The Orianne Society announces its collaboration with the University of Georgia

The Art of Studying Rattlesnakes in the North Country

Spotting Spotted Turtles

Dreaming of Georgia’s Swampland

...and more!

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FUTURE

to change the

PARTNERING

CONSERVATION

of

...and more!
Sitting on a porch high in the Appalachians, watching the last of the fall foliage drop, I cannot help but think about new beginnings. My career has been focused exclusively on the conservation of the reptiles and amphibians of the world, the species most people always seem to overlook. But at multiple points throughout my career, there have been pivotal moments where one decision has changed the trajectory of how I work to achieve conservation. I have consciously tried to make each of these pivotal moments positive ones for those species I am working so hard to conserve.

Sitting here looking out into valleys where we work to conserve Hellbenders and Bog Turtles, I am faced with the significance of this moment and the new beginning I am embarking on. The Orianne Society has moved to the University of Georgia, changed from a foundation to a public charity, and changed its mission from a focus on saving a single endangered species to working on the conservation of a variety of species in North America and beyond. These changes mean that we will not only have an impact on the Eastern Indigo Snake but also on many imperiled species from around the world, including the salamanders and turtles in the valley below. It means that a new organization has started—one that can begin the long difficult task of growing into an institution that can have a global impact on saving reptiles and amphibians for generations to come.

At this point in my career, I have seen many pivotal moments, and each has built on the last. But this is perhaps the biggest moment I have ever experienced in my career. I know the road ahead is going to be a difficult one, but the vision of a global organization that can make a difference in the future of reptiles and amphibians is an achievable one. Like the knowledge that green leaves will once again grow from the bare trees off this porch, a new beginning is underway for the Orianne Society.

Dr. Christopher Jenkins, CEO
Wood Turtles are medium-sized, semi-aquatic turtles that primarily occur in the northeastern United States and Canada. They are one of two species in the genus *Glyptemys*—the other being the equally-threatened Bog Turtle—which makes conserving this unique species all the more important. These turtles have a home range of about 30 hectares (74 acres) and can occupy a broad range of habitats, but their movements are centered around the streams or rivers nearby.

Because they are a long-lived species with low fecundity, Wood Turtles are particularly susceptible to habitat alteration and development along watercourses that eliminate their natural habitat. Roadways and agriculture also present threats to their populations, as they are often killed by farm equipment or by passing cars and recreational vehicles. And because these turtles are extremely attractive, illegal collection for the pet trade poses a conservation concern for Wood Turtle survival.

The International Union for Conservation of Nature (IUCN) estimates that Wood Turtle populations have likely declined more than 50 percent in the past 100 years. We have to work together to save these beautiful but endangered animals and their habitats.

We have added the Wood Turtle as a priority species as part of our program development to assess their populations in the Northern Appalachians and to conduct inventories to document their populations to help conserve this rare species.
James has been an Orianne member since August 2012 after seeing a friend’s Facebook post about the organization. He Googled us and liked the work we were doing, particularly with Eastern Indigo Snakes, and joined. Since then, he’s participated in Indigo Days 2013 and Places You’ve Never Herped (PYNH) 4 and 5, and he said he “had a blast at all of them.”

James grew up in northern Virginia and still lives in the area working for the Environmental Protection Agency. His interest in herpetology goes back as far as he can remember, though he recalls catching his first snakes before first grade on his grandmother’s farm in South Georgia. His dad was also interested in nature, so when James would bring home different critters from his outdoor adventures, his dad would build makeshift cages so he could keep the herps for a short time before releasing them back into the wild. As he grew older, he began catching and releasing herps on location without bringing any home.

Clearly, his love of herps continues today. James is frequently on the lookout for herps around his neighborhood, and he has a ratsnake hibernacula under his back steps so he sees them quite often during the spring and fall—he even had one make an appearance when he got home from PYNH 5, which is fitting. He sees gartersnakes, Northern Watersnakes, greensnakes, Dekay Brownsnakes, Ringneck Snakes and Eastern Worm Snakes in his neighborhood, but his favorite to find is the Eastern Kingsnake.

When he travels to participate in Orianne events, James enjoys catching and photographing species that he’s never seen before, but he said one of his favorite things about being an Orianne member is meeting fellow herpers. “It’s nice to be around people that are into the same things I am, and I’ve made some great friends which is most rewarding and keeps me looking forward to the next [event].” He also says that as a member, he enjoys knowing that he’s contributing in a meaningful way to the conservation and education of creatures he likes. “Education is the key for getting people to appreciate not just snakes, but all of nature. People won’t appreciate the things they know nothing about.”

The Orianne Society would like to send a huge “thank you” to James for his continued support of the Orianne Society—we’re proud to call him a dedicated member!
Dream of GEORGIA'S SWAMP

Photo: David Fields
WHEN I WAS YOUNGER, I dreamed of going to Georgia’s great swamp and finding the beautiful brightly-colored snakes as well as the cryptic rattlesnakes, alligators and other herpetological wonders that inhabit the swamp and its surrounding areas. The Okefenokee Swamp lies in the southeast corner of Georgia and covers roughly 600 square miles of cypress swamps, pine flatwoods, sand ridges, hummocks and sandvans. Most of these habitats can be accessed just off the main road into Stephen C. Foster State Park, very convenient for people hoping to see some of the diverse plant and animal life. If the geographical setting isn’t enough to impress, the carnivorous plants and rare orchids attract swaths of botanists and everyday naturalists.

Of course when in the swamp, it’s hard not to notice the birds and mammals. Even a hardcore herper can appreciate the sight of a bald eagle or a black bear. My favorite birds encountered in the swamp are the Wilson’s snipes, which look oh-so-much like pinecones sitting along the edges of the flooded roadside.

Then there are the invertebrates. The invertebrate life is harder to appreciate in the swamp, as the hordes of yellow flies and mosquitos almost make you want to stay in the car. But that wouldn’t be any fun, would it? Get out of the car and walk around—deal with the mosquitos and flies because what lies off the road is well worth the bites! The swamp is home to more than 50 species of reptiles and 60 species of amphibians, but that certainly does not mean they are easy to find.

I made my first trip to the swamp in 2012. In order to avoid the mosquitoes and yellow flies, we decided to make the trip in early March, spring break for me. The weather worried me, as temperatures were forecasted to be in the low 60’s—usually no problem, but rain was inevitable. Good for amphibians, but without sun, a little too cool to bring the snakes out. Driving down from Atlanta, we stopped for rest in Valdosta. The news showed tornado watches and strong thunderstorms moving across the swamp, and when we woke up and headed east, we were met with heavy rains. We finally reached our destination, and the long road into the swamp gave me a good chance to survey the terrain. I noticed an odd lacking of trees. This is because of a large fire that swept through the region in April 2011. This would prove a positive factor later in the trip.

As we passed into the park, a small information kiosk sparked our interest. However, rather than information, we got our first herps of the trip: Squirrel...
Treefrogs! They would later prove to be the most commonly seen herp of the trip, turning up everywhere from our bathroom to stump holes. Our next pass by the kiosk turned up one of the only accessible turtles of the trip, what a friend identified as a Florida Cooter. A bit farther down the road, we passed by the cabins in which we would be staying and arrived at the shop/check in/boat rental. While my parents checked us in and got some supplies, I walked around. My dad later joined me and spotted our first alligator of the trip, sitting right at the boat ramp! After we had our fair share of alligator sightings, we headed to check out the cabins. If you ever have any interest in staying near the Okefenokee, these cabins are affordable, clean and have treefrogs and lizards all over them! I highly recommend them.

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The storms were looming, and the folks at the shop warned us to be careful as severe weather was headed our way. We headed out to do some driving around and scouting when the weather cleared. A short break in the weather drew us out of the car for exploring. As I was walking the wood line, my dad came up and opened his hand, and there sat a Scarlet Kingsnake! I was ecstatic to see another one of these snakes. Scarlet Kingsnakes are small, colorful, lizard-eating mimics of the Coral Snake. Little did I know, conditions were nearly perfect for them at the time. We admired the snake, and I snapped a few photos before releasing him back into the moist stump he was found in, eager to find a snake of my own. Morale was high, but unfortunately the storms forced us back into the car. Not much else was seen the rest of the day.

The following morning brought a change in weather, and I got my first good view of the true beauty of the swamp. The sun was shining through the remaining oak trees, littered with Spanish moss. Not a cloud in the sky, but it was even cooler than the day before. I was counting on the sun to warm things up, and it did. We ventured out into the swamp, but today we took advantage of the weather to do some hiking.

We saw more of the same from yesterday, until I spotted a little head peering out from behind the burnt bark of a pine stump. I was looking at a juvenile cornsnake, most likely a yearling who looked to be at the end of its shed cycle. His colors were faded but still rivaled those of a Scarlet King. In wild cornsnakes, the color of juveniles is often less vibrant than adults, and Coastal Plain populations are often more vibrant than Piedmont or mountain populations, leading to nearly solid gray hatchlings in the mountains that are distinguishable from ratsnakes by the V-shaped marking on the head. The rest of the day was spent motor-boat-ing the swamp.

Unfortunately, water levels were too low for kayaking despite the rain. The
wind was harsh, likely discouraging snakes and turtles from basking, though plenty of alligators were seen ranging from one to 12 feet in length. As the last full day came to an end, we began to accept the fact that no more snakes would be seen, and we were right. I began planning the next trip in my head on the way home.

Before I knew it, early March had returned, 2013 ended with a bang and 2014 began with an equal bang. Before I even left for the swamp, I had found my first few snakes. Prepared more than ever and twice as excited, we departed for southeast Georgia. A stop at a random Dairy Queen yielded my first two lifers of the trip, a Dwarf Salamander and an Ocmulgee Slimy Salamander. We continued to our first destination, Amelia Island and Fernandina Beach.

Unfortunately, conditions started off similar to my last venture: dreary and cold. Highs of 60 degrees and overcast skies made me wonder if it was worth the trip. The weather did not turn out quite as bad as expected, but conditions were not ideal. The purpose of the stop in Fernandina was to visit the grave of my great grandfather who links me to the famous Ross Allen. While there, we checked out some places I scouted on Google Earth. They did NOT disappoint! I flipped my lifer Eastern Glass Lizard and Mediterranean Gecko here, as well as ground skinks and Florida bark scorpions.

Satisfied with the small lifers to start the trip, I was ready to head to the swamp where hopefully the big game resides. Many familiar faces greeted me at the swamp: American Alligators, Squirrel Treefrogs and Pine Woods Treefrogs. The weather finally looked to be in my favor—the next day was forecasted to be in the 70’s. Unable to get an early start because of the cold, I took it easy until the sun came up and everyone was ready. We hit one of our favorite trails from last year the minute the sun hit the ground. A good while passed before anything relatively exciting happened. I caught a Broadhead Skink and was able to photograph it, a first for me.

Things only got better from there, so my dad and I came up with a little competition: first snake wins. Well, first snake turned into only snake, and he won. Oh, did he win. I walked up to see him standing mere feet from a five-foot Canebrake Timber Rattlesnake, camouflaged perfectly with the leaf litter outside of its stumphole. Just like Kauffeld said, the only feature distinguishing it from the leaf litter was the bright, almost neon stripe running down the snake’s back.

What I didn’t know at the time was that this was a particularly dangerous snake. Likely the most dangerous in the U.S., as Canebrake populations from coastal Georgia possess both neurotoxic AND hemotoxic properties in their venom. Regardless of toxicity, I felt unworthy to be in this snake’s presence as a human being, as a member of a species that goes out of its way to kill an animal such as this one because they fear what they do not understand. I snapped my pictures and let it be, as anyone who encounters such a snake should do.

Regardless.
As you may know, the southeastern United States is recognized for its extraordinarily high species diversity of turtles—a number of muds and stinkpots, snappers, softshells, cooters and sliders, just to name a few, inhabit this region. Complementing our efforts specific to protecting the Gopher Tortoise, Orianne Society staff are now directing some serious energy toward the conservation of a small, mostly-aquatic species: the Spotted Turtle (Clemmys guttata).

Hands-down one of the most beautiful and engagingly-patterned species on the planet, the aptly-named Spotted Turtle is a small, bluish-black turtle with small, yellowish spots on the upper shell and orange and yellow spots on the head. The smooth shells of adult Spotted Turtles are but 3.5 to 4.5 inches long, thus fitting comfortably into the palm of one’s hand. I have come to think of these docile little turtles as the reptilian version of a soothing stone. The similar-in-appearance but more terrestrial Box Turtle may have handsome yellow colors but lacks discrete
spots and is considerably larger with a high, dome-shaped carapace.

Historically, Spotted Turtles’ pleasing characteristics resulted in the over-collection of this species for the pet trade in some regions, and illegal collection remains a threat. In fact, CITES estimates that 1,000 Spotted Turtles are exported yearly from the U.S. and that the species has experienced a 50 percent decline in three turtle generations. In 2012, the species was petitioned by the Center for Biological Diversity for Federal Listing status as “Threatened.” Many populations have become isolated, declined or disappeared due to habitat loss and adverse impacts to wetlands, and the species is now protected from collection (or collection is regulated) in the states in which it occurs.

According to John Jensen, herpetologist with the Georgia Department of Natural Resources (DNR) and a big supporter of our efforts, “The Spotted Turtle is among Georgia’s most poorly known species, with the vast majority of occurrence records obtained from observations on roads. Surveys and monitoring of this secretive species by the Orianne Society will shed valuable light on the conservation status of the species in the state—which is information coveted by Georgia DNR and the U.S. Fish and Wildlife Service.”

“Our work in the field will help decipher many aspects of this species’ life history and ecology... and we are eager to learn more.”

In 2013, we initiated studies of the Spotted Turtle’s distribution, ecology and conservation status in Georgia near the southernmost extent of the species’ range. We compiled each and every Spotted Turtle record (i.e., museum specimen or observation supported by a photograph) for Georgia that we could locate from a review of museum specimens and literature and from a questionnaire broadcast to biologists and naturalists soliciting their observations.

In doing so, we found a grand total of only 130 records for the state, the first records going back to April 1892
when two adult specimens were collected over successive days in mid-April at a large rice plantation in coastal Georgia. These specimens are still housed at the National Museum of Natural History in Washington, D.C.

Some notable information emerged from our effort. Over 90 percent of the 130 records were of turtles observed or collected from mid-February through mid-May—it was good to document this, although it isn’t surprising as these months correspond to the peak period of Spotted Turtle activity in nearby states to the north (North Carolina, South Carolina, Virginia) and south (Florida). Over half of the records were turtles found crossing roads, and half of this complement was found DOR (dead-on-road). Observations of male turtles greatly outnumbered observations of females, and interestingly, all but three records are based on adult-sized turtles. As far as we know, a hatchling Spotted Turtle has never been found in Georgia.

Georgia Spotted Turtles seem to prefer blackwater creek swamps and other shallow, tannin-stained wetland habitats. A protected population south of Vidalia inhabits a small and idyllic swampy brook fed by cool springs that seep from the deep yellow-white sands of an adjacent turkey oak ridge. To me, it’s an overwhelmingly beautiful place to be, and I am betting the oak ridge. To me, it’s an overwhelmingly beautiful place to be, and I am betting the oak ridge. To me, it’s an overwhelmingly beautiful place to be, and I am betting the oak ridge. To me, it’s an overwhelmingly beautiful place to be, and I am betting the oak ridge.

Geographic

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Monstrous loblolly bays and sweet bays, their trunks paint-splotched with colorful lichens, tower over the wetland bottom, and jungly growth of titis, fetterbush and doghobble margin the stream. Of course, “Spotties” frequent microhabitats with soft muddy substrates and accumulations of litter and debris. It’s riveting to observe a basking individual nonchalantly plink off of a log then swim-crawl to disappear in the bottom murk.

Hatchling Spotted Turtles emerge with but a single spot per scute—spots increase in number with advancing age. In actuality, the spots are transparent “windows” in the scutes overlaying deposits of yellow pigment. Some adults will eventually develop over 100 spots. These spots are simply thought to enhance the turtle’s camouflage—I can vouch that they are hard to see as they puddle about in the leaf litter of duckweed-splotched, tannin-stained waters under dappled light.

“We are excited to report that we captured and marked over 30 Spotted Turtles this spring. Notably, five of these were very small juvenile or sub-adult specimens.”

Because of the species’ preference for cool water temperatures, the Spotted Turtle has an abbreviated annual activity period compared to most turtle species, meaning that individuals have to secure adequate resources (food) for growth and reproduction in a relatively briefer window of time than is available to most North American turtle species. When water temperatures warm in early summer—to the point where they exceed 32 degrees Celsius—Spotted Turtles leave the water and become dormant. Similar to a number of turtle species including the Eastern Box Turtle and Alligator Snapper, once they reach adult size, Spotted Turtles enjoy very high annual survivorship (greater than 90 percent).

This year we initiated Spotted Turtle mark-recapture studies at several sites in Georgia including the Orianne Indigo Snake Preserve. We also have intensive field studies investigating home range size and habitat use planned for the near future in this region. Orianne Society volunteer Matt Moore and I spear-headed the mark-recapture efforts, finding good numbers of turtles by employing both wading surveys and by trapping (using small traps designed expressly for capturing Spotted Turtles).

We are excited to report that we captured and marked over 30 Spotted Turtles this spring. Notably, five of these were very small juvenile or sub-adult specimens. Turtles are marked by the time-tested method of notching marginal scutes, with one to three scutes notched per turtle. Additionally, the unique carapace and plastron patterns of each turtle are photographed. Other turtle species captured in our traps included Yellowbelly Sliders, Eastern Mud Turtles, a small Common Snapper, and one example each of the Chicken Turtle and Striped Mud Turtle.

As mentioned above, late winter through May is “Spotted Turtle Season”—they wake up, warm up, bask, bask some more, feed ravenously, find each other, bask some more, and mate, mate, mate. An idyllic April afternoon found me sitting on the damp bank at the edge of a blackwater pool, marking a gorgeous adult female Spotted Turtle, feeling good about doing some good for *Clemmys guttata*.

You can spend many minutes hypnotized, lost and far from thought, considering the beauty of these little reptiles. The black and melon colors on opposite sides of her plastron were symmetrical and you could connect the spots on one of her carapace scutes to form the Big Dipper. Entranced, I almost
missed noticing the big male *Clemmys* that popped up in the water just offshore. He looked intelligent as he cast me a glance, blinked twice and slowly turned his head to survey the pool.

We anticipate recaptures of many of our marked turtles in future field seasons. Based on a long-term, mark-recapture study conducted in Ontario by Jacqueline Litzgus, Spotted Turtle survivorship and longevity estimates are among the highest values reported for any animal species, with male and female turtles potentially living up to 65 and 110 years, respectively. Our work in the field will help decipher many aspects of this species’ life history and ecology in a region where it has been little studied, and we are eager to learn more.
HERPETOLOGY AT UGA...
IT KICKS BIOMASS!

by John Maerz

Photo: Andrew Grosse
Maerz was a transplant from the northeast where he completed his Ph.D. at the State University of New York and was a Research Associate at Cornell University. While in New York, Maerz had developed research focused on the impacts of invasive species on terrestrial salamanders and pond-breeding amphibians. In addition, he collaborated on work to reveal the terrestrial habits and movements of amphibians and explored how amphibians respond to chemical cues from their predators.

The initial work of the UGA Herpetology Lab was to continue working on invasive species’ impacts on amphibians. The group completed a four-year experiment in New York demonstrating that earthworms, which are not native to many eastern forests, are negatively impacting salamander populations by rapidly removing leaf litter from the forest floor. This results in dramatic declines in insect abundance, which negatively impacts salamanders, other amphibians and small reptiles, and birds that depend on those insects as food. The lab also began to look at the impacts of invasive plants such as Japanese stiltgrass, which is a widespread invader in the eastern U.S. They found that stiltgrass invasions are negatively impacting some amphibians in a most peculiar way. The grass actually increases the densities of spiders in forests, and the spiders in turn feed on recently metamorphosed amphibians.

The move to Georgia was a bit daunting, with a dramatically-expanded diversity of species, diverse ecosystems and hotbed of well-known herpetologists working around the region. Nine years, four dozen undergraduates, nine masters students and seven Ph.D.s later, the lab has amassed more than 70 publications, and the swell of interest among students rapidly expanded the focus of the lab in new directions and systems including understanding the influences of reptiles and amphibians on ecosystem processes, understanding the impacts of climate change and land use on the diversity and abundance of reptiles and amphibians, and the development of tools to conserve and manage reptiles and amphibians.

Some examples of the diversity of projects involving the Herpetology Lab at Warnell include participation in the Coweeta Long-Term Ecological Research (LTER) program, conservation management of Diamondback Terrapins, and captive rearing and reintroduction of the threatened Carolina Gopher Frog.

Dr. Maerz joined the Coweeta LTER as a principal investigator in 2008. The Coweeta LTER is located in Macon County, North Carolina, and is one of the oldest continuous environmental studies in North America. The Coweeta LTER focuses on the natural and social ecology of forest ecosystems within the Appalachian Mountains and is a centerpiece of a long-term cooperation between the University of Georgia and the United States Department of Agriculture (USDA) Forest Service.

The Herpetology Lab began studying the impacts of climate change and increasing exurban development on salamander populations in the region. Salamanders represent only 10 percent of global amphibian diversity but represent approximately half of North American amphibian diversity and 70 percent of amphibian diversity in Appalachian forests. Appalachia is well-recognized as a global hotspot for salamander diversity.
Salamanders can achieve remarkable densities and biomass in forests and streams, so the Herpetology Lab also started research to understand the importance of salamanders to ecosystem processes.

One theme of the Herpetology Lab has been that a lack of understanding of the importance of amphibians and reptiles to ecosystem processes makes it difficult to understand the consequences of declines in these taxa. In addition to salamanders, the Herpetology Lab has examined the importance of turtles on pond and river ecosystem processes and how agricultural impacts on riparian zones affect turtle assemblages.

Around the same time that the Herpetology Lab joined the Coweeta LTER, they also started the Terrapin Project to examine the impacts of commercial crabbing and coastal roads on populations of the Carolina Diamondback Terrapin in Georgia. Using teams of students and volunteers, the Herpetology Lab showed that terrapin abundance in coastal Georgia is negatively correlated with commercial crabbing due to the drowning of terrapins in commercial crab pots.

The Terrapin Project then transitioned to focus on the local impacts of mortality of terrapins on causeways to Georgia’s barrier islands. In collaboration with the Georgia Sea Turtle Center, the Herpetology Lab demonstrated that the killing of adult female terrapins and excessive predation on nests are likely causing local declines in terrapin populations. The lab also identified locations and times when terrapins were likely to be on roads, which has led to novel management tools such as the use of flashing signs to alert drivers when terrapins are likely to be active.

The Gopher Frog project is a collaboration between the Herpetology Lab, Atlanta Botanical Garden, Zoo Atlanta, the Joseph W. Jones Ecological Research Center, and Atlanta Botanical Garden. Dr. John Maerz handling a Green Treefrog on Lady Elliott Island, Great Barrier Reef Australia, where he teaches an annual study abroad course in animal behavior.
Research Center, The Nature Conservancy (TNC) and Georgia Department of Natural Resources. Using protocols they developed, the Herpetology Lab coordinates the captive rearing of Carolina Gopher Frog metamorphs that are released at a restored TNC property in Early County, GA. The project began releasing large numbers of metamorphic frogs in 2010 and to date has released several thousand individuals at the restored site. In 2013 the group observed their first adult frogs from the early releases, documented calling by male Gopher Frogs and found the first egg mass produced naturally at the site.

The Herpetology Lab has also been a collaborator with The Orianne Society. Orianne and the Herpetology Lab collaborated on a large project studying the status of Eastern Diamondback Rattlesnakes on Georgia’s barrier islands, and the two organizations teamed up with the Georgia Department of Natural Resources to survey and monitor Bog Turtles in the mountains of north Georgia.

Even with all of the research projects, the Herpetology Lab is probably best known on campus and around the region for its outreach efforts. The lab is home to the Herpetological Society at the University of Georgia, which is a student-run club focused on professional camaraderie and public education around amphibians and reptiles. They organize an annual bioblitz with Auburn University and other regional universities and use the friendly competition to help Georgia and Alabama inventory poorly documented areas within each state. They host dozens of outreach events around the state including their annual Day on the Lawn, which gives hundreds of visitors each year an opportunity to see and interact with native reptiles and amphibians. Students from the lab and the Herpetological Society also provide outreach in support of the Claxton Rattlesnake Round-up conversion to the Claxton Wildlife Festival, and they have been recognized for their efforts to end round-ups and promote a positive understanding of snakes and other species.

Dr. Maerz feels that the opportunity to teach and inspire students through their interests in herpetology has been the best part of the Herpetology Lab. Dozens of undergraduate and graduate students have had the opportunity to feed their curiosity, learn to conduct rigorous research, contribute to the conservation and management of species, interact with other researchers and representatives of agencies and NGOs, and engage the public with their enthusiasm. The Herpetology Lab in the Warnell School has achieved a momentum that Maerz hopes will add to and extend the legacy of herpetology at UGA.
Two years ago I visited the Cornell Laboratory of Ornithology and was inspired. I walked the trails through Sapsucker Woods, watching waterfowl feed in the pond. Inside the Johnson Visitor Center, I could see hundreds of birds feeding through the large plate glass windows. The gift shop was full of toys, informational books and customers. All of this was inspirational, but when I had the behind-the-scenes tour of the museum, library and offices, I could not believe what I was seeing. They had built one of the largest and most successful institutions for bird research, conservation and education.

The Cornell Lab has made one of the greatest impacts on species conservation of any institution in the world. All of this infrastructure inspired me, but the inspiration was not necessarily relative to birds. I was actually distracted finding myself not quite hearing every detail of the tour—all I could think about was whether we could do this for reptiles and amphibians. Could we build an institution for reptile and amphibian research, conservation and education, an institution that could make a difference and change the future for many of the world’s declining species? This was a lofty idea, but I thought that the timing was perfect.
The Orianne Society was going through a transition from a private operating foundation to a public charity including expanding the scope of our work to additional species and developing broader support for those programs. As part of this transition, we could partner with one of the world’s leading universities and use the combined momentum and history of success to turn this vision of a herpetological institute into a reality.

The story leading up to the development of a herpetological institute is a story of a small nonprofit and a large land-grant university. The Orianne Society started when a young girl asked her father if he would do something to save the Eastern Indigo Snake. In response, the Kaplan family founded Project Orianne as a family foundation to save the species. I worked closely with the Kaplans to develop the infrastructure for the organization including conservation science, lands, and captive breeding and reintroduction programs. The organization was founded on the basis of science and conservation, and we use science to inform our work on the ground.

As we began to see early signs of success, the Kaplan family made the decision to transition Project Orianne to a public charity. The organization was rebranded as the Orianne Society, and we began to work on a new strategic plan that focused on conservation of a much broader group of imperiled reptiles and amphibians. The new plan also put a great deal of emphasis on broader ecosystem conservation following the concept that by working at these broader scales, we could have a significant impact on the conservation of many reptiles and amphibians. Along with the transition, we expanded our Board of Directors and developed a membership program to give a broader group of supporters a voice in Orianne’s strategic direction. After my experience at Cornell, I began thinking about this idea for an institute and trying to determine the best potential partnership for the organization. I thought of many institutions but always came back to the University of Georgia (UGA).

First, Georgia is one of the most herpetologically-diverse states in the United States. Second, with the Atlanta
airport just down the road, there is relatively quick access to anywhere in the world. Third, we have been working with the faculty and administration at UGA for five years and have only had great experiences. But the primary reason is the strength of UGA’s programs. UGA is one of the larger universities with some of the strongest environmental-focused programs in the country. They have one of the strongest herpetology groups of any university in the country including herpetologically-focused faculty in the Forestry, Ecology and Veterinary Colleges. In addition, there are many units within or affiliated with the university that have a herpetological component including the Savannah River Ecology Laboratory, the Jones Ecological Research Center, Zoo Atlanta, Coweeta Hydrologic Laboratory, Georgia Sea Turtle Center and University of Georgia Costa Rica. The combination of a small but successful nonprofit and one of the strongest universities in U.S. made sense as a great opportunity for a partnership that could make a difference.

As a first step, I sat down with Dr. Michael Clutter, Dean of the Warnell School of Forestry, and discussed the idea. We were immediately on the same page and began moving right into, “How quickly can we make this happen?” The first step was moving the Orianne Society headquarters onto the UGA campus. Dean Clutter offered one of the most historic buildings on campus, the Whitehall Mansion. The mansion is a beautiful building full of history and a perfect setting to launch this partnership. Perhaps more fitting is that the mansion sits on an 840-acre forest that is used by the university for teaching and research. Now I can walk out the door of my office and into the forest in search of rattlesnakes, turtles or tree frogs.

Once we had the location decided, we began discussing how the organization and university could work together. First, UGA produces some of the strongest future leaders in science and conservation. We now have a direct link to those future leaders and are developing opportunities that will simultaneously help the students with hands-on experience and help us achieve our mission. We are creating internship opportunities that will bring in students to work with our conservation scientists, fundraisers, communication specialists and administrators. Second, we are developing undergraduate research opportunities. Currently we have an undergraduate student from Warnell working with us to radio track Eastern Box Turtles and Timber Rattlesnakes on the Whitehall property. We are also working with graduate students—for example, we recently completed a project modeling Eastern Diamondback Rattlesnake habitat in coastal Georgia. In the past, I have assisted with teaching small portions of the Herpetology course, and our staff will continue these efforts with existing courses and in developing new courses. Finally, our communications and fundraising staff will work closely with UGA staff to ensure that the institution develops a strong base from which we can remain sustainable.

While I enjoy thinking about the logistics, administration and fundraising associated with developing this institute, it’s the programs that really get me fired up. As part of the transition, we are expanding the scope of our programs by strategically building on existing projects. We are designating two place-based initiatives, the Fire Forest Initiative and the
Appalachian Highlands Initiative, and one cross-cutting initiative, the Citizen Science Initiative. In addition, we are actively working to develop our first international initiative based in Latin America.

**FIRE FOREST INITIATIVE**

The Fire Forest Initiative is focused on the Coastal Plain of southeastern North America including fire-dependent habitats such as Longleaf Pine uplands, hardwood swamps, coastal barrier islands and scrub forests. We have identified the Altamaha River Corridor in South Georgia as a priority landscape for this initiative. The Altamaha River Corridor is a series of Longleaf Pine sand ridges bisected with blackwater creeks and large floodplain swamps spreading across a large area of southeast Georgia. The Altamaha River supports incredible herpetological diversity including strongholds for many of the rare species in the region.

We have identified three priority species as part of the Fire Forest Initiative: the Eastern Indigo Snake, Spotted Turtle and Eastern Diamondback Rattlesnake. Eastern Indigo Snakes are the flagship species for Orianne and the species for which we were founded to save. Indigo Snakes are top predators feeding on a variety of prey, but their diet is largely made up of other snakes. Indigos have declined significantly and disappeared from approximately a third of their historic range.
Spotted Turtles are one of the most imperiled turtle species in North America and are listed as Endangered by the International Union for the Conservation of Nature Red List. Spotted Turtles occur throughout eastern North America, but in the southeastern Coastal Plain they are found primarily in large rivers, swamps and blackwater creeks.

Eastern Diamondback Rattlesnakes are the largest species of rattlesnakes in the world and have declined significantly across their range. They have also been the focus of rattlesnake roundups in the southeast and are currently being assessed by the United States Fish and Wildlife Service (USFWS) for Endangered species status.

We have made great strides in our work towards reptile and amphibian conservation in the Fire Forest. We created the Orianne Indigo Snake Preserve by purchasing key sandridges that have abundant Gopher Tortoise populations and serve as winter habitat for Eastern Indigo Snakes and Eastern Diamondback Rattlesnakes. Also included within the preserve are properties owned by other conservation organizations, the Georgia Department of Natural Resources and private landowners. On our properties we have worked aggressively to remove offsite pines and have planted hundreds of thousands of Longleaf Pines. We also have started translocating Gopher Tortoises out of sites slated for development and onto areas of our property where tortoise densities are low.

But perhaps the most important aspect of our restoration work is prescribed fire. We are working to restore natural disturbance regimes by conducting prescribed fires on thousands of acres. Many of our habitat restoration efforts have expanded off of our property to other parts of the preserve as our land management team works cooperatively with other land owners helping to restore Longleaf Pines and natural disturbance regimes. To accomplish this, we partner with other agencies and organizations, but we have also developed a private landowner partnership program. We work with landowners to give them advice on how to best restore their land and assist them with management activities.

We conduct inventory and monitoring of our priority species across the Altamaha River Corridor to ensure that populations remain stable in strongholds and recover in restoration areas. To better inform our conservation actions on the ground, we conduct research on a wide range of topics ranging from population genetics to movements and habitat selection. We also work in the Gulf Region of Florida and Alabama to restore Indigo Snake populations where they have disappeared.

We partner with Central Florida Zoo to produce Eastern Indigo Snakes at the Orianne Center for Indigo Conservation. The captive breeding program produces snakes that are reintroduced into strategically-selected sites. In partnership with Auburn University, we have reintroduced over 100 Indigo Snakes back into Alabama and are making plans to expand efforts to suitable sites in Florida. In the future, we plan to continue our work in the region by protecting and managing more land, reintroducing more Indigo Snakes, and continuing research, inventory and monitoring efforts.

“While I enjoy thinking about the logistics, administration and fundraising associated with developing this institute, it’s the programs that really get me fired up.”
The Appalachian Highlands Initiative focuses on the mountains of eastern North America running from Alabama to Quebec. We have identified the Greater Smoky Mountain Ecosystem as a priority landscape within the Appalachian Highlands. The Greater Smoky Mountain Ecosystem is the area of the southern Blue Ridge Mountains in Tennessee, North Carolina and Georgia. The landscape is diverse, containing most of the highest peaks in the eastern U.S. These mountain peaks that dominate the landscape are bisected by thousands of rivers and creeks. The diversity of slopes and aspects provided by the mountains and the abundance of water has resulted in an incredible diversity of salamanders. The southern Appalachian Mountains are the global biodiversity hotspot for salamanders. In addition, the Greater Smoky Mountain Ecosystem contains many reptile and amphibian species of conservation concern including Bog Turtles, Hellbenders, Timber Rattlesnakes and Junaluska Salamanders.

We have identified two priority species in the Appalachian Highlands Initiative: the Eastern Hellbender Salamander and the Timber Rattlesnake. Hellbenders are the largest salamander in North America and occur in Appalachian rivers and creeks from Alabama to New York. Unfortunately, Hellbenders have declined significantly across their entire range. Historically their populations would have been largest in some of the larger rivers and creeks that flowed through the mountain valleys. These valleys are also the areas where humans settled, resulting in the majority of remaining Hellbender habitat being surrounded by agricultural and residential development. All of these activities cause erosion and a great deal of sediment to enter the rivers and creeks. These sediments fill up the spaces under large rocks and in between the gravel substrate which the adult, juvenile and egg Hellbender life stages all depend on for cover.

Hellbenders are known to live 30 years in the wild, and in some areas we are likely seeing aging populations of adults that have almost no reproduction because the substrate they need to lay their eggs is gone. The Hellbender is currently being assessed by the USFWS to determine if its status in the wild warrants listing under the Endangered Species Act.

Over the past five years we have worked on a variety of research and conservation projects in the Appalachian Highlands Initiative. First, we have worked on land management and conservation issues by partnering with USFWS and Rabun Gap Nacoochee School in Rabun Gap, Georgia, on wetland restoration by removing invasive species and conducting prescribed fire in a bog, and we are currently working on a project to fence cattle out of an important Hellbender creek. We are also members of the Southern Blue Ridge Fire Learning Network and have plans to develop our own land management team to conduct prescribed fire in the Greater Smoky Mountain Ecosystem.

We recently applied a new technique for surveying Hellbenders that has become one of the standard approaches that most groups use to survey for this rare salamander. The technique is called eDNA or environmental DNA. Basically, a water sample is collected and is screened for the presence of Hellbender DNA.
The technique is very accurate and can save a great deal of time and money, allowing us to conduct more surveys. We have used eDNA and other survey techniques to inventory Hellbender populations in Tennessee, North Carolina and Georgia and are in the process of launching a monitoring program for key focal watersheds. We plan to continue our inventory and monitoring work and to continue expanding our habitat restoration efforts for Hellbenders.

Timber Rattlesnakes are a widespread rattlesnake that occurs throughout eastern North America. In the Appalachian Mountains they typically spend long periods of time (up to seven to eight months) underground during the colder months. During the warm months the nongravid females and males forage for rodents and mate late in the summer or early fall. Gravid females spend the warm months at gestation sites where they can maintain high body temperatures in preparation for giving birth to live young in the late summer or early fall.

Timber Rattlesnakes are one of the few top predators we have in the Appalachian Mountains and have long been thought of as an important cultural symbol. They were even found on flags used to display unity and freedom during the French and Indian Wars and the American Revolution. Timber Rattlesnakes have declined across their range and are listed as Threatened or Endangered in many of the states where they still occur.

We have been working on Timber Rattlesnake conservation for the last five years. In the northern Appalachians, we are working in Vermont (where Timber Rattlesnakes are endangered with only two populations remaining) with their Department of Fish and Wildlife to develop a recovery plan for Timber Rattlesnakes. We also conducted a three-year study to document the summer movements and habitat use of Timber Rattlesnakes to help prioritize future land protection activities. As part of the project, we worked with local communities to prevent direct persecution of snakes by providing a snake relocation service. We continue to work in Vermont, primarily searching historic sites in the hopes of discovering unknown populations and monitoring populations for the prevalence...
of an emerging fungal disease that is impacting Timber Rattlesnakes across the northeast.

We are also working within the Greater Smoky Mountain Ecosystem, but little to nothing is known about Timber Rattlesnakes in this region. Over the past three years we have been conducting inventory work in the Nantahala Mountains and Southern Blue Ridge Escarpment, documenting over 50 rattlesnake locations. We plan to continue inventory work and to expand in coming years towards monitoring and conducting research on rattlesnake ecology relative to natural and prescribed fire regimes. Finally, we also plan to begin efforts to restore rattlesnake habitats in the Greater Smoky Mountain Ecosystem using prescribed fire and restoration of American Chestnut forests.

CITIZEN SCIENCE INITIATIVE

The Citizen Science Initiative is focused on actively involving citizens from all walks of life in our research, conservation and education activities. Just like birders there is a group of dedicated people called field herpers who enjoy spending their free time looking for reptiles and amphibians in the wild. As a field herper myself I can say that as a group, we field herpers are seeing more reptiles and amphibians on a daily basis than all of the professional scientists and herpetologists combined. We started to realize that this is an incredible wealth of information that could be used to help conserve reptiles and amphibians.

We launched this initiative with a project called Places You’ve Never Herped (PYNH). PYNH provides multiple field herping events every year. The events are focused on a given area that may be of interest for a variety of reasons—for example, maybe we know little about the distribution of reptiles and amphibians in the area. At the multi-day events, Orianne staff travel into the field with participants in search of any and all species they can find. All the information collected during the events is stored in a database that can be used for future research and conservation efforts. To date we have held five PYNH: two in Georgia, two in North Carolina and one in Florida, with a total of 250 people attending. We plan to continue offering approximately two events per year and expanding beyond the southeast to offer events in other regions of the U.S. and beyond.

We also host a similar type of event called Indigo Days where Orianne staff escort citizen scientists to known or potential Eastern Indigo Snake sites to conduct multi-day surveys.

Our latest citizen science project launched last year is called Snapshots in Time. Snapshots in Time is similar to PYNH in that it works with citizens to gather important data, but it is not a site-specific event. Instead, citizens are asked to gather and submit data on their own from the region they live or from places that they travel for field herping. We launched Snapshots in Time requesting data on breeding and reproduction for two temporary wetland species: Spotted Salamanders and Wood Frogs.

Data are submitted through a user-friendly web page within our website, and the data are stored in a database. In the future, we plan to add additional species to the project including Box Turtles and rattlesnakes. Overall, we plan to keep developing innovative ways to involve the public in research and conservation. One of our largest goals for the future is to develop our database to the point that it can be used much more widely and become one of the primary data repositories for reptiles and amphibians.

PROGRAM DEVELOPMENT

We are in the process of developing our first international initiative. For the last three years we have been going on expeditions to Costa Rica and Panama conducting inventory work and specifically searching for one of the greatest snakes in the world, the Bushmaster. We recently completed a trip to Central America where we met with many agencies, organizations and conservation scientists to learn more about reptile and amphibian priorities in the region. We are in the processes of developing a strategy for expanding in the region, including program development and fundraising to support the initiative. While we always plan to have a strong focus in southeastern North America, there are so many species worldwide that need someone working for their future.

UGA PARTNERSHIP

As we move into this partnership, we are entering uncharted territory—there has never been an attempt to develop a global organization for the conservation of reptiles and amphibians. Thus, many of the challenges ahead are unknown, but we plan to keep moving forward and rising above any challenge that presents itself. One of the most critical things we need is support in all forms.

If you are reading this article and care about the future of wild places and the reptiles and amphibians that rely on them, spread the word about Orianne, participate in a citizen science event or make a donation.

I envision a future where there is such a large outpouring of support that the Orianne Society can grow into a global leader in conservation and has the ability to save imperiled reptile and amphibian species that may otherwise be lost.
“Timber Rattlesnakes historically made it furthest north in Vermont, but a long history of human persecution, including a bounty that was not removed until 1981, has resulted in only two populations remaining in the state.”

Photo: Heidi Hall
It is a bright but relatively cool day in Rutland County, Vermont, as Orianne Society Chief Executive Officer, Dr. Chris Jenkins, stands on a ledge in the forest holding an antenna with a radio transmitter receiver held close to his ear. Small gnats swarm us, and the air barely stirs as we listen to the slow steady beep….beep…..beep coming from the receiver. We are using radio telemetry to locate Timber Rattlesnakes (*Crotalus horridus*), a very rare and endangered species in Vermont and one The Orianne Society has been studying in the state for the last three years. It is the final year of the study—the project is wrapping up and has provided researchers very valuable data needed to conserve this species.

### WHY THE PROJECT STARTED

Timber Rattlesnakes once occurred from Maine to Florida in the United States. In the Northern portion of their range, they are an example of a species that is critically imperiled locally but will never be listed by the U.S. Fish and Wildlife Service as an endangered species due to its wide range and relative abundance in other states. This apex predator that once ranged throughout the Champlain Valley of Vermont has now dwindled to only two remaining populations, a fact which has conservationists extremely concerned.

Chris tells me, “Timber Rattlesnakes historically made it furthest north in Vermont, but a long history of human persecution, including a bounty that was not removed until 1981, has resulted in only two populations remaining in the state. With only two populations remaining, the Timber Rattlesnake’s future in Vermont is extremely sensitive to further disturbance as they are in danger of becoming extinct in the state. Threats such as habitat loss and fragmentation, intentional killing and disease are exacerbated in smaller populations, leaving them more susceptible to extinction.”

### WHERE DO YOU START TO CONSERVE A SPECIES?

So we know a species is declining—what do you do about it, and where do you start when you want to save a species? Well in this case, it all started with a simple conversation. Prior to founding The Orianne Society, Dr. Jenkins worked for the Wildlife Conservation Society (WCS), and in 2005 while attending a conference for WCS, he met a man by the name of Doug Blodgett. Doug is a biologist for the Vermont Fish and Wildlife Department. Conversation about the best spots to grouse hunt evolved to Timber Rattlesnakes, their current status, the need for research into what was causing the snakes to decline and how to address their conservation needs. Little did these gentlemen know that a passing conversation would lead to a unique and broad effort to conserve Timber Rattlesnakes and their remaining habitat in Vermont.

In 2008 The Orianne Society, Vermont Fish and Wildlife, the Vermont Chapter of The Nature Conservancy and the Vermont Herpetological Atlas partnered to do something about the decline of
Polo? Tracking an animal with radio telemetry is a similar concept, and frankly, just as fun.

“The beeps get closer together signaling we are getting closer to the snake. It is time to start watching where you walk, as even the most experienced field researchers can overlook the cryptic rattlesnake in leaf litter.”

Which brings us back to the cliff. The tell-tale beep, beep, beep from the receiver indicates that the Timber Rattlesnake we are tracking has left the hibernaculum and moved on towards its summer foraging area. Though radio telemetry has been implemented in all three years of the project, this snake has only been fitted with the transmitter for the last year. I wasn’t there to see the transmitter implanted into the snake, but I was going to be there to recapture it and watch the transmitter be removed later in the day at the veterinarian’s office. I was pretty excited—though I have conducted radio telemetry projects in the past, it had been a long time and I have never actually participated in a transmitter surgery.

The beeps get closer together signaling we are getting closer to the snake. It is time to start watching where you walk, as even the most experienced field researchers can overlook the cryptic rattlesnake in leaf litter. And that is exactly what we did. Chris tells me “it sounds like we may have walked over it.” Great. Though Timber Rattlesnakes are not prone to be aggressive, I am certain one would not take too kindly to being stepped on. We back track a bit, and there she (my guess on the gender and later confirmed) is, a beautiful yellow phase Timber Rattlesnake, half in and half out of the sun looking as if it doesn’t have a care in the world. We approach the snake and she doesn’t move, still relying on camouflage. Closer, a little bit of interest on her part, but still not defensive. In fact, I started taking photos of this beauty at around five feet away (still a safe distance considering her position and posture), and she stayed alert but did not coil and did not rattle.

After I extensively photographed the snake and Chris waited patiently, he then moved forward with tongs to recapture the animal. He approached the snake at a steady pace, gently slipped the open end of the tongs under the middle part of her body, and smoothly deposited her into a pillowcase inside a bucket. The tongs never even closed fully on her body, the process was so quick and efficient it seemed as if it didn’t happen at all except for the squirming snake in the pillowcase as evidence. As he tied off the pillowcase he told me more about the project.

“We have been tracking transmittered rattlesnakes here in Vermont for three years, this being the third and final year of the project. We capture the snakes in the spring, typically near the hibernaculum. Funding was supplied by The Orianne Society and a Vermont State Wildlife Grant to initiate a study that would lead the way to Timber Rattlesnake conservation in Vermont. The goals of the study would be to: 1) identify Timber Rattlesnake migration routes and summer foraging habitat, 2) identify lands used by rattlesnakes in the region to prioritize future land conservation actions, 3) determine the population status of each remaining population, and 4) develop a monitoring protocol to monitor changes in population status over time. Pretty simple? Yeah, right.
whether they are male or female based on the presence or absence of hemipenes. When we find females we palpate them, or gently squeeze the length of the body, to determine if she is gravid (pregnant). All of our snakes are PIT tagged (think microchip for your pet), and the base of their rattle segments are painted with a marker so that in the future we can visually identify that the snake has already been processed. All snakes are then taken to a veterinary office, surgically fit with radio transmitters, held for 24 hours to ensure recovery from anesthesia and then released back at the capture site. That is when the tracking starts. “A technician, not normally me,” he says with a smile, “locates each snake an average of once every four days. The tech will mark the snake’s location with a GPS unit and take a few notes on the habitat type the snake is using and any notable behavior the snake may display.” He says it like it is all in a day’s work.

Dr. Chris Jenkins implementing radio telemetry to track Timber Rattlesnakes in Vermont.

Photo: Heidi Hall

WHY IS THE CEO TRACKING RATTLESNAKES?

Not that it should be beneath any CEO of an organization such as this to do some field work, but normally this task is reserved for field technicians or interns. Most organization’s CEOs are often stuck behind a desk directing the focus and long-term goals of the group’s conservation efforts, meeting with partners both new and existing, and always, always, working to secure funding. So why is the CEO of the Orianne Society on the ground tracking Timber Rattlesnakes in Vermont?

“As CEO, I think it is important that I keep a connection to working with snakes in the field. So despite spending the majority of my time running the organization and managing staff, I make sure that I stay integrally involved in the field work of my ‘pet-program.’ Vipers and specifically Timber Rattlesnakes inspire and fascinate me, and thus I am driven to study their ecology and work to ensure their conservation. The Vermont project is one of the Timber Rattlesnake projects that helps me maintain my hands-on connection to the wildlife and landscapes Orianne works to conserve.”

Dr. Chris Jenkins implementing radio telemetry to track Timber Rattlesnakes in Vermont.

Photo: Heidi Hall
**DOTS AND LINES**

Here’s an example of what radio telemetry data looks like and how we use it to help protect rattlesnakes. This is the movements of one of our actual rattlesnakes, a male snake that is the distance champion of our tracked snakes—he moved a total of 20 kilometers (over 12 miles), even though he was never more than 4 kilometers (2.5 miles) from the den site. The snake had four places where it liked to hang out for long periods at a time, and in between it moved pretty quickly for a long distance. Based on the behavior of the snakes observed while tracking, we also have a good idea of what the snake was doing as it moved around. For instance, this snake moved to specific areas to shed its skin at the beginning of the summer and then later in the summer to digest a meal and shed again. Yep, snakes are picky about where they shed—they’re really vulnerable and need to maintain a certain temperature, so anywhere just won’t do. In between the first and second shedding events, our male moves around quite a bit looking for female snakes—next to feeding, this is the highest priority for his summer excursion from the den. And at the end of the summer, he returns to the same den that he left during the spring.

In addition to the snake’s activities, we use the telemetry to prioritize important habitat areas. The largest outside circle represents the total area that the snake used, the snake’s total home range. But look at this diagram, and it’s obvious that the snake doesn’t use all of this larger area; instead, it focuses its activity on a few clusters. These four clusters are the core home range and represent the most critical areas for this individual snake. So obviously, if we wanted to completely protect this snake’s summer range, then we could focus on the larger polygon. But we have limited conservation resources, and maybe it’s impossible to protect everything. So a good compromise might be to protect the core circles along with some linear corridors between clusters. It’s these sort of land prioritization decisions that our analyses are especially useful for.

— Dr. Stephen Spear

**WHAT DO THOSE LINES AND DOTS MEAN?**

Identifying Lands Used by Rattlesnakes in the Region to Prioritize Future Land Conservation Actions.

The process Chris describes seems invasive and disruptive to a novice, but the data collected at the capture and throughout the tracking season is done with great care and concern for the snake. It tells researchers so much about these animals, things they need to know in order to effectively conserve this species in Vermont. Tracking the snakes for the entire season tells researchers how the snakes are moving, what habitat types they are using during what times of the year, what the barriers to snake movement are (i.e. roads, farms), and who owns the land they are using the most—a very important aspect of this project, as one of the end goals is to prioritize land conservation to protect this species and its habitat. In addition, determining the ownership of the lands the snakes are traveling through allows researchers to focus their education outreach efforts on the importance of this species so a snake traveling through privately owned land doesn’t end up a dead snake.

In fact, as part of the project, the group formed a “Rattlesnake Removal Team.” The Rattlesnake Removal Team is a group of experienced rattlesnake handlers that are on call to respond to reports of rattlesnakes being on someone’s property who does not want them there. The removal service is provided free of charge to encourage people to use the service rather than kill the snake. The information on the Removal Team, along with facts about the Timber Rattlesnake, are distributed in a packet to residents of the region in which the snakes may still occur. Public meetings are also held in the region to inform residents about the project and the importance of Timber Rattlesnakes to the local ecosystems.
Doug, the biologist with Vermont Fish and Wildlife working on this project, is fully behind the removal program. “We have had several calls for removals in each of the last two years and have responded to three calls this year. As we’ve learned during our research of Timber Rattlesnakes in the State, adult survival is very important to the population, and we intend to continue this program into the future for this reason.”

SO, HOW MANY OF YOU LIVE HERE?

The data collected during this project, when analyzed, has told these researchers a great deal about Timber Rattlesnake movement in the region. For example, it was determined that the movements made by Timber Rattlesnakes in the study were among the greater distances reported for this species. In addition, the data shows that rattlesnakes are avoiding development and spending a significant amount of time on private land, which makes the removal program and education outreach efforts all the more important to the long-term conservation of this species.

All that tubing, touching, measuring, tagging, weighing—all that stuff that researchers do to captured rattlesnakes—why do they do that? Good question. The answer is complex. Researchers use a variety of models and formulas to process the data they collect to determine the status of a population as well as the general health of the population and whether a population has the potential to persist into the future if conditions remain the same.

For example, you may remember Chris mentioning that when they capture rattlesnakes, aside from taking a number of measurements, they also insert a PIT tag into each snake and mark the rattle. The PIT tag numbers can be read using a PIT tag reader that scans the body of the snake to find the tag. The numbers for each tag are unique to each snake, and the data collected on each snake is collected under that number. Year after year, as the snake is recaptured and more data is collected, you can start to derive a few things from the data—such as the overall health of the animal, how it has grown, whether it weighs more, and a bit about its behavior—and you can see if it has moved great distances from where it was recaptured the previous year and so on.

You can also use recapture data to estimate population size. This survey technique is fittingly called “mark-recapture.” There are many scientific formulas you can use to analyze the data collected during mark-recapture. To explain mark-recapture, we’ll go through an example, and in this example, we will use the formula: \[ N = \frac{M \times T}{R} \], where you are solving for “N” or estimated population size.

**STEP 1:** You collect animals from a population, the size of which is unknown. You mark those animals in some manner that enables you to identify that you have captured that animal at some point. You return those animals to the population. Let’s call these animals group “M.”

**STEP 2:** You revisit the population and collect animals again. This time, you make note of all the animals you have captured that are recaptures—think of this as group “R”—and the total number of animals you catch, both recaptures and first time captures—we’ll call this group “T.”
STEP 3: You enter your data into our example formula that is based on the idea that the proportion of marked individuals to captured individuals during the second survey is the same as that which was marked initially in the total population.

Confused? Let’s use some example arbitrary numbers. We are trying to estimate the population of Timber Rattlesnakes at a particular den site. We conduct an initial survey and capture 29 snakes (M), all of which we mark the rattles with our green marker. We conduct a second survey and capture 42 snakes (T), 12 of which have green rattles (R). We enter this data into our formula.

\[ N = \frac{29 \times 42}{12} \]

So our estimated population size is 101.5 individuals for that den site. Again, these are arbitrary numbers, but you get the point.

However, before one thinks they can run out and estimate a population based on the above information, you should know that this is an extremely simplified example. The formulas and models used to estimate population size are very complex and are based on a range of assumptions about the population. The accuracy of the formula depends on whether or not the assumptions for that specific formula are met. For example, one of the assumptions of this formula is that during the time between the first survey and second survey, the population is “closed” or no new individuals entered the population and no individuals were removed from the population. Another assumption of this formula is that your survey effort has not changed and that there is an equal chance for individuals to be caught in the first survey as during the second. There are many more assumptions; however, the point is that these formulas are complex, but when used correctly, data from implementing the mark-recapture technique can estimate the size of a population within a certain confidence interval without taking the time to census the entire population, which is often times not a practical technique.

THE SPOOK FACTOR AND DEVELOPING A MONITORING PROTOCOL TO MONITOR CHANGES IN POPULATION OVER TIME

There are two populations of Timber Rattlesnakes remaining in Vermont. Going to these sites year after year capturing animals, marking them and releasing them may be changing the behaviors of the snakes. As we climb boulders heading to a den site, Chris explains this phenomenon to me. “Bill Brown, a retired faculty member of Skidmore College, has seen this in other populations and coined the term ‘spook factor.’ The spook factor is an individual animal’s response to being captured and handled. These responses may include changes in basking and migration patterns. Some of these responses could end up harming the animal in the long-term, putting them in contact with threats they may not have encountered had they been left alone.”

So how does one avoid the spook factor and still monitor a population? Javan Bauder, former Associate Conservation Scientist with the Orianne...
Society, spearheaded the effort to develop a non-invasive survey method to monitor long-term the abundance of Timber Rattlesnakes at each den site without actually handling the animal.

Javan tells me, “Accurately measuring animal populations in a way that does not negatively affect their behavior is very important for wildlife conservation. We developed a technique that will allow biologists to monitor Timber Rattlesnakes at these sites in a way that does not unduly disturb the snakes while at the same time providing an accurate index of their abundance. Because rattlesnakes are cryptic species, we use two observers to improve our detection rate and provide a more accurate estimate.”

Two observers, no touching the snakes. That is the basis of this non-invasive survey method that will allow researchers to monitor rattlesnake abundance. Not handling the snakes eliminates the spook factor. Using two observers allows for a measure of detectability. Two surveyors go out at the same time, walk the same transects and collect their own data. Comparing the two datasets allows researchers to measure detectability, or the probability of detecting a rattlesnake if it is on the surface.

In fact, using this method did indeed prove that the double survey method does improve detectability, as the second observer detected rattlesnakes that the first observer did not, raising overall detectability by 32 percent per survey.

THE TRANSMITTERS MUST COME OUT

The project is ending. The last thing we need to do is remove the remaining transmitters from the Timbers that were tracked this year. We are in the veterinary office—there is myself, Chris, Doug and a big guy in his socks, Dr. Scott MacLachlan DVM. I immediately like him. Dr. Scott has been inserting and removing transmitters from our Timber Rattlesnakes for the last three years—why? Because he believes in conservation.

I ask Scott why he took on this project. “The rattlesnake project has been fun,” he tells me. “You know, for all the differences in animals, we are really all the same. Not to get too philosophical, but we all live and die, and right now, the quality of this world…” He shakes his head. “It is up to us to change things. Looking at populations that are threatened or endangered, usually it is because of habitat loss or issues, or trying to live with human beings. I feel it is my responsibility to do what I can to leave the place a little bit better than I found it. Basically, that is where I am coming from.”

Did I mention I liked him immediately? Timber Rattlesnakes are venomous, obviously, so how do you remove a transmitter from a rattlesnake? The simple answer is very, very carefully.

There is a bathtub in the corner of the vet’s office, and Chris is currently using tongs to put a pillowcase containing a rattlesnake we tracked and captured that day into the tub. He unties the knot in the pillowcase and uses the tongs to gently pour the snake out of the bag. It slithers out slowly, unsure about where to go or what to do. Right now there is no threat, just the reality of its surroundings. It doesn’t rattle, it doesn’t move.

Chris gathers two long, clear plastic tubes from a set on the counter. One is smaller than the other in diameter, but each is roughly the same size around as the snake. Slowly, he puts the end of one tube close to the snake’s head and gently nudges the body of the snake with the
right into the tube. When his head is a safe distance up the tube, Chris quickly reaches in and grabs the end of the tube and the body in the same hand, effectively holding the snake in place in the tube. With her head in the tube, the snake cannot strike.

It is here that I should mention that this is no feat for a novice. Chris has been working with venomous snakes his entire adult life and is skilled in this process, as are the other researchers working on this project. They know when it is safe to reach in and when to abort the process. Do not try this at home.

The snake is now restrained, and the removal process can begin. It starts with a little data collection. A scanner reads the PIT tag in the snake and a datasheet is filled in under that PIT tag number. The snake is weighed and measured, its rattle segments counted, the rattle painted, and it’s checked for any lesions.

Lesions—we haven’t talked about those yet. Timber Rattlesnakes, and many other snakes, are being inflicted with a contagious fungus called Ophidiomyces ophiidiicola (formerly Chrysosporium ophiidiicola). Also known as “Snake Fungal Disease,” Ophidiomyces can be fatal to snakes. Researchers are currently studying Ophidiomyces to learn more about this fungus, how it is spread and how it can be treated.

Back to the process. After data collection the snake, still in the tube, is placed on the surgical table. Scott attaches a mask of sorts to the open end of the tube the snake is in. The mask is attached to a separate tube that leads to a machine in the corner. He turns a knob on the machine, and gas starts to flow through the mask and tubing, reaching the snake and anesthetizing it. Once the snake is fully anesthetized, Scott examines the body of the snake, looking for the transmitter. You can barely see where the incision was made to insert the transmitter. It is completely healed. Scott, with his trained eye, can identify an old incision and will open the snake up again in this same spot to remove the transmitter.

Dr. Scott is calm, even with so many people in his surgery room. I think he deeply likes this project, has a stake in it and feels like he is doing something for conserving these species—and he is. He sterilizes the area on the snake where he is going to make the incision. He does one more check to make sure the snake is breathing okay and is fully under, makes a very small cut and then makes the incision slightly larger with a small pair of scissors all the while monitoring the snake. He cuts away a bit of tissue that has grown around the transmitter (not much) and ever so gently pulls the transmitter out of the snake. It is red in color and is slightly smaller but the same shape as a AA battery. He puts the transmitter aside, checks the snake one more time and then uses a few dissolvable stitches to close the incision, all the while joking that they are dissolvable so the snake doesn’t have a follow up appointment to have them removed. Dr. Scott is good. The removal only takes a few minutes at most.

If the snake did have lesions, the vet would have taken a biopsy and drawn a bit of blood. The small sample of the tissue of the lesion is taken with scissors, and the blood is taken and put on slides in a room opposite the surgery room. The blood and tissue sample will be sent to the Roger Williams Zoo who is conducting research on Ophidiomyces.

The snake is then taken off anesthesia but remains on the table in the tube until Dr. Scott is satisfied that the snake is breathing properly. Upon Dr. Scott’s approval, the snake is removed from the table. Tube and all, the snake is placed back in its pillowcase. When the snake is at the bottom, the tube is pulled off quickly. Since the snake is still a bit
sedated, it doesn’t seem too concerned as the pillowcase is tied shut and placed in a bucket. The snake will remain with researchers for 24 hours to ensure it recovers from the surgery properly before it is released into the wild where it was captured.

It has been a good day and everyone is happy that the project has provided us with the knowledge we need to save the Timber Rattlesnakes in Vermont and that it was conducted safely for both the snakes and people involved. It is time for a little celebration. The vet and researchers convene at the local pub, something of a tradition when the project wraps each year, for a few wings and a few beers.

IT’S BEEN FUN....

The project is almost over and the group feels it has been a great success. We have learned a great deal that will allow us to conserve Timber Rattlesnakes. We have formed and solidified partnerships that will continue, partnerships formed in the common goal of saving a great species. We are back in the forest now, Chris, Doug and me. Chris has a backpack on that holds a bucket that once contained several snakes but now has just one. We have been releasing snakes all morning, and this is the last one. The snake, in a pillowcase, is taken out of the bucket. The pillowcase is untied and the snake is ready to be released. Suddenly I recognize where I am. We are in the spot where we collected the first snake the group caught upon my arrival on the project. No sooner do I remember than I see her slither out of the pillowcase. It is the pretty yellow phase female. She is released on a large flat rock partially covered in lichen and with a large downed log on top of it. Here she will bask and recover from her ordeal, close to shelter but in an area where she can get some sun. As she is released she immediately coils, but not in an aggressive manner, not tightly, and she doesn’t rattle. She looks….pensive, as if she is contemplating what has happened and why.

Though I try, it is hard not to put human characteristics and thoughts to animals. They are their own beings, not entirely like us, but not entirely different.

But as she rested there, loosely coiled in the sun, I like to think that she was not angry at being caught and handled. I like to think she knew there was a reason for it. So that she and her offspring should persist for generations to come. So that someone else could walk by her some day and see the beauty of her and her offspring in one of the last wild places in Vermont and recognize her value to our ecosystems and inherent right to persist.

Ophidiomyces?

Ophidiomyces is informally referred to as “Snake Fungal Disease” and has been found in eight different species of snakes including rattlesnakes and several colubrid species. Snakes infected with Snake Fungal Disease usually show signs such as open wounds, lesions and scabs. Infected rattlesnakes primarily show signs of the disease on the head and face, but symptoms can also occur elsewhere on the body.

It is not known where Ophidiomyces originated or how it is transmitted. What we do know is that more often than not, snakes show more severe signs of the disease directly after hibernation. The disease has been fatal in Massasaugas, and mortality is relatively high for Timber Rattlesnakes that are infected with the disease.

Open wounds, scabs and lesions are not 100 percent indicative of the disease. When possible, blood samples and tissue samples should be collected from snakes showing symptoms and sent to one of many institutions currently studying the disease for confirmation.

Learn more about Snake Fungal Disease at www.nwhc.usgs.gov/disease_information/other_diseases/snake_fungal_disease.jsp
In August, Dr. Chris Jenkins and I visited University of Georgia Costa Rica to learn more about the station and explore how The Orianne Society may use the station as part of our developing Mesoamerican Project. As Dr. Newcomer describes, there are many exciting projects ongoing at the station, yet there is an opportunity to develop herpetological projects to complement the existing projects on other taxonomic groups. Although the station is not in proximity to the range of our current focal species in the region (bushmasters), UGA Costa Rica has potential as a base for expanding our Mesoamerican Project to other species.

For instance, the Monteverde Cloud Forest Reserve and surrounding area suffered extensive declines due to *chytrid* fungus (and possibly climate change), but scientists are observing that some species are beginning to reappear and perhaps are starting to recover. Such a possibility highlights the need for connections among habitats to allow for frog populations to spread back across their original range. The Bellbird Corridor that is a focus of the UGA Costa Rica station could help provide this function, and The Orianne Society could work with current UGA Costa Rica personnel to protect and improve amphibian habitat.

Dr. Jenkins and I were very impressed with the lab and working facilities at the station, and we look forward to exploring herpetological conservation efforts in the Monteverde region.

—Dr. Stephen Spear

by Quint Newcomer

Photo: James W. Porter
The 155-acre campus sits adjacent to the world-renowned Monteverde Cloud Forest Reserve, just below the Continental Divide on the Pacific slope of the Tilarán Mountains in northwestern Costa Rica. Every year, over 2,000 people come to UGA Costa Rica for a hands-on immersion experience, including participation in citizen science research initiatives that are part of UGA Costa Rica’s on-going research program.

In addition to the breathtaking location, the delicious locally-grown food and the beautiful facilities, one of the things that makes the UGA Costa Rica campus special is the way in which hands-on, field-based scientific study is integrated with formal and informal educational activities. Even students who come to the campus to study the arts, humanities and Spanish language leave with a deepened awareness and appreciation for the natural world and for efforts to support biodiversity conservation. The structure of the campus and facilities also facilitates interaction among visiting scientists from a variety of backgrounds, resulting in the rich discussion of ideas across disciplinary perspectives.

UGA Costa Rica has established several on-going research programs based at the site, including a permanent forest plot which is part of a national network aiming to better understand tropical forest dynamics and the impacts associated with changing climate conditions. UGA Costa Rica has also planted over 32,000 native tree species since 2008 as part of a carbon offset program for UGA students traveling to the Costa Rica campus on education abroad programs and in 2013 began a monitoring program to understand growth rates and survival in these enriched regeneration plots.

In the spring of 2006, Dr. Jim Porter, Meigs Professor of Ecology in UGA’s Odum School of Ecology, brought a small group of undergraduate students on UGA Costa Rica’s first spring semester program. Several of these students were freshmen and sophomores, and none were science majors. However, by the end of the program, they had made a very important contribution to the study of biodiversity in Costa Rica.

Dr. Porter first took his students to Costa Rica’s National Biodiversity Institute where they learned about the institute’s goal of cataloging the country’s biodiversity—estimated at five percent of all of the species on the planet—and in particular, the butterfly species of the Monteverde region. Dr. Porter and his students then proceeded to collect and identify the butterfly species found at the UGA Costa Rica campus. For three years (2006 to 2008), Dr. Porter and his students delivered their collections to the National Biodiversity Institute, resulting in an increase in the identified butterfly species for the Province of Puntarenas by six percent.

In 2007 Dr. Porter’s students were collecting in a forest within a national reserve which only 60 years prior had been over-grazed, degraded cattle pastures. They found two specimens of a butterfly that had never previously been identified in Costa Rica. This discovery demonstrated very clearly for the students the importance of habitat regeneration and the role of protected areas.

Thanks to a generous donation from UGA alumnus Paul A. Gross to support the on-going study of butterflies at UGA Costa Rica, Dr. Porter and a team of scientists from the Odum School of Ecology have continued to study the butterfly population in San Luis. In 2006, local experts suggested that up to 150 species might be found in this area. However, by 2014 this study has revealed over 230 species and continues to climb with each new field season. The UGA Costa Rica campus houses this collection.

A high proportion of the species being added to UGA Costa Rica’s list are range extensions of butterflies that normally live in the lowland tropics of Costa Rica. Dr.
Porter's hypothesis is that climate change, particularly increasing temperatures, is causing butterfly species to move upslope. The long-term study of butterflies in this region will contribute to a better understanding of how changing climate conditions are impacting different species' habitat ranges.

In 2010 another Odum School of Ecology faculty member, Dr. John Pickering, approached UGA Costa Rica with the proposition of establishing a long-term moth research project at UGA Costa Rica as part of his larger Discover Life Mothing Project. Since that time, Dr. Pickering has installed permanent mothing boards within the UGA Costa Rica campus and has had a consecutive string of eight student research interns at the UGA Costa Rica campus. These interns go out nightly to document and identify the moths that are found. In addition to the Discover Life research, these interns and their moth boards have become one of the favored stops during night-time natural history walks in the forest for the students and other guests at the UGA Costa Rica campus.

Discover Life Mothing Project's scientific objectives are to understand how weather patterns, urbanization, latitude and other factors affect moth communities. Since 2010 participants have photographed over 400,000 insects at 19 study sites in the eastern United States and UGA Costa Rica, documenting nightly differences in the seasonal activity and abundance of over 2,900 moth species across years and sites. Novel results show how body size of a species can change between generations and years, how smaller moths are relatively less active than larger moths at colder temperatures and how moths with larvae that feed on lichens may be more detrimentally affected by urbanization than other species.

Discover Life's educational objective is to involve the public in all aspects of the project from hypothesis generation, data collection, identification, analysis and presentation of results. As part of this program, Discover Life is developing Moth Math to teach students how to analyze real-time moth data. In
partnership with the Moth Photographers Group that provided 40,000 diagnostic photographs, Discover Life now provides online identification guides to 12,000 moth species customized by U.S. state or by Canadian province or territory. Similar guides for Central and South America will be developed.

UGA Costa Rica is one of the founding members and continues to participate on the Local Advisory Council for the Bellbird Biological Corridor, part of a network of 37 biological corridor areas throughout Costa Rica that are recognized by the Costa Rican government as priority areas for integrated biodiversity conservation, sustainable resource management and rural development. One of UGA Costa Rica’s long-term research goals is to develop a better understanding of the complex socioecological processes influencing water quality and water quantity throughout the three watersheds that run from the Monteverde Cloud Forest Reserve down to the mangrove forests along the Gulf of Nicoya. This is particularly important as all of the climate models for the coming century suggest significant increases in temperature, and severe drought is the most likely scenario for the Pacific slope throughout Central America.

UGA Costa Rica, Dr. Tom Shahady, a professor at Lynchburg College in Virginia, and several faculty from UGA’s Warnell School of Forestry and Natural Resources and the Odum School of Ecology initiated a water quality study throughout the Bellbird Biological Corridor including study sites within the watersheds of the Lagarto, Guacimal and Aranjuez Rivers. Dr. Shahady and his student interns from Lynchburg College sample each stream system at the headwaters, several sites through the mid elevations and one location near the coastal terminus for each stream system. A series of chemical, biological and physical measures are analyzed, including samples of aquatic macroinvertebrates, flow and discharge rates, documentation of streambed changes, and levels of nitrates, total phosphorus and other chemical parameters.

Sampling occurs four times throughout the year to capture rainy and dry seasonal impacts. Water quality relationships, biological inventories and water supply calculations are under initial investigation.

Early on, it was clear that the typical biological index used for estimating water quality in temperate streams didn’t work well when applied in these tropical river systems.

Thus, one of the primary goals is to develop a biological index of water quality project at UGA Costa Rica is the first in-depth analysis of its kind for the watersheds of the Biological Corridor.”
“Land disturbances and other sources of pollution produce trends in aquatic insect populations found in streams. These trends are analyzed and then compared to similar chemical changes in the streams for verification to model a region specific water quality index.”

quality for use in the Biological Corridor and in other similar tropical settings. Land disturbances and other sources of pollution produce trends in aquatic insect populations found in streams. These trends are analyzed and then compared to similar chemical changes in the streams for verification to model a region specific water quality index. Ideally, students and researchers at all levels will use this index when collecting and studying aquatic insects in the rivers and tributaries within the Biological Corridor. Furthermore, local officials and citizens concerned with stream health and the monitoring of water quality can use the index to document threats posed from community water pollution. Local workshops demonstrating use of the index are planned with local partners inviting residents and professionals throughout the area, which will encourage citizen science and educate locals on the rivers in their area.

This water monitoring study has many interesting components and social dimensions in addition to the development of a biological index for water quality. First, the water quality characterization of the Monteverde Cloud Forest Reserve gives us insights into an undisturbed functioning river system. When a group of Quakers settled in the region in the 1950s, they established a protected forest area surrounding their water supply. This area is now included within the larger Monteverde Cloud Forest Reserve. The unique water quality and biological communities here provide a picture not found elsewhere.

Second, shortages in water supply and diversion are occurring in streams at lower elevations, increasing the demand for good data and expertise to aid government decision-making and local participation. The continued operation of the water quality laboratory at the UGA Costa Rica campus and scientific expertise on use of the water quality index will contribute to improving the efficiency and sustainability of water resource management region-wide.

Third, agribusiness and hotels need independent monitoring to ensure water quality protection throughout Costa Rica. This program is providing that support structure.

The water quality project at UGA Costa Rica is the first in-depth analysis of its kind for the watersheds of the Biological Corridor. With the development of an index throughout the plethora of life zones represented in this biologically-unique and important area, it will be easier for future scientists—from highly-trained Ph.D.s to citizen scientist school children—to observe and interpret changes and impacts in the local environment.
Relatively little is known about the habits and current status of Timber Rattlesnakes in the Georgia Piedmont. This region represents one of the furthest limits of the Timber Rattlesnake’s range, and it has undergone extensive urbanization and development in the last several decades.

Clarke County is no exception, but it has the added benefit of being home to the University of Georgia (UGA) and Whitehall Forest. Whitehall Forest covers 840 acres and is actively owned and managed by UGA. However, it is not open to the public.

As a result, there is a wealth of forest and habitat types in a very small area. Due to this large amount of landscape diversity in a fairly small area, it provides a rare opportunity for us to see how Timber Rattlesnakes utilize varied habitats in the southern limits of their range.

The main focus of my research is to determine how Timber Rattlesnakes move throughout various habitat types and to determine whether or not they preferentially select certain habitats within Whitehall Forest. Eastern Box Turtles are also included in this study, as they move great distances throughout their selected habitats and will provide a strong contrast to Timber Rattlesnakes, who tend to stay within a selected area.

Radio transmitters will be implanted within Timber Rattlesnakes and glued onto Box Turtles, which will then be tracked daily to determine their location and movement within Whitehall Forest. Once located, their habitat type, behavior and climatic conditions will be recorded so that any trends across these variables may be determined.

Determining the types of habitat utilized and how far the rattlesnakes move during their active season can provide important information regarding their conservation in the Piedmont region. Compared to populations in the northern areas of their range, Timber Rattlesnakes in the South are known to behave differently in several ways. Southern Timber Rattlesnakes tend to den solitarily instead of communally and tend to have longer active seasons due to the warmer climate.

With this in mind, lands and habitats in the region can be managed to support greater populations of Timber Rattlesnakes in fragmented landscapes.
1. CLAYTON THOMAS
   Spotted Salamanders
2. ANTHONY HENEHAN
   Speckled Kingsnake
3. DEVIN BELLISTON
   Jackson’s Three-horned Chameleon
4. ASHLEY TUBBS
   Texas Horned Lizard
5. CARY HOWE
   Timber Rattlesnake & Broadhead Skink
6. CHRISTOPHER PELLECCHIA
   Galapagos Marine Lizard
7. JAMES MUCHMORE
   Ecuadorian Annulated Tree Boa
8. HOUSTON CHANDLER
   Scarlet Kingsnake
9. MATT MOORE
   Eastern Coachwhip
10. ZHIY
    American Alligator
11. KILE
    Midge
PHOTOS

Spotted Salamanders
Timber Rattlesnake & Broadhead Skink
Ecuadorian Annulated Tree Boa
Kiley Mitchell
Midget Faded Rattlesnake
American Alligators

Juan Ge
Tim Y Mitchell
Faded Rattlesnake
UPCOMING events

NOVEMBER

EAST COAST REPTILE SUPER EXPO
November 1
Oaks, PA
www.eastcoastreptilesuperexpos.com

REPTICON ATLANTA
November 8-9
Lawrenceville, GA
www.repticon.com
(Additional locations and dates online.)

FEBRUARY

SOUTHEASTERN WILDLIFE EXPO
February 13-15
Charleston, SC
http://sewe.com/the-exposition/

SOUTHEAST PAC ANNUAL MEETING
February 19-22
Covington, LA
http://www.separc.org/meetings/

NORTHWEST PAC ANNUAL MEETING
February 24-27
Portland, OR
www.nwparc.org/meeting.html

MARCH

WILDLIFE DISCOVERY CENTER’S REPTILE RAMPAGE
March 9
Lake Forest, IL
www.wildlifediscoverycenter.org

CARIBBEAN PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION INAUGURAL MEETING
March 12-14
Santo Domingo, Dominican Republic

CLAXTON RATTLE SNAKE AND WILDLIFE FESTIVAL
March 14-15
Claxton, GA
www.claxtonevanschamber.com/events/rattlesnakefestival.html

ASSOCIATION OF ZOOS AND AQUARIUMS MID-YEAR MEETING
March 21-27
Charleston, SC
www.aza.org/midyearmeeting

MONTHLY

CINCITY REPTILE SHOW
11/7, 12/14, 2015 Dates TBA
Mason, OH
www.cincityreptileshow.com

INDIANA REPTILE BREEDERS EXPO
11/2, 12/7, 2015 Dates TBA
Clarksville, IN
www.irbexpo.com

KALAMAZOO REPTILE & EXOTIC ANIMAL EXPO
11/15, 12/20, 2015 Dates TBA
Kalamazoo, MI
www.kalamazooreptileshow.com

MICHIGAN REPTILE SHOW
11/8, 12/13, 2015 Dates TBA
Taylor, MI
www.michiganreptileshow.com

ST. LOUIS REPTILE SHOW
11/2, 12/28, 2015 Dates TBA
St. Louis, MO
www.stlreptileshow.com

TEXAS REPTILE EXPO
11/1, 11/2, 2015 Dates TBA
San Antonio, TX
www.texasreptileexpos.com

= The Orianne Society will be participating

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Photo: Kevin Stohlgren
Wood Turtle
Glyptemys insculpta

INDIGO magazine

Front Cover Photo: Kevin Stohlgren; Back Cover Photo: Pete Oxford

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