees; ecological forestry, removing thousands of acres of offsite pines; and ground cover restoration, planting hundreds of acres of native grasses and forbs.

MESSAGE *from our* CEO



As our programs grow, we are taking this habitat-first model to other places we work; implementing riparian restoration in Appalachian streams for Hellbenders and soon launching a program to restore and manage riparian areas in the Great Northern Forest for Wood Turtles. In my travels around the world, I have also noticed that in many countries habitat restoration does not happen at the same scale as in North America. Our global programs for viper conservation are transitioning this year, with the goal of incorporating more on-the-ground conservation (including habitat restoration) for endangered vipers in developing countries.

While I know many of you subscribe to this magazine because of a love for reptiles and amphibians, I hope this issue helps you appreciate the importance

of habitat conservation. In many cases, without habitat restoration and management, the species that we all care about so much would no longer exist. I would like to invite you to become a partner in habitat conservation for endangered reptiles and amphibians and there are many ways to do so. If you are a landowner, you can become part of our landowner network. Everyone is invited to come help us collect seed for understory restoration. You can join The Orianne Society by donating to help support our habitat restoration efforts for these amazing species. 🌱

Sincerely,

Dr. Christopher Jenkins, CEO

SPECIES spotlight

by Ben Stegenga



Green Salamander

Aneides aeneus

The Green Salamander is the only

member of the genus *Aneides* that occurs in the Eastern United States. They are gray or black salamanders with green or gold-green lichen-like flecks covering their entire dorsal surface. Their whole bodies are flattened for navigating tight spaces, and their wide, squared toes and prehensile tails are adaptations for climbing. Salamanders of the genus *Aneides* are often known as climbing salamanders, due to their arboreal or semi-arboreal tendencies, and although Green Salamanders are often associated with cracks in shaded rock outcrops, they have also been occasionally documented under bark and in the trees of humid deciduous forests.

It has been hypothesized that prior to chestnut blight, the devastation of the American Chestnut in the early 1900s, that Green Salamanders frequently utilized cavities and loose bark associated with these trees. Without mature chestnuts, Green Salamanders may now rely more heavily on rock formations as their primary habitat. However, the extent of historical chestnut use and the frequency that they utilize other tree species today is still largely unknown due to the difficulty in surveying such arboreal habitats.

Green Salamanders reach sexual maturity at three years, and females typically reproduce every other summer, laying clutches of 10-30 eggs in rock crevices. Females will guard their eggs until they hatch and the terrestrial young disperse. Green Salamanders undergo direct development, meaning they skip a larval stage. Adult male salamanders are highly territorial, and will frequently combat other males over choice crevices.

Green salamanders have experienced serious decline throughout much of their range and are listed as endangered or threatened in many states. They have also been petitioned to receive federal protection under the Endangered Species Act. Their biggest threats are thought to be habitat loss, climate change, disease, and over-collecting. Present-day research seems to indicate that the currently recognized species is actually comprised of multiple cryptic species, which would make conservation efforts all the more important. 🌿



Photo: Kevin Stohlgren



Photo: Ben Stegenga



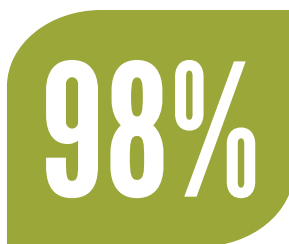
Photo: Ben Stegenga



Years estimated for life expectancy in the wild.



Populations exist in moist forests between 130-4,430 feet in elevation.



Some populations in NC, SC and GA have declined by 98% since the 1970's.



MEMBER spotlight

by Cody Bliss

BRENT GLAMANN



A corrugated piece of metal and the curiosity of an 8 year old was all that it took for Oriante member Brent Glamann. It was under this metal that Brent discovered a Western Bullsnake (*Pituophis catenifer sayi*) and, unknowingly at the time, his lifelong interest in snakes. “I grew up in a small town in southernmost Kansas in the 1960’s. My father travelled extensively by car and rarely failed to bring home some fascinating creature. Western Box Turtles (*Terrapene ornata*), Texas Horned Lizards (*Phrynosoma*

cornutum), Western Collared Lizards (*Crotaphytus collaris*), tarantulas and on and on.”

At the age of ten, Brent’s family had relocated to Texas. Despite the unfamiliar territory, he soon discovered Corn Snakes (*Pantherophis guttatus*), kingsnakes, Western Hognose (*Heterodon nasicus*), Western Coachwhips (*Masticophis flagellum*), various racers, every venomous variety indigenous to Texas and, ultimately, a large female Texas Indigo Snake (*Drymarchon corais errebenus*).

"After less than a week she laid ten eggs. I had no idea what to do so I contacted Dr. John Werler at the Houston Zoo. With his coaching, two of the ten miraculously hatched." It was this chance encounter that would remain a visceral memory for Brent and make him a "*Drymarchon* devotee for good."

Brent's herping "escapades" eventually became isolated to summer breaks during college where he proudly lays claim to converting some of his "herpephobic friends." As life went on, Brent's time spent hunting herps was soon replaced with his career in cardiology.

Years later, Brent would finally return to the same innate interest for reptiles he once experienced as a young boy. Fueled by curiosity, Brent has developed an extensive "to find" list that includes the Speckled Racer (*Drymobius margariferu margariferus*) and the Black-headed Bushmaster (*Lachesis melancephalia*), among many others. He notes, that despite his interest in locating these species, he has always "been in awe of the iconic Eastern Indigo Snake (*Drymarchon couperi*). The king of North American colubrids."

Over the last few years, he has donated eight captive bred specimens from different gene pools to the Houston Zoo (www.houstonzoo.org) in hopes of establishing a breeding nucleus and sharing them with other institutions. It was through this collaboration that he became aware of The Orianne Society and their Longleaf Savannas Initiative. Brent has been a devoted member of The Orianne Society since 2014 and a regular participant of our annual Indigo Days events.

Although that fateful day, peering under the corrugated sheet of metal is long gone, Brent still recalls the impact of that first experience and the importance of educating future generations.

"I'll never forget the first time I held a native caught Eastern Indigo Snake for the rest of my life...I believe the education of children and youth is critical to the future of these creatures and many others."

“

I'll never forget the first time I held a native caught Eastern Indigo Snake..."

Members like Brent keep The Orianne Society functioning. We are incredibly grateful to all of the members that have joined us for the conservation of reptiles and amphibians. 🌿

Become a member today by visiting:

www.oriannesociety.org/become-member



A FUTURE FOR THE **GOPHER TORTOISE**



A Model Partnership for Species Conservation

by Dr. Chris Jenkins

I woke up early, stepped out onto the front porch of my cabin, and looked out onto the sandhill. Though it was late spring, there was still a hint of winter in the morning air - and a hint of something else - smoke. I could smell the smoke that had settled close to the ground during the night. I pictured the fire moving slowly as it engulfed the grasses and forbs below the pines. For a moment, I wondered where the fire might be, but I quickly remembered that I was in the heart of the Orianne Indigo Snake Preserve, where fires are a critical part of the ecological balance. I eased myself into my rocking chair, sipped my coffee, and considered all the plants and animals that depend on these fires. Thanks to the fire that burned that morning, somewhere a Gopher Tortoise (*Gopherus polyphemus*) basked on the apron of its burrow, gathering energy from the warm, South Georgia sun. Thanks to these fires an Eastern Indigo Snake (*Drymarchon couperi*) had a place to spend the night - in that same burrow. In my mind's eye, I watched as an indigo snake emerged from the burrow and headed towards the river as it worked its way down into the cool bottomlands to hunt. Thankfully, the sound of a bird perched on the feeder broke my day dream. If I wanted to see any real Gopher Tortoises or indigo snakes that day, I realized, I had better stop day dreaming and get into the woods.

On this particular trip my son was with me; he was 6 years old at the time and had already developed a fascination for wildlife and the wild places they occur. We drove a quiet, camouflaged golf cart across the Preserve, stopping frequently to search for tortoises and snakes. We traveled from one sandhill to another, moving from tortoise burrow to tortoise burrow looking for snakes basking close to the entrances. As the morning began to give way to the sun, we came across a large adult Gopher Tortoise walking through the Wiregrass. After a few photographs, we followed his trail back to the burrow from which he had emerged and, to our amazement, there was an Eastern Diamondback Rattlesnake (*Crotalus adamanteus*) coiled in the sun right next to the burrow.

Photo: Pete Oxford



Dr. Chris Jenkins and an Eastern Indigo Snake.

Looking at the trails of both the tortoise and the snake coming from this one burrow really hit home in terms of the value of the Gopher Tortoise.

Tortoises are keystone species that hold together the Longleaf Pine ecosystem and without the tortoise the diverse food web would collapse. Hundreds of animals depend on the burrow created by the tortoise for at least some time period during the year. Surrounded and immersed in knee-deep Wiregrass and forbes, I explained to my son that much of the Southeast used to look just like this but so much of it has disappeared. With all the native grasses, forbs, and trees that have gone, so has the Gopher Tortoise. I explain that the Gopher Tortoise is one of the most important wildlife species in North America and that it has declined so significantly that it is a candidate for endangered species status. I tell him that something really big, something ground-breaking is going to have to happen to change the future for the Gopher Tortoise and thus the Longleaf Pine ecosystem.

Almost five years later and I find myself part of an unprecedented effort to save the Gopher Tortoise. A group of somewhat unlikely partners have come together with the common goal of conserving the remaining viable populations of Gopher Tortoises in Georgia. Land conservation in the form of both protection and restoration are the corner stones of this effort. Our goal is to protect, restore, and manage the habitat required to preserve the majority of remaining viable tortoise populations. If we are successful, it is very likely that this effort could be one of the primary reasons the Gopher Tortoise does not get listed as an endangered species and the primary reason that future generations of Georgians can experience this large land turtle as it forages its way through the Longleaf Pine forests.

Built For Survival

Gopher Tortoises are a unique and fascinating species in eastern North America. One of four North America

tortoises, the Gopher Tortoise is the only tortoise species east of the Mississippi. Gopher Tortoises are large land turtles that can weigh over 22 pounds and whose carapace (or shell) can be over 15 inches long. At first glance, their large dark-brown to grayish shell gives them a drab appearance, but when you look closer at the detail on the shell and grayish-black rounded head you realize the incredible detail and beauty. Like most turtles, females have a flattened bottom shell (plastron) and a relatively small tail, whereas males have a concave plastron and relatively large tail. Male Gopher Tortoises also have two scent glands beneath the chin, used to attract potential mates. The scutes or individual plates on the tortoises shell, look like they have concentric rings radiating out from the center, called scute annuli. These rings are like the rings on a tree and can sometimes be used to age a tortoise. However, after the tortoise reach 20-25 years old the scutes are typically too worn to discern individual rings. Gopher Tortoises are also very long-lived with some individuals observed living to over 50 years old in the wild. The front legs of Gopher Tortoises are shaped like a paddle with strong, flat nails that are used like a garden hoe to excavate burrows. These paddle-like legs are very strong with little flexibility in the foot, creating a rigid digging tool. As the tortoises dig they use their "paddles" to push sand behind their body, ultimately resulting in the prominent apron of sand seen at the mouths of burrows. The apron is an important part of the burrow as it is often used as a platform for the tortoise or other species such as Eastern Indigo Snakes to bask. In addition, tortoise nests are often laid in a chamber excavated in the apron by the female. Their hind legs are much different but equally as important for digging. Like other tortoises, the Gopher Tortoise has flat elephant-like hind feet that are used

for anchoring and pushing while digging. The tortoises build the burrows to provide themselves cover from extreme temperatures and predators, but in doing so, provide one of the most important habitat features for many other Longleaf Pine associated wildlife species. The burrows are typically one relatively long, straight tunnel that go from 8 to 15 feet long to a chamber that is typically 5 to 7 feet underground. But the record length and depth for a burrow are 67 and 22 feet, respectively. Tortoises typically build the end chamber at the level of the water table. End chambers are often 30% wider than the rest of the burrow and usually turn off from the primary trajectory of the burrow. The tunnel leading to the chamber is often wide enough to allow the tortoise to turn around completely at any point. Over 350

species use Gopher Tortoise burrows including a minimum of 60 vertebrates and 302 invertebrates. Vertebrates from all of the major groups use tortoise burrows, including amphibians, reptiles, mammals, and birds. Many of the species that depend on tortoise burrows are of conservation concern and would likely decline or become extirpated if tortoises disappeared.

A Vital Species

The Gopher Tortoise is a great example of a keystone species, and like other keystone species, the Gopher Tortoise is one that supports so many other species that, by removing it from the system there will be a disproportionately high effect on the others. The effect would

be very similar to removing a keystone from a door; without it the doorway would collapse. Similarly, by removing the tortoise from the Southeastern Coastal Plain system, we would face the collapse of the entire ecosystem as hundreds of species would no longer have the burrows for refugia. When I say tortoises create habitat for other species, think of them like the beaver of the Southeastern Coastal Plain. Beavers build dams that create wetlands and tortoises dig a burrow; both the wetland and the burrow provide habitat for hundreds of species that would not otherwise be able to live in that environment. Some of the species that we recognize as icons of our Southeastern Coastal Plain ecosystems are among the species known to use and depend on tortoise burrows; species such



Photo: Pete Oxford

Gopher Tortoise at a recent prescribed burn site.



Eastern Indigo Snake on the apron of a Gopher Tortoise burrow.

as indigo snakes, Eastern Diamondback Rattlesnakes, Gopher Frogs (*Rana capito*), Bobwhite Quail (*Colinus virginianus*), and Burrowing Owls (*Athene cunicularia*). But there are also many lesser known species that use tortoise burrows such as the rare Florida mouse (*Podomys floridanus*) and numerous invertebrates that specialize in eating tortoise feces. As the Gopher Tortoises continues to decline

and disappear, so will the invertebrates, amphibians, reptiles, birds, and mammals that depend on the burrows they create.

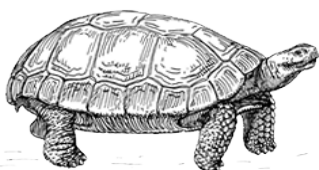
A Life of Limits

Gopher Tortoises were once widely distributed from Louisiana to South Carolina. Over the last 150 years, their distribution has contracted and in those areas they remain, their numbers have declined. In 1987, the United States Fish and Wildlife Service listed Gopher Tortoise populations west of Mobile Bay, Alabama as threatened under the Endangered Species Act. In this western most portion of the tortoise's range, the species is threatened with extinction. The threatened Western populations of Gopher Tortoise remain strong in only a few areas such as Camp Shelby, Mississippi. Similarly, east of Mobile Bay in Alabama, in Southwest Georgia, and in the Panhandle region of Florida, tortoise populations are much smaller as compared to populations in Southeast Georgia and portions of peninsular Florida. In the early 20th century, tortoises from this region were gathered extensively and used for food. The turtle became

known as “the Hoover chicken” referring to its role as food and helping people survive through the Great Depression. One of the most widespread methods for collecting tortoises was pulling them from their burrows using long handled gaffs or hooks. Even today you can find tortoises that have the portion of their shell broken where the hook broke through the carapace as someone tried to pull them from their burrow. The Gopher Tortoise is a candidate species for federal listing and listed as protected non-game wildlife in Alabama east of Mobile Bay, State threatened in Florida and Georgia, and State endangered in South Carolina. The peninsula of Florida and Southeast Georgia remain strongholds for the species; Gopher Tortoise populations in these regions are fragmented and continue to decline but you can still find locations with dense tortoise populations relative to the rest of the range.

Despite its protected status, the Gopher Tortoise still continues to experience declines and faces an uncertain future. There are many threats that Gopher Tortoises face. The greatest threat is the loss and fragmentation of habitat. The Southeastern Coastal Plain is one of the most degraded and fragmented ecosystems in the world. As we continue to increase the amount of residential development and roads, Gopher Tortoises will continue to decline. Additionally, tortoises require relatively open habitats for basking and foraging. Historically, frequent fire regimes maintained the open nature of Gopher Tortoise habitats, but in most remaining forested areas, fire is actively suppressed, resulting in conditions not suitable for tortoises. A second threat is human-subsidized predation, including predation by invasive/exotic species such as wild hogs and fire ants. We do not know the true impact of subsidized predation, but recent studies using enclosures to

GOPHER TORTOISE
IN DECLINE



INDIGOS
NEED
BURROWS



A look inside a Gopher Tortoise burrow.

Photo: Ron Grunwald

keep predators out suggest that the impact may be great. A third threat is disease, specifically; there is a highly contagious upper respiratory tract disease that is found in Gopher Tortoises. We know very little about the impact of this disease on wild populations but a similar disease is causing declines in the closely related Desert Tortoise (*Gopherus agassizii*). Finally, human collection primarily for food, while illegal and likely very infrequent, definitely still occurs.

To truly understand how we can help the Gopher Tortoise have a future in the wild, it is important to understand some of the unique aspects of Gopher Tortoise biology that makes them so susceptible to the threats they face. Recall the tale of the tortoise and the hare. In this famous story, the tortoise wins the race by being 'slow and steady'. Similarly, the reproductive biology of Gopher Tortoises is 'slow and steady'. Rodents such as rabbits have completely different reproductive biology;

a very 'fast' life history. Many rodents become sexually mature at young ages and can give birth multiple times per year to many offspring. However, most turtles are much different; Gopher Tortoises can take 10 to 20 years to reach sexual maturity. Though they can live to be 50 to 100 years old, they have relatively high mortality rates of both eggs and juveniles. With this type of life history, it can take tortoises surviving well over 50 years just to replace themselves (i.e., produce one offspring that ultimately reaches sexual maturity) in a population. Back to the tortoise and hare analogy, in an undisturbed setting, the truth is both win the evolutionary race to replace themselves in the breeding population. Both the tortoise and the hare have evolved different strategies to achieve the same goal. But the difference comes when you put human disturbance into the equation. Animals with 'slow and steady' life histories, such as the tortoise, are much more susceptible to disturbance

that lower adult survival, or more simply put, anything that kills adult tortoises can very quickly cause a population to decline.

Forming an Alliance

A group of public and private partners have come together in an unprecedented coalition, the Gopher Tortoise Conservation Initiative, to turn the tide of Gopher Tortoise decline by saving the species in the State of Georgia. This Initiative has worked over the years to determine the status of the Gopher Tortoise in the state. We determined the distribution of remaining habitat, the locations of existing viable populations (defined as populations with at least 250 tortoises), and the landownership of properties containing remaining habitat and existing populations. The results of the status assessment showed that there are roughly 120 viable Gopher Tortoise populations remaining in the state and that approximately 41 of them currently reside on protected lands, such as state land or private land with conservation easements. The goal of the Initiative is to protect a minimum of 65 viable populations in the state through land protection and restoration and management. To achieve this, we are currently working to protect an additional 100,000 acres of Gopher Tortoise habitat.

The partnership of the Initiative is a diverse, collaborative effort with each group serving their own roles and is one of the most comprehensive and smoothly functioning programs I have ever been involved with. The partners work together seamlessly without being proprietary, everyone has the future of the Gopher Tortoise in mind. Partners include The Orianne Society, Georgia Department of Natural Resources (GDNR), the Georgia Forestry Commission, the Georgia Conservancy, The Conservation

Fund, The Nature Conservancy (TNC), the Georgia Chamber of Commerce, The Trust for Public Land, the U.S. Fish and Wildlife Service, and private foundations and individuals. All the partners are working collectively led by GDNr and TNC on the conservation of 100,000 additional acres containing viable tortoise populations. In addition, The Orianne Society, GDNr, Georgia Forestry Commission, and TNC have land management teams that are working on-the-ground to restore and manage Gopher Tortoise habitat. The Georgia Chamber of Commerce is working to link the business community into the project by developing corporate partnerships that will increase our capacity to protect and manage habitat. Georgia Conservancy is working in the State House to ensure that politicians recognize the importance of this Initiative and influence policy. The Orianne Society and others are working on an outreach campaign to raise awareness of this great effort and to bring in additional supporters and partners.

Finally, multiple government agencies, private foundations, and individuals are providing the resources needed to implement the conservation program.

The Tools to Succeed

There are many important protection and restoration tools that we are using to achieve our goals. Perhaps the greatest tool is outright purchase of properties that contain viable tortoise populations. The majority of the properties that are being purchased under the Initiative are ultimately becoming state Wildlife Management Areas (WMA). These WMAs are a win-win because they protect the tortoise populations in perpetuity but also allow the public to access the land for recreation. Another land protection tool we are using are conservation easements. Conservation easements allow landowners to retain ownership of their properties but place protections on the property to prevent impacts to the tortoise populations. For example, a conservation

easement for a tortoise would likely include restrictions on subdividing, give guidelines on structure building and placement, and provisions for ensuring the habitat is managed for tortoises in perpetuity. These easements are often purchased, but private landowners can become partners by donating at least a portion of the easement value to the project.

We also use a variety of tools for habitat restoration and management. But by far the most important tool for managing tortoise habitat is fire. The land management teams associated with the partnership, including ours, are working year-round to implement prescribed fires that are critical to the maintenance of tortoise habitat by keeping it open and preventing unwanted hardwoods from shading out native grasses and forbes. The tortoises depend on the open, savanna-like nature of Longleaf forests for thermoregulation and foraging. Without fire, the tortoises are pushed to road and field sides where their survival is much lower. As part of the restoration and management tool

THE STORY OF ALLIGATOR CREEK

The story of how the Gopher Tortoise Conservation Initiative created Alligator Creek WMA is a great example of the potential we have for achieving our goal to conserve the Gopher Tortoise. One of the most significant populations of Gopher Tortoises in Georgia lives on a series of sandhills in Wheeler County. Much of this area is owned by private landowners that are working to conserve the tortoise, but one of the largest parcels (over 3,000 acres) on the sand ridge was owned by a company that was just about to turn the land into a large carrot farm. Orianne and GDNr had been conducting rare reptile (including tortoise) surveys on the property for years and knew it was one of the highest priority sites for Gopher Tortoise conservation in the state. However, the landowner had been approached in the past and wanted a very high price for the property. I began working with the farming company to negotiate a reasonable price and after months and multiple meetings, we had the price negotiated down to a point where we were close to being able to purchase it. I then brought in a colleague from TNC and he was able to finalize the deal and TNC took ownership of the property. While TNC owned the property, multiple partners including Orianne, worked on restoration and inventory projects and, approximately one year, later the land was transferred to the state to become Alligator Creek WMA. Today Alligator Creek is open to the public for many forms of recreation and the tortoise population is protected. The project was funded with federal, state, and private dollars. This is a great example of the projects we are working on across the entire range of the Gopher Tortoise in Georgia.

box, the partnership is also implementing Longleaf Pine tree plantings and ground cover restoration. When people think of tortoise habitat they often think of the trees, but it is the ground cover that is of greater importance and is also significantly more expensive to restore.

Why You Should Care

You may not generally care about tortoises, but there are so many reasons you should care about the Gopher Tortoise Conservation Initiative. I have already gone through the ecological value of the Gopher Tortoise as a keystone species, but it is worth mentioning again. If you care about forests in the Southeast and the wildlife that lives in those forests, this project is important to you because we are fighting to save an entire ecosystem, not just a single tortoise species. If the turtle goes extinct it impacts hundreds of other species and the decline of those species will in turn have rippling effects through the entire ecosystem. If you enjoy recreating in the outdoors you should care about this project. First, this project is significantly increasing the amount of public land you have to recreate on. If you are a bird watcher, field herper, or just someone who enjoys seeing all wildlife, this project is protecting the resources that are the keystone to your recreation. If you enjoy hunting and fishing, this project is creating thousands of acres for you to explore and the habitat management is improving habitat not only for tortoises but also for deer, turkeys and quail. If you are a Southerner and you take pride in your heritage you should care about this project. There is no greater symbol or icon for our Southeastern forests than the Gopher Tortoise. The Gopher Tortoise is the state reptile in Georgia and we Georgians should take incredible pride in our state and saving the wildlife and wild

places they depend on. There are so many reason for us all to care about this project, it is a win-win-win.

Forging a Future

Despite the threats the Gopher Tortoise faces, I truly think there is a bright future for this critical species. First, people recognize the tortoise as an important part of their landscape and are often proud when they have tortoises on their property. There are also many large protected areas within the range of the tortoise that provide the opportunity to mitigate for many of the threats the tortoise faces. Finally, a number of organizations and state and federal agencies place a great deal of focus on preventing the Gopher Tortoise from declining further. So, while the tortoise continues to disappear, I suspect that much of the conservation effort over the last 10 years has slowed the rate of the decline. With the Gopher Tortoise Conservation Initiative growing, and some focused hard work and resources, we can turn that decline around and get to the point where populations are increasing. But it is not the Gopher Tortoise Conservation Initiative alone that gives me hope, it is the momentum that this Initiative is harnessing and the great potential to inspire our communities to act and save one of their greatest natural and cultural icons.

I hope that I have done a good job of illustrating that this is one of the most ambitious wildlife conservation initiatives ever. A project to save a species that is currently declining towards extinction. The project is built on a strong foundation of partnership that is unparalleled in wildlife conservation. I see this project as a movement, as something much bigger than just the partnership, it is about us as a society taking responsibility for a species decline and showing the leadership and

resolve to turn the tides. The Gopher Tortoise is one of the greatest icons for the Southeast and needs all of our help. We are still working on developing the funding to protect and restore the habitat required to support a minimum of 65 tortoise populations. Providing funding to help the partners acquire additional tortoise properties and to support to operations of the various partner organizations, so we can continue to work diligently on this effort, is of critical importance. Every donation counts. I encourage you to make a restricted donation, no matter how small, for Gopher Tortoise conservation to organizations such as The Orianne Society, TNC, Georgia Conservancy, or the Georgia Chapter of the Conservation Fund. For those of you that cannot support the effort financially, you are in luck because perhaps the greatest thing, the thing all of us need to do, is to support the tortoise. If you see a tortoise crossing the street, move it; if you see someone harassing an animal or destroying a burrow, say something; if you hear someone talking negatively about conservation, educate them. If we truly want a future with Georgia's state reptile flourishing in the wild and not living in our collective memories, it is the broader partnership comprised of all of us that will need to take initiative and make it happen. 🌱

To join us in conserving the Gopher Tortoise, please visit:
www.oriannesociety.org

Partners:
www.georgiaconservancy.org
www.nature.org
www.conservationfund.org
www.gadnr.org
www.fws.gov
www.gachamber.com


LIFE & LOSS

IN THE LONG-LEAVED PINES

by Brannon Knight, Ben Stegenga &
Reese Thompson



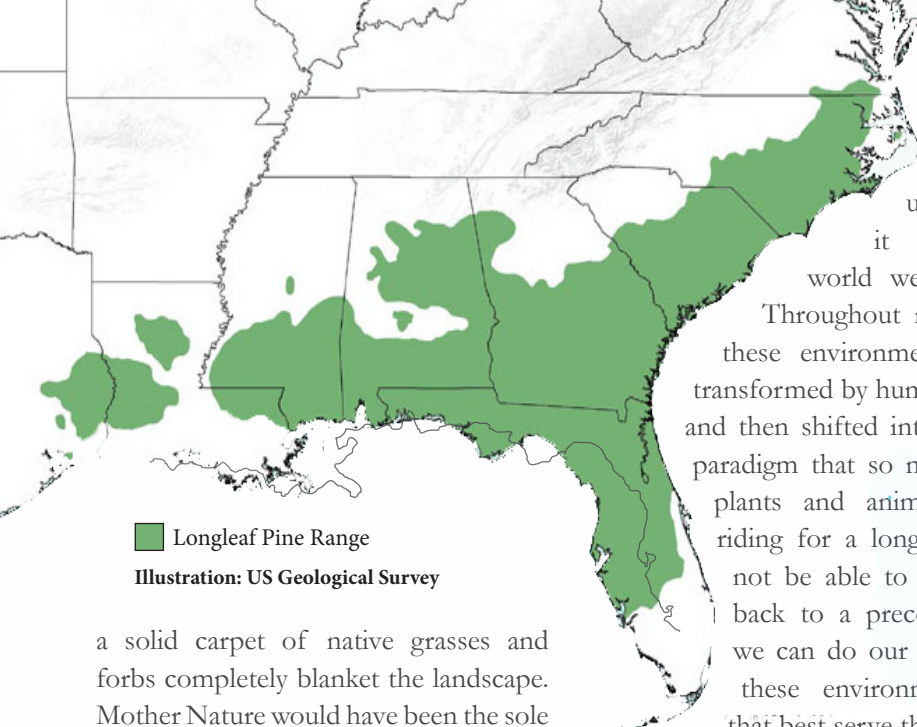
Photo: Cody Bliss



“We find ourselves on the entrance of a vast plain which extends west sixty or seventy miles. This plain is mostly a forest of the great Long-Leaved Pine, the Earth covered with grass, interspersed with an infinite variety of herbaceous plants, and embellished with extensive savannas, always green, sparkling with ponds of water.”

- William Bartram, 1791

William Bartram, a Philadelphian native, was an accomplished naturalist, writer, and artist that spent about 5 years exploring the South. In 1791 he published a book on his explorations called “The Travels of William Bartram”. In his book he wrote, “We find ourselves on the entrance of a vast plain which extends west sixty or seventy miles. This plain is mostly a forest of the great Long-Leaved Pine, the earth covered with grass, interspersed with an infinite variety of herbaceous plants, and embellished with extensive savannas, always green, sparkling with ponds of water.” I (Brannon) often find myself wishing I was in his shoes about 250 years ago, walking around with a DSLR camera and a notepad, because I sure don’t have the ability to draw. Then, all of a sudden, be able to teleport back to present day and have the most accurate depiction of what the Longleaf Pine woods should look like. Although we have old photographs and historic accounts, nothing could compare with being able to step back in time and experience it firsthand. I often romanticize on what it was like seeing giant and almost statue like Longleaf Pine as far I could see; an untouched landscape where



■ Longleaf Pine Range

Illustration: US Geological Survey

a solid carpet of native grasses and forbs completely blanket the landscape. Mother Nature would have been the sole provider that delivers the forces in which shapes, expands, and creates the world that Bartram experienced. It would be an experience unlike any other, but

unfortunately it is not the world we live in today.

Throughout modern history, these environments have been transformed by human intervention and then shifted into a detrimental paradigm that so many species of plants and animals have been riding for a long time. We may not be able to restore habitats back to a precolonial era, but we can do our best to manage these environments in ways that best serve the ecosystem. It is a privilege to work with The Orianne Society to be able to do just that. I hope by writing this article I can share with the reader how we do our best to shift this

paradigm, not only on the property the organization owns, but also on other lands as well. I believe before I go in-depth and describe how we do this as an organization, it is important to understand Longleaf and the fire-dependent ecosystem it thrives in.

History in the Longleaf

The Longleaf Pine ecosystem once covered approximately 92 million acres, ranging from Virginia to eastern Texas through central Florida. Longleaf occurred in a variety of sites from mesic-wet flatwoods and wet savannas to montane areas in North Alabama and Northwest Georgia upwards of



Photo: Brannon Knight

A mature Longleaf Pine stand that was burned in June 2017 with intact native ground cover.

2,000 feet elevation. It has been estimated that approximately 60 million acres were dominated by Longleaf and 32 million acres were mixed Longleaf Pine. So, to put this into perspective, Longleaf covered about 60% of the Coastal Plain landscape with wetlands coming in second. The Europeans and Spanish settlers saw this landscape as a vast area that couldn't be exhausted or just didn't stop to think it could be. The Spanish and Europeans had different agendas in the Americas, where the Spanish were more interested in maintaining military outposts and the English were more interested in commercial ventures. At this particular time they did not have the means to really exploit the Longleaf forest due to the lack of technology. Major land changes date back to Hernando De Soto exploring the Southeast in 1539. He is credited for introducing feral hogs we know today. Later, taming of the land evolved into clearing land for agriculture and open, free-range grazing. The free-range grazing really began to set the stage for the demise of Longleaf Pine. Feral hogs and cattle love carbohydrate rich Longleaf seedlings and over time grazing depleted the next generations of seedlings. These practices continued until the 1870s when fencing laws were implemented in the South and, depending on which state you lived in, varied to what year it became law.

The Birth of an Industry

After the Europeans settled Jamestown in 1607, the turpentine industry was born in 1608 when Captain John Scott exported the first barrels. Tar, pitch, and rosin were consumed at a local scale until the early 1700s when the industry began to expand and it started moving south. Turpentine workers would cut a "box" on sometimes 3 or even 4 sides of virgin

timber, depending on how big the tree was. The box was a triangular shaped area at the bottom of the tree where the gum would accumulate. This was typically done during winter months. Once the weather started warming up, workers would streak the bark above the boxes to get the gum to flow. They would later dip the crude gum out and develop it into other products. Workers were able to get anywhere from 4-6 years out of an orchard, and then they would move on, because the trees would essentially bleed out. The trees that were left behind would either catch fire from lightning caused wildfires and become girdled or were blown over from wind events. The trees that were abandoned were basically wasted until the middle part of the 19th century. In 1902 Charles Herty developed a clay pot called the "Herty Cup" that was nailed to a tree and metal flashing would funnel the gum into the clay pot. This did extend the life of turpentine orchards by minimizing the depth at which the pot needed to be set inside the tree, but by this time it was too late. Much of the damage had been done.

Additional Pressures

As the turpentine industry began to expand, agriculture began to expand as well. The more fertile land, if not in turpentine production, was converted to agriculture by 1850, excluding the coastal and inland gulf portions of Longleaf Pine's range. It wasn't until 1821 when the cession of Florida from Spain allowed settlement by Europeans into these areas. The Spaniards maintained control of this area of the Longleaf Pine's range which inhibited the turpentine industry from moving west as well. It is important to note that Bartram described the Indians along the Atlantic region as utilizing fishing and hunting for food more than agriculture.

Whereas, additional observations in some areas of Alabama, Longleaf Pine was already converted to agriculture, suggesting that tribes in this region relied more heavily on agriculture. Nevertheless, land clearing was not conducted on a large scale during the earlier years of settlement, most likely due to the restriction of Europeans throughout Alabama, Texas, Mississippi, Louisiana, and Florida during this time. Advancement in technology was also a major contributor to the commercialization of farming. Cotton was a hot commodity in the South and when Eli Whitney invented the cotton gin in 1793, it drastically increased profits and refined the production of cotton. Ultimately, increasing the expansion of agriculture and the loss of Longleaf Pine.

Transformations from Timber

The combination of turpentine, free-range grazing, and agriculture created a cumulative effect that contributed to the demise of the ecosystem, however, these factors were not alone in shaping the future of the Longleaf Pine ecosystem. Logging was another huge factor that ultimately wiped it off the map - literally. Small scale logging had been around since the time of settlement, but it did not play a major role on the environment due to the limitations of available technology. Until this point most logging was done by hand, ox, and mules. Logs had to be dragged to waterways where they would float them to wherever they needed them to go. They were restricted to logging no more than 4-5 miles from navigable water. Timbering was not made possible on a commercial level until the early 17th century when water powered saw mills were invented, but even with this, loggers were not able to venture away from major

CONTINUED ON PAGE 21

WORKING TOGETHER

WITH REESE THOMPSON

After 400 years of pressure and degradation on the Longleaf Pines ecosystems, restoring this habitat requires partnerships and collaborations amongst many. With this understanding, The Orianne Society has teamed up with private landowners throughout South Georgia. One such person is myself, Reese Jordan Thompson. I am a 63 year old tree farmer, who still enjoys riding a planter, while planting Longleaf. I am quick to make the point, that like a Gopher Tortoise sitting on a fence post, I could not be the good steward of the land without the assistance of many conservation focused people, organizations, and agencies. It was a stroke of luck or fate that The Orianne Society purchased their Indigo Snake Preserve near my property, which is blessed with indigos, Gopher Tortoises, and other sensitive species in some undisturbed Longleaf habitat. A mutually beneficial relationship was formed eight years ago between us. Whereas, I had always been a good conservationist, I lacked the understanding of the complex interaction of fire, habitat, and sensitive species. My family had been in the turpentine business for several generations and the woods were traditionally burned during the winter for wildfire reduction. This action helped to create good habitat. But general wisdom was and in some places still is, that fires should be suppressed in the forest.

BURNING AS A TOOL

The Orianne Society's Land Management Team introduced me to a new way of thinking. They taught me to see fire as a tool to produce desired objectives. Originally, I was burning during the dormant months of January and February, and at night, before smoke became a liability issue. We were in a very rural area, and never thought of smoke as a concern. It was always a challenge to find your way out of the woods at 1 AM, after the fire had died down, and the smoke had settled to the ground. There is a real beauty to a night burn with the fire light, shadows, and smoke. I miss the experience greatly. But The Orianne's Fire Team brought professionalism to this process. The terms mixing height, transport winds, relative humidity, etc. became relevant. Instead of burning when it "felt right", burns and smoke management were planned according to weather conditions. Also, at Orianne's encouragement and assistance, burns were shifted from dormant to growing season. The results were amazing; I had never seen Wiregrass seed stalks waist to chest height. Winter burns are still used for fuel load reductions and burning young planted Longleaf, but most burns occur in the growing season, April to July. The resulting hardwood control and ground cover restoration has been remarkable.

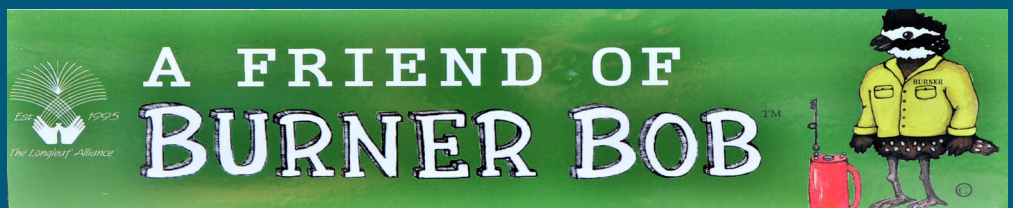
A TRANSFORMING EXPERIENCE

When I turned fifty, I began wondering what my purpose in life was. One day, a good friend, Lynn Lewis with the National

Wild Turkey Federation, was visiting. She randomly laid a yard square frame on the ground and identified twenty-nine different plant species. My eyes were opened to what I had spent a lifetime walking over. The Longleaf ecosystem on a square yard basis at the ground rivals a tropical rainforest in plant biodiversity. This is a significant treasure, and only about 10% of these plants are commercially available for restoration. As the result of summer burns, I had noticed an increase in quail, turkeys, song birds, and Gopher Tortoises. As someone who has witnessed the positive benefits of prescribed fire in the Longleaf forest, I pose the obvious question; why are not more landowners using this useful tool?

A NEW VOICE

After thoughtful consideration of Smokey Bear's message of preventing forest fires, I realized what was needed was a counter balancing voice to promote the benefits of control burns. With the help of a talented young artist, Francie Lowman, the concept of Burner Bob was developed. He is a Bobwhite Quail that has seen his forest family's habitat degraded by the suppression of nature's cleansing mechanism of fire. Burner Bob's mission is to become the "Johnny Appleseed of prescribed fire" spreading the message that controlled burns are necessary to produce good habitat for sensitive species. There is a 3x3 foot poster of Burner Bob and his forest family, a sixteen page children's coloring book with Burner's story, and bumper sticker saying "A friend of Burner Bob". Other promotional items are in the works, including a life size Burner Bob costume for event appearances. Recognizing that Burner Bob and his important message was bigger than my resources, the concept has been licensed to our good partners at the Longleaf Alliance. It is a natural fit with their mission promoting a sustainable Longleaf ecosystem. The creators of Smokey Bear have done an excellent job of promoting him and his message, "Only you can prevent forest fires." Smokey is one the most recognizable characters in American culture. A little known fact is that Smokey has his own zip code, because so many children wrote to him, especially after the Disney movie, Bambi. But we have to educate the next generation, in order to change course. Sadly, most school children know more about the moon, which is a quarter of a million miles away, than the Longleaf ecosystem in which they live. Maybe with the help of Burner Bob, with his message of prescribed fire being necessary to produce good habitat, we can generate an understanding and an appreciation for the priceless and threatened ecosystem that is our home.



bodies of water, and production remained limited. In 1833 the first railroad was constructed in America, right through the heart of Longleaf country. This development foreshadowed what was to become of the Longleaf ecosystem. At the same time, steam power technology started gaining ground, and between 1850 and 1870, saw mills and skidders began running off of steam power. Railroads began expanding to parts of the country that could not have been accessed by previous logging methods. These backcountry rail lines were called tram roads. Railroad companies began to purchase property and exploit the timber resources as well. By the late 1880s almost all of the commercial timber had been exhausted near major streams, and rivers and virgin timber inland was essentially gone by 1930.

Recognizing the Demise

It was around this time that pine plantation began to take shape. Almost all of the second growth timber was Loblolly or Slash Pine. When it was first realized that the Longleaf Pine was gone from the landscape, early plantings were largely unsuccessful. Bare root Slash Pine and Loblolly Pine was a lot easier to establish and grow. Bare root Longleaf is more sensitive to drying out during handling and transport and is easily impacted by nearby competitors. Bare root seedlings are also easy to “J” root, curving back to the surface, and the seedlings will become sinuous if they survive, producing poor timber. Over time, the poor seedling quality (i.e. small root collars) and the lack of knowledge associated with Longleaf Pine restoration became evident to the forest landowners. In response, they shied away from Longleaf and essentially planted the low-hanging fruit – Slash and Loblolly. This



Photo: Cody Bliss

Fire is essential for many plants and animals in the Long-leaved forests.

in turn led to short-rotational forestry practices. Pulp products began taking off and markets began to shift.

Fire in the Forests

Of all the forces that shape the Longleaf Pines, fire reigns supreme. Fire is such an important natural process in the Longleaf Pine ecosystem. It is just as essential as water and oxygen for forest health and a “functioning” system. The Atlantic and Gulf Coastal Plains alone have approximately 6,170 native species of plants. Of these, approximately 1,748 can only be found in the Coastal Plain and 927 species are only associated with the Longleaf Pine ecosystem. It is important to note that plant communities, such as dry and wet prairies of Florida, would have been formed by a combination of natural processes such as high fire frequency, variations in hydrological regimes, hurricanes and other major wind events.

Historically, fire would have

predominately occurred from lightning strikes during the natural fire season. This would have created open, park-like conditions in the canopy with a diversity of warm season grasses, forbs, and woody species of small stature in the understory. These fires would have grown into big landscape level fires. Entire watersheds would have burned, or possibly the entire Coastal Plain would have burned in a season. They would have also varied in intensity, scale, and frequency based off of the El Niño–Southern Oscillation (ENSO) cycle. There are two phases associated with the ENSO cycle that are important for fire managers to understand which are La Niña and El Niño. They are driven by Pacific Ocean temperatures, which then change the global atmospheric circulation. Above average temperatures will typically bring cooler and wetter winters, but also increases the chance for more severe weather because of the position of the sub-tropical jet stream. The jet stream brings the cool arctic air towards the Southeast, and when it



Photo: Brannon Knight

A closed canopy will prevent sunlight from penetrating to the forest floor.

collides with moist warmer air from the coast, it creates a shearing effect. This can generate a squall line that will produce heavy winds and possible tornadoes. Low pressure systems will follow bringing rain. These winter conditions set the stage for a typically “milder” fire season. La Niña conditions are created by cooler Pacific temperatures, which can cause the opposite climate conditions. Winters are typically warmer and drier. The Pacific jet stream is variable and tends to shift northward by not dragging cooler polar air towards the Southeast. This climate pattern tends to lead to a more active fire season with increased fire behavior. The two phases tend to shift back and forth every 2-7 years. Historic fires that occurred during La Niña were the fires that would have created, shaped, and maintained grasslands. Pyric wetland plant communities would have been formed during these times. Species such as pitcher plants and many other obligate wetlands species would have benefitted from these fires. During wetter years, plant communities such as upland depressional wetlands or wet savannas may not have burned. Fires that occurred during El Niño years still would have been important, but would have functioned more as upland maintenance.

Suppressing Nature

Natural fires and anthropogenic fires were relatively common across the landscape up until about the Civil War. Ranchers would burn off their woods in order to provide green-up for their cattle. At this time no fire laws were in place, but fragmentation was fire’s worst enemy. Large scale agriculture, roads, and development slowly started to scale down the amount of fire that occurred on the landscape. Once the Civil War was over, it was at the same time that fencing laws became

established and cattle was no longer the main source of income. Without the need for new succulent foraging grounds for cattle, human-set fires started to dwindle as well. Fire suppression laws began in the South around 1910-1930. Early foresters were not aware of the benefits of fire for Longleaf Pine and its plant communities. In 1927-1931 a group of young foresters in the South set out to preach the gospel that fires were bad. This alone made a big impact and changed the mindset for many people, especially those who did not grow up in a “fire culture”. Then in 1944, probably the best anti-fire advertisement campaign ever was created by the U.S. Forest Service. Smokey Bear was invented and then, later in 1950, a cub was rescued in New Mexico on a wildfire contributing to the misconception that fire was bad.

The Longleaf Pine ecosystem is down to only about 4 million acres today. It is also important to note that not all of those acres are represented as the intact natural plant communities that should be there. We are working extensively with private landowners, such as our good friend Reese Thompson (See “Working Together with Reese Thompson”) and other nonprofits, state, and federal agencies to change the paradigm this amazing ecosystem has followed for the past 400 years. Why does Orianne care about this ecosystem? Well, not only does it have significant intrinsic value to us – but it also houses a myriad of reptile and amphibian species.

Most of the species that The Orianne Society works with in the Georgia Coastal Plain benefit from frequent fires in one way or another. This includes the Southeast’s iconic Gopher Tortoise (*Gopherus polyphemus*).

Life in the Longleaf

It’s hard to talk about prescribed fire and Longleaf Pine ecosystems without

mentioning Gopher Tortoises. They epitomize what it means to be a fire-dependent species. Through habitat loss and degradation, road mortality, and occasionally being harvested by people for food, the Gopher Tortoise has declined considerably. It is thought that populations of wild Gopher Tortoises have declined by 80% in the last 100 years, and they are now listed as threatened in many states, and federally protected under the Endangered Species Act in the Western portion of their range.

Gopher Tortoises are herbivores, which feed primarily on grasses and forbs no higher than a foot off the ground. When fire is suppressed in a pine dominant ecosystem, that allows for woody shrubs and hardwoods to take hold, and they gradually out-compete and shade-out the herbaceous layer on forest floor. When this happens, it becomes difficult for Gopher Tortoises to persist in that habitat for several reasons. First, the abundance of herbaceous ground cover is lost, leaving limited grazing opportunities for tortoises. Second, less sunlight reaches the ground, hindering a tortoise’s ability to thermoregulate and limiting the amount of suitable nesting sites where their eggs will incubate at the proper temperatures. And

<5%

Remain of the original 90-million acre ecosystem



Fires are essential to the survival of Longleaf Pines

250

Longleaf Pines can reach 250 years in age or more

lastly, increased woody vegetation makes navigation more difficult for tortoises. Dense shrubs and trees cannot be pushed aside or treaded over like grasses and herbaceous vegetation, and without fire, more fallen tree limbs accumulate on the forest floor, creating even more obstacles. This presents a real problem for avoiding potential predators. A tortoise's burrow is one of its main defenses, and when an imminent threat presents itself, a Gopher Tortoise will typically scuttle directly to its burrow. With all these new obstacles impeding a hasty retreat, a tortoise is much more likely to fall victim to predators.

The Florida mouse (*Peromyscus floridanus*), gopher tortoise hissing beetle (*Chelyxenus*

xerobatis), gopher tortoise rove beetle (*Philonthus gopheri*), gopher tortoise burrow fly (*Eutrichota gopheri*), gopher tortoise robber fly (*Machimus polyphemi*), and the gopher tortoise acrolophus moth (*Acrolophus pholeter*) are obligate commensals, meaning that they are only found in association with tortoise burrows and depend entirely on them and tortoises for survival. Many reptile and amphibian species also rely on Gopher Tortoise burrows. Some specifically seek out burrows during certain times of the year, while others simply use them opportunistically. Florida Pine Snakes (*Pituophis melanoleucus mugitus*), Eastern Diamondback Rattlesnakes (*Crotalus*

adamantus), Eastern Coachwhips (*Coluber flagellum flagellum*), Gopher Frogs (*Lithobates capito*), Southern Toads (*Anaxyrus terrestris*), and Eastern Indigo Snakes (*Drymarchon couperi*) are just a few of the species that benefit from tortoise burrows. In the case of the Eastern Indigo Snake, they use Gopher Tortoise burrows in the winter, not just to escape the cold, but as locations to find mates and lay their eggs. Without tortoises, indigo snakes would simply not be able to survive throughout most of their range. So as you can see, Gopher Tortoises play a significant role in the biology of a vast amount of wildlife, and therefore, tortoise conservation is incredibly important to broad reptile and amphibian conservation in the Southeast.

Reptiles of the Longleaf Pines

For reptiles of the Longleaf Pine ecosystem, fire on the landscape has many positive effects. Probably the most significant is it stimulates herbaceous plant growth and seed production. The abundance and diversity of grasses, legumes, and forbes maintained by a regular fire regime provide a huge amount of energy flow into the ecosystem. An abundance of plant biodiversity allows for an incredible amount of insect, bird, rabbit, and rodent diversity. Lizards enjoy the abundance of insects, and box turtles benefit from increased fruit production. Snakes benefit from an abundance of prey such as grasshoppers, lizards, toads, rodents, and rabbits, and they themselves provide food for hawks, owls, and large mammals. It's a wide-reaching, cascading effect that benefits species at all trophic levels. In addition to prey availability, fire also benefits snakes by altering the physical aspects of the habitat. Increased ground cover, such as Wiregrass, provide refuge from the sun and cryptic hunting



Photo: Brannon Knight

Trumpet pitcherplants (*Sarracenia flava*). Response after a prescribed fire June 2017 on private property in Wheeler County, Georgia.

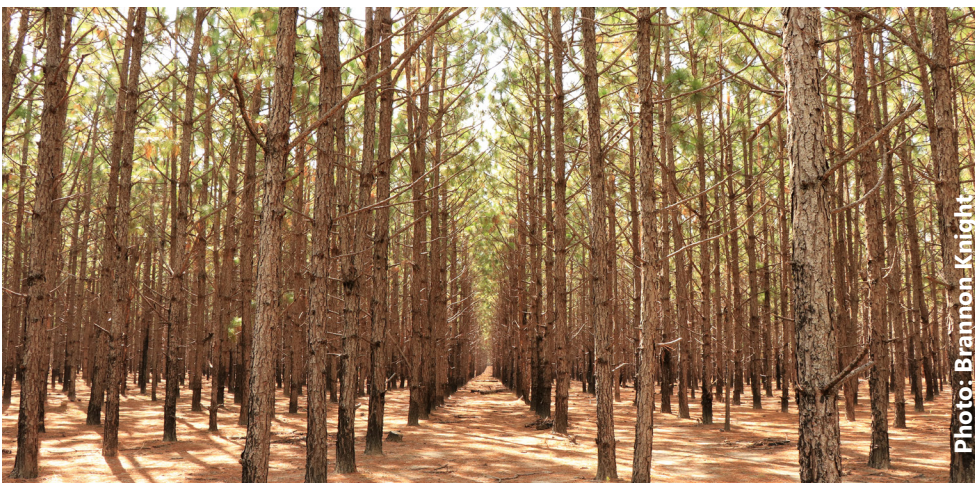


Photo: Brannon Knight

Longleaf Pine plantation in straw production heavily stocked with no herbaceous component in the understory.

positions for ambush predators such as Eastern Diamondback Rattlesnakes. The increase in rodents means that there will be more burrows for smaller snakes to use as refuge, and burned out pine stumps provide snakes with deep root networks that can be used as winter hibernacula. The occasional pine that dies during a fire provides Scarlet Kingsnakes (*Lampropeltis elapsoides*), Corn Snakes (*Pantherophis guttatus*), and Broadhead Skinks (*Plestiodon laticeps*) with thermoregulation and hunting habitat under the loose bark still clinging to the trunk. Woodpeckers create holes in those same pine snags, and songbirds nest in the cavities, providing Eastern Rat Snakes (*Pantherophis alleghaniensis*) with refuge and prey. And once those snags fall to the ground, they will provide small fossorial snake species with cover and Timber Rattlesnakes (*Crotalus horridus*) with ideal locations for hunting squirrels.

Amphibians of the Longleaf Pines

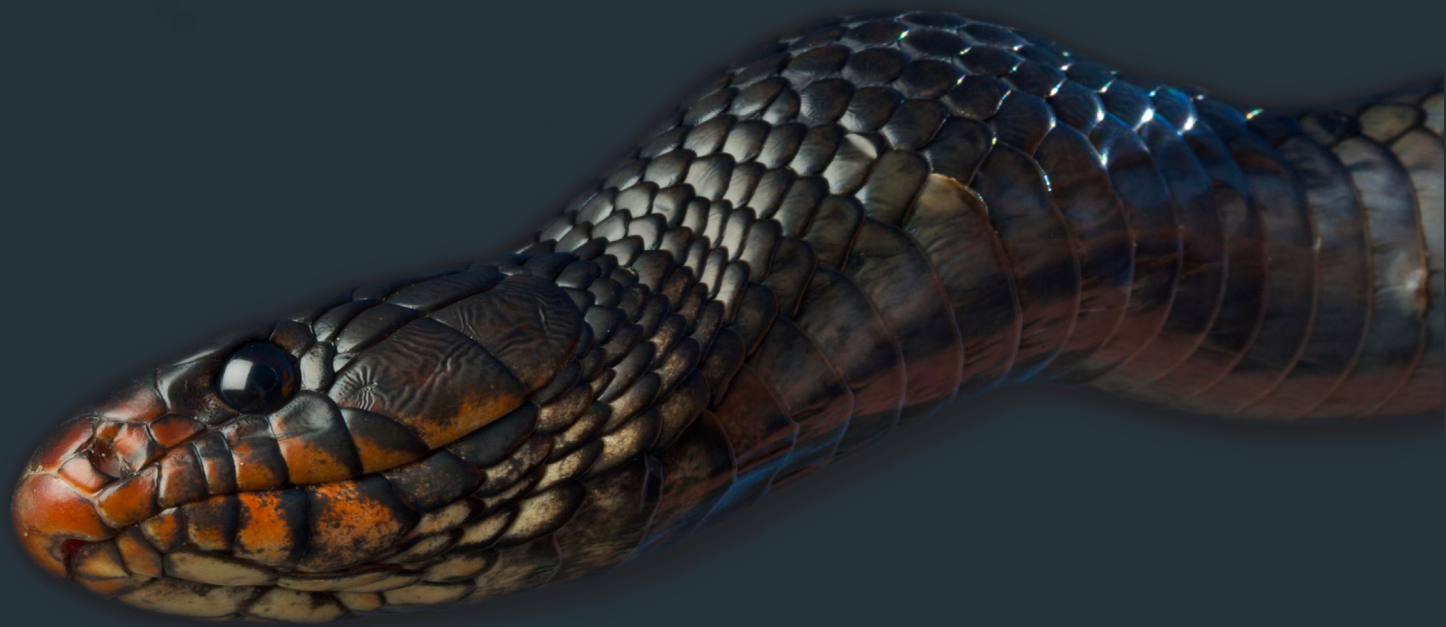
Prescribed fire also plays an invaluable role in the persistence of many amphibian species, such as Gopher Frogs (*Lithobates capito*), Frosted Flatwoods Salamanders (*Ambystoma cingulatum*), Eastern Tiger Salamanders (*Ambystoma tigrinum*), Ornate Chorus Frogs (*Pseudacris ornata*), and Striped Newts (*Notophthalmus perstriatus*). All of these amphibians depend on depressional wetlands or other similar wetlands with seasonal hydroperiods. These wetlands when exposed to a regular fire regime are typically characterized by abundant grasses, sedges, and other herbaceous vegetation. This vegetation offers amphibians a place to deposit eggs and refuge for developing larvae. The vegetation also provides ample foraging opportunities for larval salamanders, as it supports a wealth of aquatic invertebrate biodiversity. However, when fire is



Juvenile Gopher Tortoise.

suppressed in these wetland landscapes, water tolerant trees and shrubs gain a foothold and begin shading out the herbaceous layer. Additionally, a thick duff layer of rotting leaves, pine needles, and twigs will start to accumulate, further hindering growth of herbaceous vegetation. If these wetlands are fire suppressed long enough, entire amphibian populations will blink out due to lack of reproductive success. Even in places where fire is regularly introduced, these amphibians can still disappear due to the timing of the burns. If a fire takes place in the wetter part of the year, these wetlands will still be holding water, and the fire will not effectively burn up the duff layer and knock back woody growth. Therefore, these landscapes require a fire during drier times, like what would have occurred historically, so that it can burn through the dry wetland basins. Unfortunately, land managers often don't prescribe fire during these drier periods. This fire suppression and altered seasonality of prescribed fire, combined with the total loss of breeding pools through agricultural use and human development, has left many of these once prolific amphibian species in dire need of conservation efforts.

Reversing the course of hundreds of years of unguided land use is a lofty task. In order to be successful, it is critical that we continue on-the-ground efforts that include educating local landowners, implementing sustainable land use practices and conducting innovative research that can be used to guide conservation efforts. Together we can add a new chapter to the story of the Longleaf Pines. 🌱



Indigos & Gopher Turtles

a new beginning

by Dr. Lloyd Newberry



Time and Place Come Together for Two Iconic Species

Within a few days after Martha and I purchased our new tract of land we were on the way there to lay out a site for the cabin we would soon build. The majority of the 200 acres was in sand hills which were colonized by a healthy population of Gopher Turtles (*Gopherus polyphemus*). I have always loved these interesting denizens of our xeric ecosystems and made sure to locate the cabin where it would not disturb any of their burrows. The property was to be used for hunting deer, hogs and turkey. This necessitated a cabin since our home was two hours away on the coast.

We had driven some stakes where we wanted the cabin to go when my eye caught movement in front of my truck. It was a dark colored snake moving slowly toward one of the gopher burrows. Way too slow and too large in diameter for a Black Racer (*Coluber constrictor*) I knew instantly that it was an Eastern Indigo Snake (*Drymarchon couperi*). Screaming “indigo” I ran to the glossy blue-black reptile grabbing it just before it entered the hole. It hissed a bit and then settled down in my hands quite comfortably.

I was ecstatic, yet, in disbelief. I had never seen but one indigo before in the wild. It was as though I had just discovered gold on the property. Actually better than gold. Martha and I enjoyed the regal snake for quite a while before releasing it into the burrow. Before we left for home we repositioned the cabin 70 yards further away from the burrow into which the indigo had disappeared. The

snake probably used numerous burrows, but it made us feel better not to have a lot of construction occurring in its backyard.

Just that quick, the 200-acre property now assumed a whole new meaning and objective. The primary purpose of our endeavors there would be to protect and nurture the indigos and Gopher Turtles. Hunting would of course still be enjoyed, but would now play second fiddle to these very special reptiles. So how did I get to this point in my life and how would it lead to a much greater endeavor, one which would receive attention on the World stage? Some background information is necessary.

The Early Days

I grew up on a farm in middle Georgia just north of Macon. My father was a science teacher and later school superintendent, but he thought my two brothers and I needed the hard work a farm necessitated if we were to grow up to be responsible citizens. He was probably right. We had two 6,000 capacity broiler houses, two milk cows, 100 hogs and a few beef cattle. Throw in a one-acre garden and you have enough work to keep three boys out of trouble. When the chores were done, usually Sunday afternoon, we were allowed free time. I hunted rabbits and squirrels when they were in season. More pertinent to this narrative, I collected a large variety of snakes, turtles, lizards, salamanders, and frogs. My father, a physics major, thought no good would ever come of my interest

in herps, but he brought me high school biology texts and reptile and amphibian field guides. He was never one to hinder learning – a good thing.

I entered the University of Georgia where I completed a doctorate in 1968 with a major in vertebrate zoology and ecology, and certification for preparing science teachers. Martha and I were married in graduate school and our first son, Wyck, was born. We ran a farm north of Athens where I continued my collecting of herps moving now into mountain species which were close at hand.

Building a Life in the Southeast

After graduation, I accepted a position with Armstrong State University in Savannah and moved to the coast. The rivers and marshes of the Southeast offered great duck hunting and fishing, but equally as interesting, new grounds for studying reptiles and amphibians. Though we followed our interest in hunting and wildlife to 69 countries around the world, it was always our local Southeast Coast that gave us the most pleasure.

We purchased a 70-acre piece of land and with our two sons, Wyck and Sam, built a cabin. After two years we felt the need for a larger place and bought 500 acres on the Ogeechee River. It was loaded with deer and turkey and I fondly remember photographing huge Rainbow Snakes, (*Farancia erytrogramma*) in the swamp there. We built another much nicer cabin and a fish pond. I became Dean of Faculty at the University and built a real-estate business at the same time. This enabled us to acquire several tracts of land for growing timber, hunting and continuing our enjoyment of wildlife in general.

Settlement in the Sand Hills

By 2001 I was serving on numerous conservation boards and had become

very involved in preserving endangered ecosystems and threatened species. It was at this time that we found the 200 acres of sand hills in Telfair County, Georgia, where I discovered the Eastern Indigo Snake. The dry sandy soil had a few Longleaf Pines, but most of them had been cut down in the 1950's. The numerous stumps were witness to the fact that this was once a climax Longleaf forest. The dominant off-ground vegetation now was twisted old Turkey Oak and Blue-jack Oak, Wax Myrtles, Blueberries, Gall-berries, Cactus, and Palmetto. The ground cover consisted of Wiregrass, Bluestem, Three-awn, Toothache and Indian Grass and a great variety of forbs and wildflowers.

These sand hills and many more like them, are found on the Northeastern banks of rivers in the lower Southern Coastal Plain. Late Pleistocene environmental conditions produced extremes in river discharge providing exceptional quantities of sand which accumulated on the banks and bars. Westerly wind events then remobilized this sand 15,000 to 30,000 years ago forming ridges and dunes usually in close proximity to the river drainage system. The sand hills are inactive today, but provide unique habitat for a variety of species. The sands range up to 26 feet in depth allowing tortoises to dig their deep burrows. These tunnels provide refuge from the extreme summer heat in this desert-like environment. They also provide winter hibernacula for several species of snakes including indigos. The thermal stability of the burrow provides an excellent environment to a variety of other organisms as well.

I had hunted in Africa many times as had some of my friends. Several of them had remarked that the dwarf and ancient looking oaks in the sand hills reminded them of mopani forests in Africa. I too had noticed that and for that reason, we named the place Mopani.

My first inclination was to do nothing but provide protection for these unique animals. After some preliminary surveys

we realized that we had a very healthy population of indigos and Gopher Turtles, so why do any manipulation to the ecosystem. The old adage, "if it ain't broke, don't fix it". But a closer look revealed that the system was changing and the new habitat would be deleterious to gophers and therefore, indigos as well.

Fire at Mopani

As a result of years of fire suppression, the oaks were spreading in density throughout the sand hills. In a few places they were already shading out the ground cover to such an extent that the grasses and forbs on which the gophers depend were being eliminated. Without fire, there would be no control on the over-story. Without sunlight, there would be no ground cover. Without these grasses and forbs there would be no gophers and without the tortoises, there would be no indigos. The equation was simple enough. For centuries nature had provided fire through lightening. I would now have to supplement the natural phenomenon with prescribed and controlled fire to ensure the future of these species at Mopani.

A few years after we purchased Mopani, a 700-acre tract separating our sand hills from the Ocmulgee River came on the market. It included over a mile of river frontage and a beautiful old oxbow lake that had long-since been separated from the main channel. It was composed of 600 acres of riverine ecosystem and another 100 acres of sand hills. The indigos left the winter habitat with its tortoise burrows after the last frosts and foraged throughout the transitional ecotone and river bottoms. It strained our budget but we had to have it.

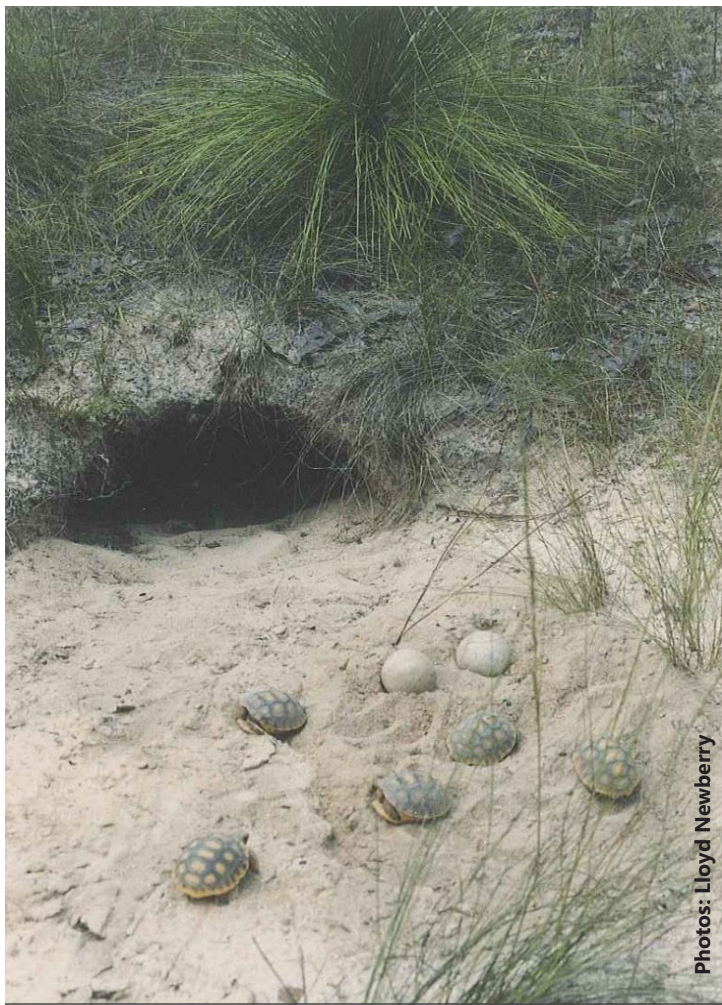
Seeding a Forest

Much of the sand hills were bare with only heart-pine stumps to remind us of what once existed. I decided to re-establish fire-tolerant Longleaf in these areas. In late winter of the following year, I purchased 20,000 seedlings as a start.



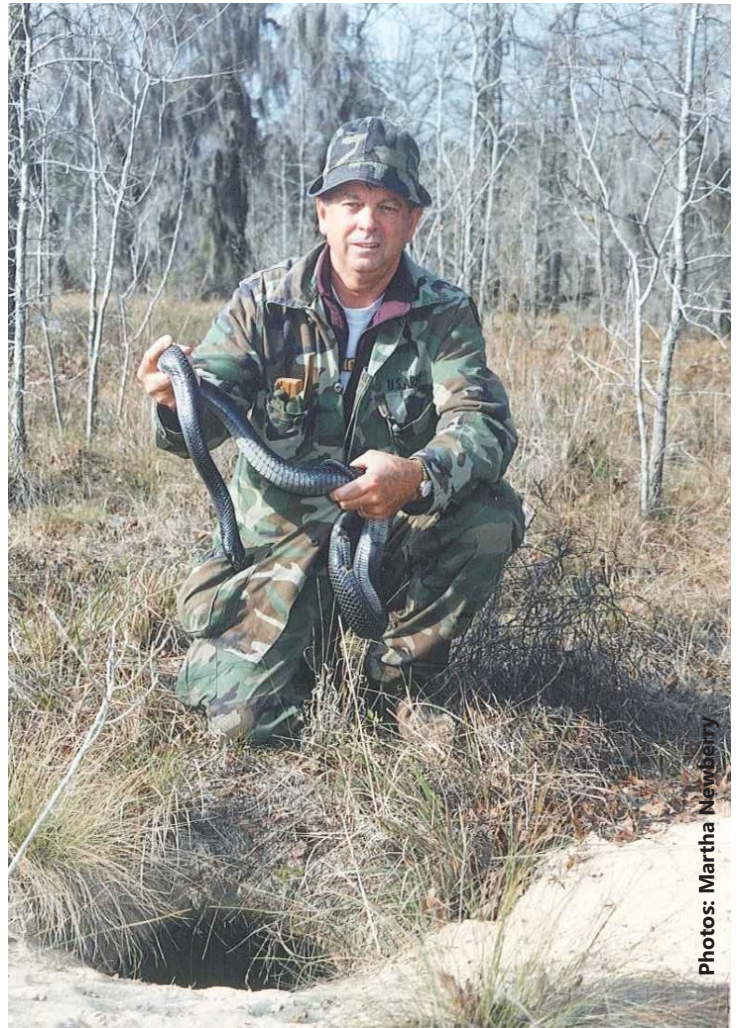
Photos: Lloyd Newberry

A raccoon dug up a few indigo eggs. We successfully incubated four of the five eggs.



Photos: Lloyd Newberry

Baby Gopher Tortoises hatched in the yard in September 2005.



Photos: Martha Newberry

We usually found indigos in the winter sunning by the entrance to gopher burrows.



Photos: Lloyd Newberry

The beautiful Ocmulgee River and wife, Martha, at Mopani. Indigos forage here in the summer months.

“My first inclination was to do nothing but provide protection for these unique animals- but a closer look revealed that the system was changing...”



Dr. Lloyd Newberry and the indigo “Big-Boy” that lived around the compound.

Photos: Martha Newberry

With a heavy dibble and a bucket-full of promise I spent long days punching in the seedlings wherever there was an opening for the sun to enter. Those long hours were a productive, if not mind-cleansing, experience, maybe one of the better things I ever accomplished. I knew I would never live to see them reach maturity, but it didn't matter in the scheme of things. Watching them push upwards each year with a promise of what could once again be was enough.

The needles of mature Longleaf allow enough sun to penetrate to the forest floor so that ground cover flourishes. And when the needles fall they contain rich stores of sap which along with Wiregrass enables fire to slowly crawl across the landscape.

I always loved the sand hills in the fall. In September when most of the adjacent woodlands are slowing their growth engines, the sands come alive with color. There are pink, scarlet and blue flowers, but the predominant astors turn the hills yellow from ground to knee-high. It was a wonderful time to meander through this wonderful ecosystem and Martha and I spent many mornings doing so.

Living with the Land

After I observed a wild hog feeding on an indigo snake it had just killed, we made the decision to harvest all the pigs possible. I remember a lot of smoked ribs with plenty to give away. The swamp provided venison when a change of menu was needed and blueberries from the sand hills made ample filling for Martha's pies. I often observed gophers harvesting these berries while I was doing the same. I laughed at their purple mandibles stained from chomping the over-ripe fruit which had fallen.

There was one large indigo that we often ran across in the yard around the barn or cabin. We named him “Big Boy”. How dare I speak in anthropomorphic terms, but I really believe he recognized us and

felt that we were harmless and therefore to be tolerated. Occasionally we would run across an Eastern Diamondback Rattlesnake (*Crotalus adamanteus*). What a beautiful animal, especially when freshly shed. Once when I was in my favorite rocker on the porch, a five-foot specimen crawled across the yard at noon. It was July and very hot. That sand had to be most uncomfortable for the snake. Why was he out traveling then? I saw a lot of wildlife from that rocker.

Two clutches of tortoise eggs hatched in the yard. The mother had deposited them in the sand apron around the burrow entrance and we discovered the hatchlings digging out. Both occasions were in September. Another time I discovered fresh digging activity around a rotten log that was laying across the sand apron to another gopher burrow. There were several large snake eggs over three inches in length which had been unearthed and destroyed. Judging by the size I was sure they were indigo eggs. Raccoon tracks in the sand told me who the culprit was and I assumed he would be back. Digging around in the sand under the log I found five more unharmed eggs which I incubated in a snake cage. Four of the five hatched in early October, a momentous occasion which we celebrated.

A New Relationship is Formed

As time moved along we began to worry about what the future held for the gophers and indigos at Mopani. Through our work with The Nature Conservancy and the Georgia Department of Natural Resources (GDNR), we knew that our population of these threatened animals was one of the most viable remaining. We initiated procedures toward a conservation easement that would at least protect the land from future development or sand mining once we were no longer in control.

In March of 2007 John Jensen, a GDNR Wildlife Biologist, visited Mopani to hunt



Children, eager to learn, were always welcome at Mopani. Dr. Lloyd Newberry (left) with Colin Guthrie (right) from Zimbabwe, Africa.

and tag several indigos. Accompanying him was Dirk Stevenson, a herpetologist from the Fort Stewart Military Base. Through their contacts, Martha and I were invited to meet with a group that had been organized by Tom Kaplan and Chris Jenkins. Dr. Kaplan is a wealthy conservationist who puts his money up-front and center to protect endangered species of the world. At his daughter, Orianne's suggestion, he decided to create an organization to save the indigo from extinction. He enlisted Dr. Jenkins, a well-known herpetologist, to head up the organization. Kaplan, known for his expertise in such matters, found in Jenkins the single best-suited person available for such an initiative. And for Chris Jenkins, to be given this responsibility, to save such an iconic species, it was a dream come true.

We met in Albany, Georgia, in October of 2007. Dr. Kaplan was a fast mover and Chris Jenkins orchestrated a two-day conference as we developed plans and procedures for implementing the initiative.

As a result of that meeting and my very positive introduction to Tom and Chris, I invited them along with several others to visit Mopani. In February of 2008, they spent the day at Mopani and John Jensen found a large indigo sunning by the entrance to a gopher burrow. It was the first wild indigo for many of the guests and made for a memorable afternoon.

About this time I was requested by the Dean at Auburn University to work with Valerie Johnson and Dirk Stevenson on a project to restore indigos to Alabama, namely the Conecuh National Forest. Being a loyal University of Georgia graduate three times over I knew that nothing good could ever come out of Auburn, but for a project to help indigos, I could not refuse. On their first visit in March we caught four indigos in 30 minutes, all between 2:00 and 2:30 p.m. We released three after photographing and Valerie took one gravid female back to Alabama. When the eggs were deposited in the laboratory she returned the female back to its gopher burrow



Photos: Martha Newberry

Dr. Lloyd Newberry (left), Valerie Johnson (middle), and Dirk Stevenson (right) found four indigos in 30 minutes.



Photos: Martha Newberry

Dr. Lloyd Newberry (left) with Dr. Tom Kaplan (right) during his first visit to Mopani in 2008.

home at Mopani. I enjoyed working with things wild in the Southeast than Dirk her and Dirk who was later hired full-time Stevenson. And that is especially true of by Orianne. The more I got to know Dirk his knowledge and love of the Gopher the more respect I developed for him. No Turtle and the indigo snake. Dirk is also one I know has more knowledge for all an incredible writer with the ability to

blend scientific vocabulary with layman language and logic. He is truly a disciple for the indigo.

Preserving the Future

Chris and Tom were actively looking for the “right land” to purchase, a ground zero for the Orianne Project named after his daughter. I had been having conversations with Chris about my concerns for the future of Mopani. The timing and place was right. It appeared that everyone’s interest would be served if Mopani became that “ground zero”. Especially the gophers and the indigos. Tom purchased the land and as they say, “the rest is history”.

Martha and I had many mixed feelings at first. I had always been of the opinion that a private landowner could better protect the land and wildlife on it, than any organization no matter how well-meaning. However, I had learned more than enough about Kaplan and Jenkins to realize that this initiative would be hugely beneficial to its flagship species. Not only would the animals at Mopani be protected, but the research and educational programs that Orianne would produce would provide a viable future for the populations as a whole.

Still, it was tough to walk away. I would miss the Barking Tree Frogs, (*Hyla gratiosa*), in the spring, and the Spotted Salamanders, (*Ambystoma maculatum*) in February. I wondered if R2-D2, the Gopher Tortoise who lived under the porch, would miss the squeak of my rocking chair. Most of all, would I ever again stand frozen in awe as I witnessed a seven-foot indigo slowly move through the Wiregrass with his head raised a foot high scanning his domain.

Those first few months after leaving Mopani I found these thoughts always with me. Then one day the phone rang. It was Chris Jenkins. He called to see if I might be interested in serving on the Board of Directors for The Orianne Society. All is well that ends well. 🌿



Photos: Lloyd Newberry

The cabin at Mopani.



Photos: Martha Newberry

The group that visited Mopani with Dr. Tom Kaplan.

Managing Wetlands

embedded within Longleaf Pine forests

*a case study of pine flatwoods wetlands
in the Florida Panhandle* by Houston Chandler

Often characterized by dry sandhills and other upland habitats, Longleaf Pine forests are also home to a high diversity of wetland habitats, embedded within the surrounding matrix of upland forests. Wetlands embedded within Longleaf Pine forests include but are not limited to cypress domes, Carolina bays, and flatwoods ponds. These various wetland types have different characteristics depending on their landscape position, surrounding geology, and fire history. Wetland characteristics, especially

hydrology and vegetation structure, are crucial to determining the species assemblage that can utilize a particular wetland. Wetlands embedded within Longleaf Pine forests support and provide habitat for a diverse reptile and amphibian fauna, including many species that specialize in these types of habitats and are found nowhere else.

Wetland resources across the Southeast have experienced a history of destruction and poor management, dramatically reducing the overall number of wetlands and leaving many of the remaining wetlands

highly degraded. Unfortunately, wetland degradation can even occur on properties that have well-managed upland Longleaf Pine forests because wetlands are often either considered of secondary importance or are flat out ignored by land managers. Of particular concern is the loss of regular growing season fires burning through wetland basins, which can change the entire structure of a wetland. Reducing the total number of wetlands combined with declining habitat quality is problematic for many of the reptile and amphibian species



Photo: Houston Chandler

(not to mention the other aquatic organisms and wetland adapted plants that depend on wetland habitats) that use wetlands for various parts of their life history (e.g., breeding and foraging).

Here I discuss the lessons learned from a >10 year research project aimed at improving wetland habitat for amphibians in pine flatwoods wetlands located in the Florida panhandle. Although every wetland system is different, many of the management techniques that were applied to these wetlands can either be used in or

used to inform management in other wetlands across the Coastal Plain of the Southeastern United States.

The Importance of Fire

A loss of the natural disturbance regime affects fire-dependent wetlands in many of the same ways that it does upland Longleaf Pine forests. Pine flatwoods wetlands are characterized by open canopies composed mostly of pines and cypress, with thick

herbaceous vegetation (grasses and forbs) covering the wetland basin. Wetlands tend to be shallow (<2 feet), and it can sometimes be difficult to distinguish wetland edges from the surrounding flatwoods unless the wetland is completely full. Wetland basins historically burned every 3–10 years during the growing-season (a slightly longer fire return interval than in the surrounding forests). However, as the time between fires lengthens from fire suppression and exclusion, flatwoods wetlands undergo a vegetation shift via the



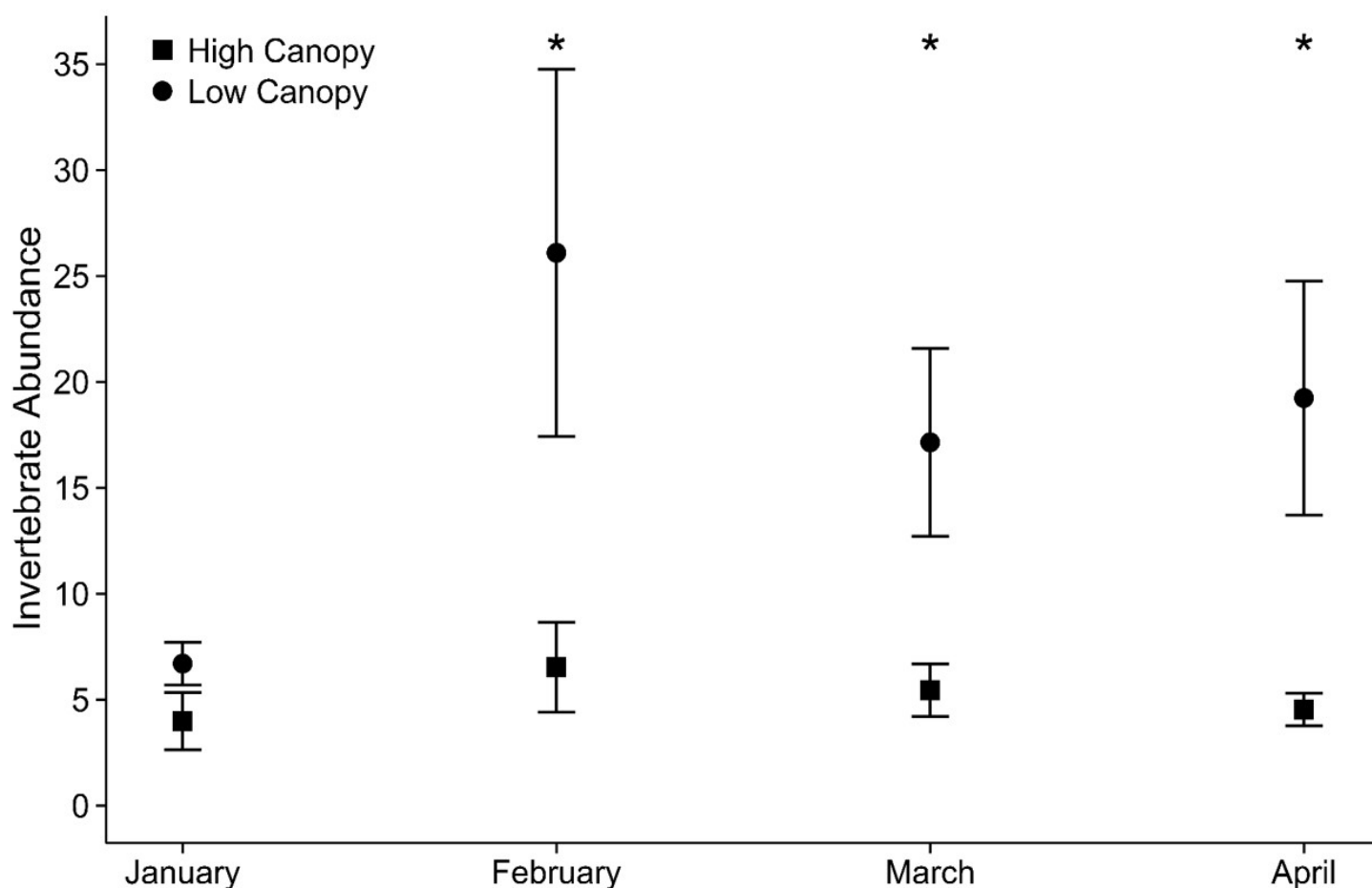
Photo: Houston Chandler

High-quality flatwoods wetland characterized by abundant herbaceous vegetation and low canopy cover



Photo: Houston Chandler

A flatwoods wetland that has been fire suppressed for many years.



Aquatic invertebrate abundance per dipnet sweep measured over a four-month period in high canopy cover and low canopy cover sections of six pine flatwoods wetlands. Error bars represent standard error, and asterisks represent months where there was significantly higher invertebrate abundance in low canopy sections.

development of a thick mid-story composed primarily of shrubs (e.g., *Ilex*). This increases canopy cover and decreases the abundance and diversity of herbaceous vegetation covering the wetland basin. These changes in vegetation can often be quite dramatic with canopy cover increasing from approximately 20-35% in well burned wetlands to >65% in severely fire suppressed wetlands. Herbaceous vegetation cover can go from >50% to <5% in these same wetlands, creating vastly different habitat for the species depending on them.

These vegetation changes have

multiple direct and indirect effects on the species using flatwoods wetlands for at least a portion of their life history. Specialist amphibians (e.g., Ornate Chorus Frogs (*Pseudacris ornata*) and Reticulated Flatwoods Salamanders (*Ambystoma bishopi*)) are more likely to be present in wetlands with low canopy cover and high herbaceous vegetation cover because they are adapted to those vegetation types. For example, Flatwoods Salamanders need thick herbaceous vegetation for every part of their reproductive cycle, from egg deposition to larval metamorphosis. Removing the majority of the

herbaceous vegetation in wetland basins reduces the structure in the aquatic environment, which many species use for foraging and predator avoidance. Some aquatic predators also use structure in the environment to increase their feeding success. An increase in canopy cover reduces water temperatures, slowing the growth and development of larval amphibians (potentially problematic for larvae attempting to metamorphose before wetlands dry in late spring). In fact, aquatic invertebrate abundance is greatly reduced in wetlands with high canopy cover, simplifying the aquatic

food web by removing a large portion of the lower trophic levels. Finally, vegetation changes also directly impact large-scale wetland processes through altered fire effects and changing wetland hydrology.

Clearly, the loss of the natural fire cycle and subsequent vegetation changes have widespread negative effects on the remaining flatwoods wetlands. In recent decades prescribed burning has become a common practice across the Southeast as land managers have realized the importance of regular fires in Longleaf Pine ecosystems. Unfortunately, wetlands present unique challenges, and it can be more difficult to burn wetland habitats than the surrounding forests for multiple reasons. A large majority of prescribed fires are set during the winter and early spring, which coincides with the time of year when flatwoods wetlands are most likely to be inundated. This means that in many years wetland basins will not burn even if the surrounding uplands are well-maintained, essentially creating islands of degraded habitat within a larger well-managed landscape. Furthermore, as wetland vegetation characteristics shift from lack of fire, plant species that help carry a fire through a wetland basin are replaced with plants that will only burn during hot fires that burn up into the canopy of woody shrubs. These type of fires are often avoided during prescribed fires.

Restoring Degraded Wetlands

Given the challenges associated with burning flatwoods wetlands, what can

land managers do to restore degraded wetlands and to maintain habitat quality in wetlands with a good fire history?

There are several techniques that can be applied to degraded wetlands to improve the habitat quality and transition vegetation characteristics back to the fire-maintained norm. The first problem that managers face is removing the thick shrub layer that prevents herbaceous vegetation from growing. It is possible to kill some shrubs on the edge of a wetland with hot fires, but it would take multiple fires over several years to even begin to penetrate the interior of a wetland. In large, severely overgrown wetlands, it is unlikely that prescribed fires would ever completely reverse the vegetation changes that have already occurred. However, it is possible to go into a wetland and manually remove unwanted shrubs and trees using a combination of saws and appropriate herbicides. Treatments are ideally applied by a small team of workers, moving through a wetland on foot to remove shrubs and trees that fall below a certain size (i.e., leaving larger overstory trees). These mechanical treatments effectively lower canopy cover to historic levels and can be applied to small wetlands in a single day. Cut shrubs and trees can be hauled out of the wetland basin and stacked in piles that will burn up during the next prescribed fire. Although labor intensive, a mechanical treatment creates minimal disturbance in wetland basins (no heavy machinery) and is the best method for rapidly reversing some of the negative impacts caused by fire suppression.

Unfortunately, even several years after canopy cover has been reduced,

herbaceous vegetation cover is generally slow to regrow into wetland basins. This is likely because many degraded wetlands develop a thick duff layer (ca. 2–4 inches) that is slow to decompose. Duff layers are composed primarily of leaf litter from the shrub midstory and can persist for years after the thick canopy has been removed. There are two ways to deal with this problem. First, in some wetlands prescribed fires can successfully burn through wetland basins, removing large portions of the duff layer. This generally requires a late spring or summer fire that is hot enough to burn through leaf litter without the aid of fire-adapted plants, and fires must be set when wetlands are completely dry for this method to be effective. Second, duff layers can be manually removed by raking away the decaying leaf litter and exposing the mineral substrate. This promotes germination of plants and dramatically increases the amount of vegetation growing in raked areas. It is also labor intensive and likely not suitable for treating entire wetlands. In reality, a combination of manually removing the duff layer and prescribed fire likely represents the quickest path for restoring herbaceous vegetation.

Applying the above techniques to degraded wetlands can restore natural vegetation conditions over the course of several years, but they do not solve the original problem- a lack of regular growing season fires. Given the difficulties associated with burning wetlands during traditional winter or early spring prescribed burns, a new strategy is needed to successfully implement fire in these wetlands. The easiest solution is to simply



Overgrown wetland before (A) and after (B) mechanical treatment designed to remove shrubs and lower canopy cover.



Photo: Houston Chandler

Fires set during drought years can successfully burn through wetland basins even during the winter and early spring.

set prescribed fires during the late spring and summer (i.e., the normal fire season). Summer fires are hotter and more effective at controlling the growth of shrubs and other plants that are not fire adapted. Most importantly

wetlands are less likely to hold water during the summer, although the longer fire return interval for wetlands occurs because in some years wetlands will be inundated regardless of when fires are set.

Unfortunately, on certain properties logistical constraints prevent large-scale fires from being set during this time of year. In these cases, land managers will have to ensure that wetlands are burned through other means. Wetlands may still be targeted for summer burns if the surrounding landscape was burned earlier in the year, essentially creating a large buffer around the wetland. Drought years may also represent a unique opportunity to burn wetlands in the winter or early spring when it would normally be impossible. Even though winter fires are not ideal, fire at any time of year is preferable to leaving wetlands unburned.

Where Do We Go From Here?

Overall, a history of fire suppression and exclusion has caused many pine flatwoods wetlands to degrade to a point where they are unlikely to be restored through fire alone,

Reticulated

Flatwoods Salamander

Ambystoma bishopi



Illustration: Sarah Seeley



Photo: Houston Chandler

necessitating a more active management approach. Too often small ephemeral wetlands are an afterthought in land management when in fact they should be a priority because of the biodiversity that they support. The management options discussed in this article are successful at improving habitat quality when properly implemented, but they tend to be labor intensive. There are often limited resources to apply to habitat restoration and management, and this can force land managers to make tough decisions about which locations would be most beneficial to commit resources to.

In landscapes with abundant small wetlands, it can be difficult to determine which wetlands contain the most conservation value. A couple factors can be assessed to make these

decisions easier. The presence of specialist species (either current or historical) is a good indicator that a wetland either has or had high quality habitat that is worth maintaining. Wetlands within a close proximity of wetlands with specialist species are also good candidates for restoration because maintaining a network of closely linked, high quality wetlands is important for species persistence (i.e., if local extirpations occur there is a nearby source for recolonizations). Finally, wetland hydrology is the most important factor determining the breeding success for aquatic animals in ephemeral wetlands. Given a variety of wetland characteristics, wetlands with long hydroperiods (the length of inundation) and slow drying rates are potentially more suitable for amphibians, making them a higher priority than wetlands that dry rapidly.

Hopefully, land managers will begin to include these ecologically important wetlands in their management plans and work to restore wetlands that

have experienced many years of poor management. Combined with the continued push to restore Longleaf Pine forests, a focus on wetland restoration will ensure that these incredibly diverse habitats continue to persist in a rapidly changing world. ♪

Eggs are laid on the edge of seasonally flooded wetlands. Hatching is triggered during rainfall



The primary activity area around their breeding pond is estimated to be a radius of 1,476 feet



Only 20 known populations exist in Florida and Georgia. It is currently listed as an endangered species



CHESTNUTS & RATTLESNAKES

by Kiley Briggs

an unsuspecting consequence

Photo: Kiley Briggs





Tucked securely under a boulder on a ledge overlooking rolling hills of oak and hickory, I found my very first Timber Rattlesnake (*Crotalus horridus*); plump and pregnant with a belly full of young. Sweat, heat, and a thousand hungry mosquitos faded from thought as I spent the next half hour framing the perfect photo, not sure if I'd ever see something so special again. Thankfully, the summer turned out to be a good season for rattlesnakes and I would see many more gestating females in the coming weeks, but subsequent summers were not nearly as productive, and a fungus may be to blame. Over a century before herpetologists uttered the words, "snake fungal disease", snakes in the Northeast were dealt a serious blow by another fungus, but that fungus never killed, let alone infected, a single snake. The fungus at play here is lethal, but only to a single species of tree.

For millions of years the American Chestnut (*Castanea dentata*) provided huge mast crops annually, fueling ecosystems in the Appalachian Mountains, an area spanning from Georgia to Maine, with a reliable source of food year after year. The trees were very large, with trunks spanning up to nearly 10 feet in diameter, crowns towering a 100 feet in the air, and with each tree producing 6,000 or more highly nutritious nuts every year. There were some trees that three grown men together could not reach around and chestnut trees



Photo: Gail Whistance

Historic picture of a large American Chestnut tree (Ten Eyck Dewitt barns - Paul Farm NY).

numbered in the billions; perhaps one out of every four trees in the Appalachians was an American Chestnut. Yet, despite growing up in the region, I had never in my life looked up at a healthy chestnut tree until recently; or rather looked down at, thanks to chestnut blight (*Cryphonectria parasitica*) which was introduced from Asia.

First noticed by staff at the Bronx Zoo in 1904, yellow cankers turned up on some of the chestnuts in New York City. Eventually the cankers girdled branches and trunks, killing the trees. Within two years the disease was well-established in other states and by 1945 had killed almost every single mature American Chestnut tree. Some sources state that blight killed 99.99% of all mature American Chestnuts, but that would mean there are hundreds of thousands of large chestnuts left. In actuality, only a few hundred naturally-occurring mature trees survive today. The species persists, barely, with blight killing the above ground portion of trees once they reach sapling height. Roots survive, send up shoots, then the shoots become saplings and die, with very few trees ever living long enough to produce seeds. The mast crop is gone, the American Chestnut is functionally extinct, and the Eastern hardwood forests are missing their most important player, the loss of which sent shockwaves through forests that can still be seen today.

One of the nice things about ecosystems with high biological diversity is that when one species vanishes, another can step in and fill the empty niche, but in the case of the American Chestnut, no other species could provide the same function lost after blight wiped them out. Other trees do produce mast crops, but the chestnut's ability to provide large mast crops every year was unique; they were a reliable source of food that always provided. Oaks, which are now the dominant species group throughout much of the Appalachians, produce large numbers of acorns, but not every year.



The crown of this American Chestnut died from blight several years ago, but some lower branches still survive, but all show signs of blight and will not last long.



Photo: Kiley Briggs

American Chestnut flowers are an incredibly rare sight these days. Very few chestnuts live long enough to flower before blight girdles and kills the trees.



Photo: Kiley Briggs

Gravid Timber Rattlesnakes lose a lot of body mass after birthing and can only reproduce every few years or so, but likely did so more frequently prior to the loss of American Chestnuts.

Instead, oaks produce small numbers of acorns most years then, in synchrony, all of the oaks in an area produce a huge mast crop sending a pulse that ripples through all trophic levels. Oak acorns are an important supply of food for many animals, but the fluctuating supply of acorns makes life difficult for long-lived animals that evolved in ecosystems where chestnuts were available in large quantities every fall. Timber Rattlesnakes are one such species out of many.

Timber Rattlesnakes can live a long time and give birth to between four and fourteen young, but not every year. Reproduction is a very expensive process for female Timber Rattlesnakes and a few or

more years will pass between reproductive cycles. If the matter were only that simple, you might expect roughly a third of all adult Timber Rattlesnake females to give birth in a given year, but what we actually see are years with low birth rates and then years with high birth rates. These birth pulses more or less resemble what we see in oak mast production and may be connected to them.

Timber Rattlesnakes do not eat nuts themselves, but their food does. Short-lived and with high reproductive rates, the mice and other rodents Timber Rattlesnakes feed on explode in population size when resources are plentiful and become scarce when resources are not. Back in the time

when American Chestnuts dominated the landscape, resources were plentiful almost every year and rodent populations were much more stable and larger than they are today. One study a few years back estimated that after blight removed American Chestnuts from the Appalachian Mountains, populations of white-footed mice decreased by nearly 50% and year to year variation in population size increased by 60%, with other species and studies showing similar declines in abundance and increases in variability. White-footed mice make up the bulk of the Timber Rattlesnake diet, so there should be no surprise that in a post-chestnut world, Timber Rattlesnakes have a more difficult

time gathering the resources they need to reproduce.

Hope for the resurrection of the American Chestnut, ironically, resides in the very species from which blight originated; the Chinese Chestnut (*Castanea mollissima*), which is naturally resistant to blight. The Chinese Chestnut is different in form from our native species and would not make a suitable replacement for the American Chestnut in our hardwood forests, so simply introducing the Chinese species to our forests is out of the question. Efforts to breed blight resistance into the American Chestnut through hybridization began almost immediately after blight wreaked havoc, but those early hybridization efforts were largely abandoned after years of ill success; the hybrid trees could not compete against native species and failed to thrive. In 1983, with the creation of The

American Chestnut Foundation (www.acf.org), a more systematic approach to hybridization was employed and today, finally, the American Chestnut is close to making a comeback.

The American Chestnut Foundation crossed Chinese Chestnuts with the healthiest surviving American Chestnuts. Seedling hybrids were then inoculated with blight and those that survived were crossed again with native trees. This process, albeit more complicated than I am letting on, was repeated again and again, with each cross halving the genes from the Chinese species in the hope that after seven generations they would produce trees that are almost entirely native except for their possession of the genes coding for blight resistance. With trees needing to reach about seven years of age before they can flower, the process was slow. Now, over a century after blight

first reached the Appalachians, potentially blight-resistant trees are being planted in restoration plots all throughout the species' native range with the anticipation that many will survive and breed.

I was very excited to learn of one such restoration plot at a site very near and dear to my heart, though I had not visited in nearly ten years. The Jericho Research Forest (https://www.uvm.edu/rsenr/jericho_research_forest_and_conservation_center), which is home to a great diversity of trees and is a favored destination for many forestry, botany, and wildlife classes at The University of Vermont, is where I saw my very first American Chestnut. The tree was perhaps 30 feet tall and the lower branches were covered in small thorny chestnut husks, but the upper branches were leafless and the limbs that did have leaves also bore visible orange blisters. Elsewhere on the



Photo: Kiley Briggs

This Timber Rattlesnake waits patiently by a log in strike position, waiting for its next meal to run by, likely a white-footed mouse.

property were scattered chestnut shoots between knee and head height, which is common in places that once supported mature trees. The Jericho Research Forest and those trees left an imprint on me, so to learn the property was seeded with potentially blight-resistant chestnuts filled me with joy and I had to see the trees for myself.

The mature tree I remembered from a decade ago was long gone during my recent visit to the Jericho Research Forest. Presumably the tree was cut down years ago as there wasn't any evidence the tree ever existed other than a few shoots nearby, probably growing from the very same roots as the missing tree. Knowing that the same tree is destined to grow and die time and time again with blight mowing down the crown just prior to maturity added a bitter note to my visit, but I was there to find trees with a different fate. As a toad hopped across the path I wondered briefly how the toad's life might be affected by the return of the chestnut, but my thoughts were cut short as I caught a glimpse of shiny white tubes on the forest floor in the distance; seedling tubes meant to protect young trees from predation and dehydration. To say finding the blight-resistant chestnut plot was as exhilarating as finding my first rattlesnake all those years ago might be a bit of an exaggeration, but just a small one. The young trees seemed so unimportant, just twigs with leaves poking up out of plastic sheathes and surrounded by a carpet of fern, but knowing the implications their presence has on the future of the forest filled me with a sense of awe.

My jaw dropped mere moments later when I saw one towering above all others. The tree must have been nearly 30 feet tall and was too large for me to fully grasp with my hand. For the first time in my life I looked up at a seemingly healthy American Chestnut, something

I've wanted to do ever since seeing that first diseased tree in college. My sense of gratification for checking that sight off my bucket list turned to disappointment later that evening when I learned the tree I had looked up at was a naturally occurring tree and that despite the tree's healthy appearance actually had no blight resistance. Chestnuts grow fast, however, so I took solace in knowing the forest is now filled with seedlings that could tower above me in just a few years. While the seedlings being planted in test plots up and down the Appalachian Mountains are only considered "potentially blight resistant", decades of effort are leading us to a point in the very near future where our forests can be seeded with "really blight resistant" trees and, with any luck, balance will return to our hardwood forests.

The loss of the American Chestnut was perhaps the worst ecological disaster ever to strike hardwood forests on the East Coast, but chestnuts are not the only tree to vanish from their hills in the past century. Dutch elm disease arrived in the 1920s and we no longer have mature elms. Over 90% of Butternut trees are infected with a lethal canker fungus and their survival as a species is questionable. Emerald ash borer beetles threaten ash trees, and the woolly adelgid beetle has the potential to almost completely wipe out hemlock, a loss that would greatly harm ecosystem processes and functions in many of the same areas hit by chestnut blight. What species will be next and how many losses can our forests sustain? Some losses

are greater than others, but every time we lose a species the consequences can be incredibly far-reaching and disrupt complicated species relationships.

Protecting and restoring biodiversity where we can is the least we can do to ensure a healthy, functioning environment. I am very proud to be joining The Orianne Society, an organization that works to conserve and restore critical ecosystems for imperiled reptiles and amphibians using science, applied conservation and education. Through our dedication and commitment to protecting biodiversity, The Orianne Society, and other like-minded organizations, help secure the future of healthy, working landscapes for the centuries to come. 🌱

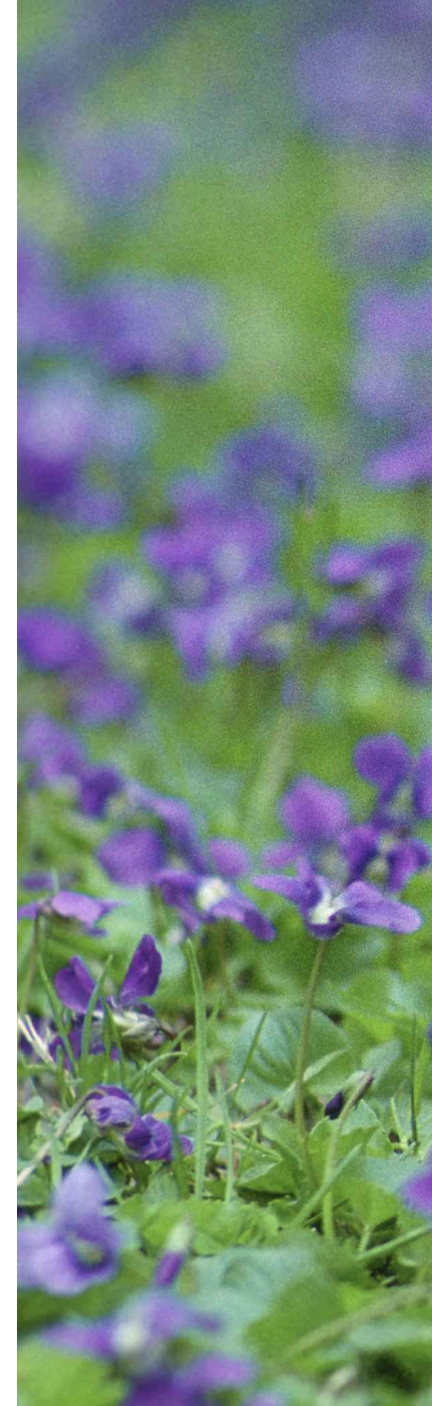


This seedling tube protects a young, potentially blight resistant, American Chestnut in a test plot at the Jericho Research Forest.

The ceiling is built of centuries old, flat-topped Longleaf Pine that reach up into the orange morning sky. There are sparse clouds of low lying fog over the knee high inflorescences of native bunchgrasses which carpet across the woodland's floor. Oh, the stories that this space could tell. The morning has a slight nip to it. The sea of grasses part in front of us as the pointer works. All at once everything goes still. The old pointer freezes and takes form on a few indiscrete clumps of Wiregrass like he had done time and time before. A small, curly-haired brown dog rushes to where the pointer is directing his attention and begins rooting its nose underneath the clumps of grass as if it were searching for its long lost bone. The brown dog continues to nose the clumps and, without warning, an explosion of white and brown feathers erupt from the forest's floor, dispersing all across the space. The icon of the "gentleman's South". Where outings to harvest a few of these much sought after gamebirds are filled with top dollar bird dogs, classic shotguns, and vintage cigars, and possibly even mule drawn buggy rides to and from the course. Everything that embodies Southern proper is the infamous Northern Bobwhite (*Colinus virginianus*).

My grandfather has told me story upon story about how drastically the land around this area has changed since he was in his late teens/early twenties. He was raised in Dodge County, Georgia, a county adjacent to the Orianne Indigo Snake Preserve. Often times, I admit, I am skeptical to believe some of his claims due

to the period of time that I have been around. For instance, every fall I get amped up about waterfowl hunting and I make it well known. Granddaddy would tell me his memories of floating silently around Black Willow covered oxbows on the Ocmulgee River in his dad's old jon-boat. "Sheets and sheets of birds" are the words that he used to describe the amount that would get up off the water and not just Wood Ducks, he claimed. From Northern Pintails to Mallards to Green Wing Teal, the Ocmulgee had it. Given, this was during a time when he and his father were the only ones with an outboard motor on that particular stretch of the river. What an unbelievable sight that would be. The same goes with bobwhite. I can remember evenings when I used to sit with my grandparents on their front porch rockers and just listen. I still do occasionally when I visit home. When I was young we would hear a sound and he would tell me to whom it belonged. As I got older and progressed through my college years, the tables turned and I was telling him who we were hearing for a change (more times than not, it was some flavor of frog). One call that always resonated with each of us, though, was that distinctive whistled hoot wheet, sounding like it had said its name



by Jacob Barrett

THE SOUTH'S PHOENIX



Photo: Pixabay

“bob white”. He has always said that he remembers hearing them more often when he was young versus nowadays. His father used to be somewhat of a hunting guide during the fall of the year. Not to the point of running a business or making a living off of it but more so taking people hunting on the “back forty”. They would just walk through the woods. No bird dogs, just their shotguns and conversation. Most times they would bust up several coveys before lunch. As a kid, and even more so now, I still have

trouble comprehending busting several coveys before noon. I often wonder what the woods looked like during that time.

A Connected System

By this point, if you have not already had this thought, you are probably wondering something along the lines of, “Why in the world does The Orianne Society have an article about some bird in their magazine?” That is an excellent

question. The bobwhite has faced, much like any other declining species, habitat fragmentation and destruction via conversion to intensive agricultural lands, urbanization, and lack of frequent fire in the forest. In last summer’s issue of *Indigo*, our CEO, Chris Jenkins, wrote a piece about the Gopher Tortoise, serving as an “umbrella species”. When management plans are based around an umbrella species, the Gopher Tortoise in this instance, many other species reap the benefit as well (i.e. Eastern Indigos

Snakes (*Drymarchon couperi*), Gopher Frogs (*Rana capito*), Red-cockaded Woodpeckers, (*Leuconotopicus borealis*) and Northern Bobwhite (*Colinus virginianus*), just to name a few of the well-known heavy hitters). Although we are not directly managing for the declining bobwhite, it is relatively easy for us to survey this species via spring whistle counts and fall covey counts. After a few years' surveys are completed, we are hopeful to be able to identify a trend in bobwhite population and covey locations across the Orianne Indigo Snake Preserve. Through our continued habitat management and groundcover restoration efforts, we are expecting to see an upward trend throughout the coming years and see coveys expanding their ranges into areas where they have not been previously recorded. The bobwhite, for our purposes, serves as an indicator species. I use the term "indicator species" loosely because we are not using the same management practices as a quail plantation would use to produce the most birds per acre (i.e. winter disking, planting agricultural crops, etc.). We are not trying to farm quail for a huntable population. There is nothing wrong with how plantations manage for quail, we just have different methods and goals. Through our management

practices, we try to have minimal impact and disturbance on our native ground cover and let the process of fire shape the landscape.

The Habitat

Only 2% of the once ninety-two million acres of Longleaf Pine ecosystem remain intact throughout its historic range in North America. This entire ecosystem was once solely maintained by the most important process: fire. The bobwhite quail was given the alias of the "fire bird" by Herbert Stoddard, who is one of the most important conservationists of the twentieth century and widely known as the authority of bobwhite quail management. Stoddard was a huge advocate for returning the process of fire back to the forest during a time when much of the world saw fire as a force of destruction. Both the Gopher Tortoise and the bobwhite are adapted to an open Longleaf woodland that is characterized by approximately 60% open canopy, few to no mid-story hardwoods, diverse herbaceous groundcover, and sparse shrubs. But, out of the other Southern Yellow Pine species, why is Longleaf such an important part of the fire forest? The short answer, like many other species, it

is adapted to handling the heat and stress of frequent fire as well as aiding in the spread of fire across the landscape. The Longleaf Pine has more resin content in its needles which makes it burn more readily versus species like Loblolly and Slash Pine's needles. The growth form of the Longleaf should also be noted. The Longleaf has a more open growth form that takes up more canopy area, relative to Loblolly and Slash, but still allows for more sunlight to get through to the forest's floor so that herbaceous understory growth is stimulated. The Longleaf Pine is also a longer lived tree, somewhere in the neighborhood of four hundred years. It is a fire tolerant species, even as a grass-stage seedling. This enables it to be burned throughout the stand's rotation from the very beginning.

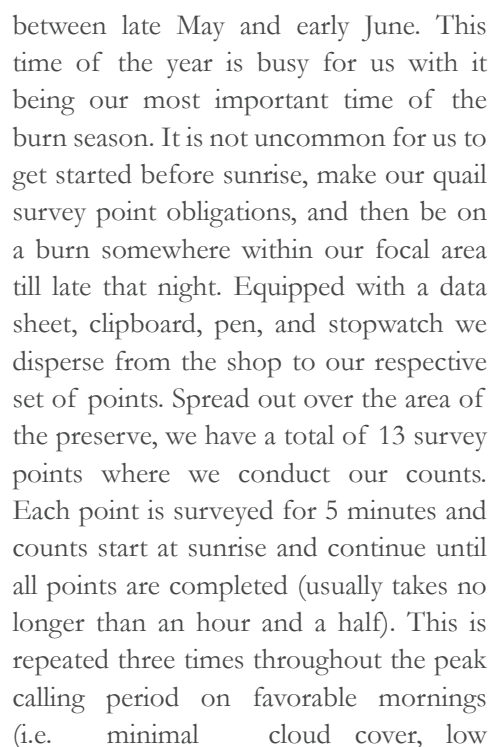
Seasonality plays an important role in the process of fire, too. We try to burn as much as possible during the natural fire season, which occurs late April-June. It is called the natural fire season because, in the Southeast, the majority of lightning strike caused fires would have occurred during this time frame. According to the National Weather Service, from January 1st, 1996 to December 31st, 2005 much of the state of Georgia recorded anywhere from

"It is becoming a difficult matter in the Eastern United States to find areas where quail [or any animal] are living under natural conditions, unaffected by man and his works." —Herbert L. Stoddard

In addition to applying fire during the growing season we are also working on restoring native ground cover over multiple sites on the Orianne Indigo Snake Preserve. As was mentioned earlier in the article, some plants, such as Wiregrass, have a significantly higher seed viability when burned during the natural fire season. The following fall is when all of our hard work seems to finally pay off. Depending on environmental conditions, we can usually expect Indian grass species (*Sorghastrum spp*) to begin to cure towards the end of September to early October. This seed has a very narrow collection window (~1 week) before it shatters and falls to the ground. A large wind or heavy rain event could shorten the collection period. Later in November we can usually begin collecting Wiregrass seed mix via hand stripping and/or flail vac. If we have enough room to navigate through the site without hitting trees with the flail vac, that

is our primary means of seed collection. Its aluminum construction, while light weight, allows it to be easily damaged with just the slightest bump of a small tree. The flail vac is comparable to a street sweeper but with a hopper that accumulates seed throughout the traverse(s). The flail vac can be elevated via hydraulic lift arms so that it is sweeping just the culms so that it collects mostly seed and minimal undesired plant matter. The seed is then brought indoors for a drying period of around two weeks before a sample of the collected seed is sent to the lab for seed germination testing. Results for the test take close to 50 days or until seeds stop germinating. After we receive the results from the seed tests, we are able to begin planting as soon as possible. This past year, we were able to plant 18.5 acres in our “donor sites” on the preserve. Our donor sites are comprised of several open fields that will be lush with native ground cover in the near future. These donor sites will enable us to have the fields on rotation from year to year so that we can harvest seed from them with ease (i.e. we will not have to dodge trees and other woody debris with the flail vac). The donor sites will also be easier to burn as there will be no worry of scorching a canopy. We use a Grasslander™, a native seed drill, to plant our ground cover. It allows us to calibrate down to the number of viable seeds placed per square foot of the total acreage. This proves to be invaluable, especially when we have low seed viability years and we need to make the most of our seed supply.

Our spring whistle counts begin early in the morning during the peak calling time during the breeding season, which usually falls somewhere



wind speed, steady or slightly rising barometric pressure). Each data sheet has an aerial map with concentric circles at set distances from the survey point as well as other general information blanks (i.e. temperature, cloud cover, wind, noise, etc.). Each time a unique whistle is heard within the five minute survey period it is recorded by the observer by placing an estimated location mark on the map from which the whistle was thought to have been heard. Then the observer writes in the four letter bird code, "NOBO" for Northern Bobwhite, and records the time interval at which it was heard, the estimated distance from the point, and if it was an audio or visual account. Over a period of seasons, these surveys will provide us with an index or "trend" of the bobwhite population on the preserve. These counts provide an index of breeding capital and if we continue to listen at the same locations at the same time of day year after year we will be able to track how well

the birds are surviving winter in relation to our management. We will also be able to tell if the numbers are increasing or decreasing over time and also have some insight of individual stations compared to the thirteen station mean. It can also aid us in troubleshooting why there are birds in one area but not another. For example, we can compare a particular survey point's habitat that has had five roosters calling versus a different point that has had none.

During the late summer and fall, birds from different broods begin to mix and form social groups called coveys. These coveys usually range from 20-30 birds. During this time, the birds begin the characteristic roosting behavior of forming a circle on the ground where each individual faces outward. This behavior is thought to have important heat conservation benefits. As mid-late fall approaches, the birds begin to break into coveys as small as 10-15 birds as they settle into their winter range. Unlike

the calling behavior of spring, most of the calling occurs 20-30 minutes before sunrise. Although peak calling activity may shift, we can usually assume it to be around the last two weeks of October. In order for us to figure out the time at which the peak calling is occurring, we must begin monitoring the calling intensity a few times in September and early October. Doing this will indicate when calling begins to increase, indicate peak timing, and when more intensive surveys should begin. Just like with spring counts, we have a similar data sheet but we arrive at the points 45 minutes before sunrise and stay until the sun rises. Much like spring counts, we try to shoot for mornings with minimal cloud cover, low wind speed, and steady or slightly rising barometric pressure. We will conduct these surveys up to three times during the peak. In order for us to estimate the population on the property, we multiply the number of coveys counted by the



Photo: Jacob Barrett

Well established ground cover on Orianne Indigo Snake Preserve with young Longleaf Pine interspersed.

average covey size. We can determine the average covey size by flushing and counting as many members of each covey as possible but usually at least 10 coveys is sufficient. In the case that we are not able to flush the coveys, it is widely accepted by many southeastern quail biologists that the average covey size is 12 birds.

Understanding the Future

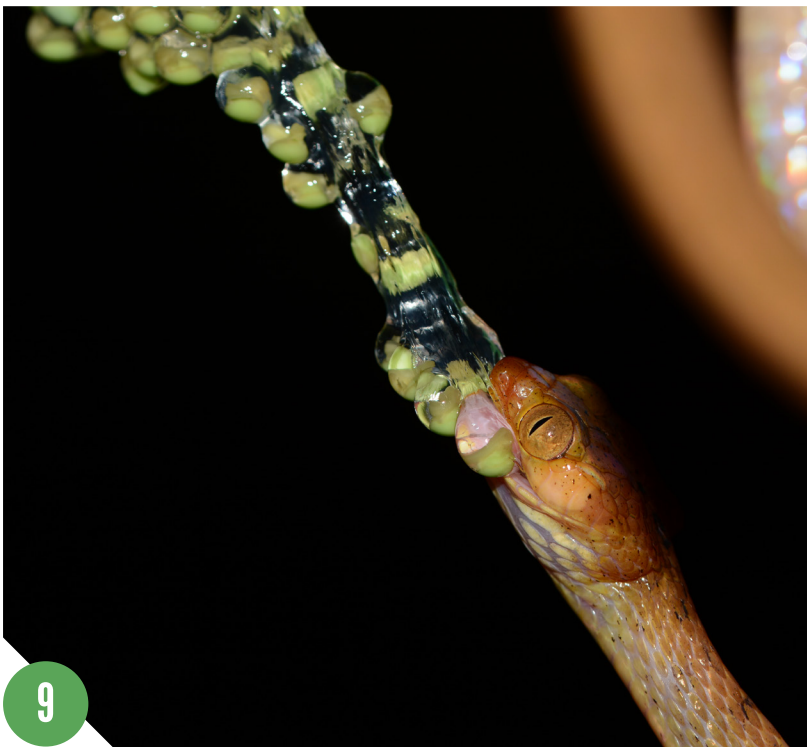
Through urbanization and development, various types of intensive agriculture (i.e. row crops, short rotation timber, etc.), and fire suppression we are losing these invaluable plant communities that support Northern Bobwhite and Gopher Tortoise. The benefits for managing this fire adapted ecosystem is not just limited to the bobwhite and Gopher Tortoise. The white tailed deer and Eastern wild turkey also benefit from fire in the forest. If you keep up with our social media pages you may already know that we not only manage the Orianne Indigo Snake Preserve but we also work in cooperation with many different private landowners on their land. Sadly, the selling point of managing for tortoises and indigo snakes does not always totally win over a landowner. Sometimes it proves useful to bring to their attention that our management practices does not stop at being beneficial for just indigo snakes and Gopher Tortoises but it is also great for Northern Bobwhite and afore mentioned game/non-game species. There is also a plethora of flora species that are site specific to the soils of undisturbed Longleaf ecosystem ranging from carnivorous pitcher plants (*Sarracenia spp*) and Florida dropseed (*Sporobolus spp*) in wet meadows and bogs to more xeric sites containing Wiregrass (*Aristida stricta*), Lopsided Indiangrass (*Sorghastrum secundum*), and various legume species

(Family *Fabaceae*). We are promoting plant communities through the application of fire during the natural fire season with the mentality of the famous Field of Dreams quote, “If you build it, they will come.” We are excited to watch the magnificent South’s Phoenix rise from the ashes of our frequent growing season fires so that we can continue to hear more and more of that iconic whistle for generations to come. 🌲



Photo: Jacob Barrett

 FIELD



PHOTOS



3



4



5



6



8



7

1. BEN O'CONNOR
Eastern Collared Lizard

2. RUSSELL GRAY
Eastern Rat Snake

3. EDWARD LANDI
Southern Hog-nosed

4. DUNCAN METTS
Florida Softshell Turtle

5. KEVIN KAMINSKI
Scarlet Snake

6. NOAH GARWOOD
Surinam Horned Frog

7. SAMANTHA DILLON
Western Coachwhip

8. NICK SCOBEL
American Crocodiles

9. JOHN CURLIS
Yellow Blunt-headed Vine Snake

10. GRIFFIN MCDANIELS
Eastern Hog-nosed

11. BRITTANY SHERBACK
Gopher Tortoise

UPCOMING events

September 2017

100 MILES: NATURALIST 101 SERIES

September 7

Brunswick, GA

www.onehundredmiles.org/Naturalist101

ASSOCIATION OF FISH & WILDLIFE AGENCIES 107TH ANNUAL MEETING

September 10-13

Sandy, UT

www.afwaannualmeeting.org/

ASSOCIATION OF ZOOS AND AQUARIUMS ANNUAL MEETING

September 9-13

Indianapolis, IN

<https://www.aza.org/conferences-meetings>

WEST VIRGINIA HERPETOLOGICAL SOCIETY CONFERENCE

September 15-17

Holly River State Park, WV

www.facebook.com/groups/1582337412018892/

CONSERVATION EASEMENTS FOR FOREST LANDOWNERS AND THEIR ADVISERS

September 19-20

Macon, GA

www.conted.warnell.uga.edu/courses/cons-ease2017

PLACES YOU'VE NEVER HERPED 11

September 23-24

Tennessee River Gorge, TN

www.oriannesociety.org

THE WILDLIFE SOCIETY 24TH ANNUAL CONFERENCE

September 23-27

Albuquerque, NM

www.wildlife.org/tws-24th-annual-conference/

GEORGIA PRESCRIBED FIRE COUNCIL ANNUAL MEETING

September 27

Tifton, GA

www.garxfire.com

SUSTAINABLE FORESTS INITIATIVE ANNUAL MEETING

September 27-29

Ottawa, Canada

www.sfiprogram.org/annual-conference/annual-conference-2017/

October 2017

COASTFEST

October 7

Brunswick, GA

www.goldenisles.com/event/coastfest-2017

38TH ANNUAL GOPHER TORTOISE COUNCIL MEETING

October 12-15

Aiken, SC

www.gophertortoisecouncil.org/meeting

November 2017

PLANTATION WILDLIFE ARTS FESTIVAL

November 11-12

Thomasville, GA

<http://www.pwaf.org/>

2017 PARTNERS IN COMMUNITY FORESTRY CONFERENCE

November 15-16

Tulsa, OK

www.arborday.org/programs/pcf/

GIVING TURTLE TUESDAY

November 1-28

www.oriannesociety.org

GIVING TURTLE TUESDAY ONLINE AUCTION

November 28

www.oriannesociety.org

December 2017

11TH SOUTHERN FORESTRY & NATURAL RESOURCES MANAGEMENT GIS CONFERENCE

December 11-12

Athens, GA

www.soforgis.net/2017



= The Orianne Society
will be participating

Want to announce an upcoming herpetology or land management event in the winter issue of *Indigo Magazine*?

E-mail the event information to info@oriannesociety.org by October 31, 2017 to be included.

MEMBER | levels

Our members are the backbone of our organization, and we cannot accomplish all we do without your support! This year, we have expanded our membership program to offer differing levels of support to encourage members to become sustaining supporters of reptiles, amphibians and their habitats:

Spotted Salamander Membership: \$35

- Car Decal
- Invitations to Exclusive Events
- Monthly E-newsletters
- Bi-yearly Magazines (electronic)
- Annual Report (electronic)
- Bragging Rights!

Wood Turtle Membership: \$100

In addition to the \$35 member benefits, you'll have the option to receive one of the following:

- Printed Magazines and Reports
- Limited Edition Print

Indigo Snake Membership: \$150

In addition to the \$35 member benefits, you'll receive both of the following:

- Printed Magazines and Reports
- Limited Edition Print



TAKE action



BECOME A SUSTAINING DONOR

Members can continue to support our conservation efforts throughout the year by scheduling a recurring donation of your choice on a monthly, quarterly, bi-yearly or yearly basis through our secure website or by contacting us directly.



SPREAD THE WORD

We don't underestimate the power of word of mouth when it comes to letting people know about our work and the ways they can contribute! Please consider sharing this magazine with others who have an interest in conservation, and follow us on Facebook, Twitter and Instagram.



PLAN YOUR GIVING

Don't just plan for your future—plan for the future of reptiles, amphibians and the great places they inhabit. Whether you prefer to set up an annual donation or a deferred gift, we can work with you to determine what you want your gift to support and how it will benefit these amazing animals and landscapes. Please contact us at info@oriantesociety.org or 706-224-1359 for more information about our planned giving opportunities.



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