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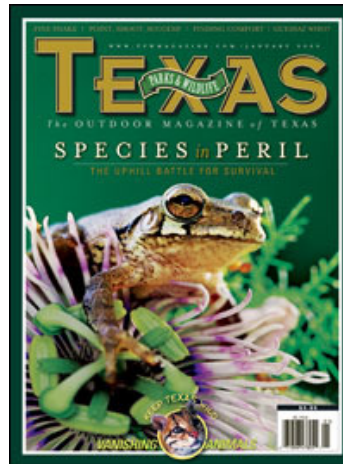
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THE SNAKE UNDERGROUND

The Louisiana pine snake, like its longleaf pine habitat, may be running out of time.

By Wendee Holtcamp

Craig Rudolph's white hair and bushy white beard are a common sight in the longleaf pine savannah of East Texas. A U.S. Forest Service Southern Research Station biologist, Rudolph has been researching the Louisiana pine snake - one of North America's rarest reptiles - for more than 15 years. He and his colleagues regularly check dozens of 4 by 4 foot square wood box traps in locales throughout the snake's historic range, and with over 350,000 "trap-days" under their belt, they catch a lot of snake species. But unfortunately, as the years pass, they're catching fewer and fewer Louisiana pine snakes.



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Rudolph's research has revealed previously unknown secrets about the snake's natural history - including that they live underground in mature longleaf pine forests, they prey on pocket gophers and they depend on gopher burrows for much of their life cycle. He also discovered the snakes remain in only three small isolated populations in East Texas, in addition to three slightly larger populations in western Louisiana. "My gut tells me they're in a world of hurt," says Rudolph, who has more experience studying the snake than anyone. But justifying formal protection requires extensive scientific research - and that is what Rudolph has spent the last several years doing.

Texas lists Louisiana pine snakes as a threatened species, which makes it

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illegal for people to collect, sell or harm them, but the status offers no habitat protection, and Louisiana law does not protect them. In 1999, the U.S. Fish & Wildlife Service identified the snake as a "candidate" species for listing as endangered or threatened, but for nearly ten years has precluded its listing. In other words, FWS has enough information on the species' status and threats to list them under the Endangered Species Act, but it's precluded by other higher priority species.

The robust tan-and-brown checkered Louisiana pine snakes grow to around 6 feet long. They live primarily in fire-adapted longleaf pine forests, an ecosystem that once stretched across the southeastern United States, from Virginia to eastern Texas. Timber companies prized longleaf pine, but replanted with faster growing loblolly. Only 3 percent of the original 90 million acres of longleaf pine savannah acreage remains, with less than 0.01 percent of the original old growth forest left.

The open park-like forests near Angelina National Forest's Boykin Springs reveal a glimpse of what early pioneers saw before 19th century loggers came and before years of fire suppression changed the face of the forest. Longleaf pines grow in nutrient-poor sandy soils, comprised largely of quartz crystals, so the trees don't achieve large girth for hundreds of years because they may as well be growing in glass. Knee-high grasses and plants carpet the forest floor. In centuries past, regular wildfires swept through the pine forests clearing out underbrush, but wildfire suppression through the 20th century drastically changed the character of these fire-adapted forests. Although the Forest Service now regularly does carefully controlled burns, biologists are just now coming to grips with how past mismanagement has affected the forest ecosystem.

Rudolph was first intrigued by the Louisiana pine snake in the early 1980s. While monitoring red-cockaded woodpecker nests, he saw a road-killed snake near Boykin Springs, which got him thinking, "We really ought to learn more about that species." He knew they were rare, but as time went by, he wondered why he didn't see more. "I spent a lot of time in what should have been good habitat," he says, but "I never saw one." When they started researching the snake in 1993, scientists didn't know if the species was rare or just rarely seen, and they didn't understand basic information such as what the snakes ate, what habitat they preferred, when they bred, or how vulnerable they might be.

How does one catch such an elusive snake? By using 4 x 4 foot contraptions, which catch snakes without bait. When a snake slithers into one of the four wire fences stretching 50 feet out from each side, it crawls along the fence until reaching a funnel into the box. Snakes can escape back through the funnel, but they typically stay put.

The biologists started trapping in areas they thought might be prime habitat - the remaining longleaf pine savannah - and they caught some right away. "We started doing a basic telemetry study," explains Rudolph. Radio telemetry allows scientists to follow snakes' movements and study their behavior. After catching a snake, they'd surgically implant a transmitter inside the snake's body. "They have a pretty good threat display if you disturb them," he recounts. "They take in a lot of air and puff up and expand their body, coil, and hiss very loudly. It's a pretty spectacular bluff." Though they put on a

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Rudolph started trapping where records indicated Louisiana pine snakes lived in times past. "We did a lot of surveys throughout their historic range," he explains. Relatively quickly, they located three isolated populations in Texas - Boykin Springs on the Angelina National Forest, Foxhunters Hill in the Sabine National Forest, and Scrappin' Valley on private timber company land. Then their luck ran out. "After the first few years, we never found any new populations."

The radio tracking studies revealed one reason why the snakes had been so hard to spot - they live underground. "They spend most of their time in close association with pocket gopher burrows. It's where they hibernate, where they shelter, and where they forage. And it's how they escape from fire," explains Rudolph. Although most people don't give the world underneath the ground much thought, a whole subterranean ecosystem exists there. Pocket gophers create extensive burrow systems that provide shelter for dozens of species, from frogs to tortoises to salamanders to insects. The gophers eat roots and tubers, and, when necessary, try to escape from what Rudolph found was their most formidable predator, the Louisiana pine snake.

During their studies, the biologists also collected fecal samples - snake poo - and examined stomach contents of a few roadkilled individuals, which revealed that they specialized on eating pocket gophers. "They're really closely tied to the gophers and their burrows," says Rudolph. "The gophers, in turn, are pretty much associated with sandier soils and well-burned sites where there's lots of herbaceous vegetation for them to eat."

Most constrictors, including pine snakes, coil around their prey, but Rudolph became curious about how this species managed the feat in a narrow burrow. He created a huge ant-farm-like terrarium and filled it with soil and two Plexiglas inserts. He placed a pocket gopher inside, which immediately burrowed throughout the soil. He then released a Louisiana pine snake inside. He discovered that the snake has a novel technique for killing pocket gophers: instead of coiling around, the snake crawls past the gopher then turns around, kinking its body to press the gopher against the burrow wall until it suffocates. Rudolph repeated the experiment with three other snake species, which proved not nearly as efficient at nabbing gophers.

This connection between Louisiana pine snakes and pocket gophers provided a major clue about their decline. Wildfires once regularly scorched the forest, but Smokey Bear taught that forest fires were bad, and decades of fire suppression ultimately caused an ecological domino effect. Pine forests became overgrown with brush and lost herbaceous groundcover, causing pocket gopher numbers to plummet, and in turn affecting Louisiana pine snakes. A court case in the late 1980s forced the U.S. Forest Service to better manage fire and controlled burns in national forests for endangered red-cockaded woodpeckers, which incidentally improved habitat for gophers and Louisiana pine snakes. But much work remains.

Although U.S. Fish & Wildlife Service has not yet listed the Louisiana pine snake as endangered, they developed a Candidate Conservation Agreement, a collaborative effort that allows every impacted entity to help protect the species in the meantime. "The basic idea is to get different partners to do beneficial actions to reduce the threats and improve its conservation status," explains FWS biologist Ben Thatcher. "It does appear that the species has been extirpated from much of its historic range." Entities working on the CCA

include TPWD, Louisiana Department of Wildlife & Fisheries, the U.S. Forest Service and the Department of Defense (some populations in Louisiana occur on military installations), and they agree to take certain actions to help the species, but nothing is legally binding. Private landowners are also invited to the table.

Those concerned about the snake's future must address serious issues before the species has any chance of recovering: drastic losses of historic longleaf pine forest habitat, decades of wildfire suppression, roadkills, fragmentation of remaining forest and the problems caused by the physical isolation of the handful of small populations from one another. And a new threat has arisen: timber companies managing longleaf pine forests in Louisiana - which have the largest populations of the snakes - have switched to intensive silviculture including herbicide to eliminate all groundcover. Removing fire once again from the forest does not bode well for the snakes or the ecosystem.

Besides the CCA, one positive step for the snake involves captive breeding. Although captive zoo populations exist from Louisiana stock, scientists want to create a captive population based on Texas stock since the population is vulnerable to extinction, which could eventually help reintroduce animals to the wild. In April 2007, the Forest Service started collecting Louisiana pine snakes for Lufkin's Ellen Trout Zoo. They wanted to start with 15 males and 15 females to fully represent the Texas population's genetic diversity, but during the past year and a half they've caught just 5 males and one female. "At this rate it will take us 30 years to catch 15 females!" Rudolph says. "It's going to take a lot longer than I thought."

In the early 1980s, Ellen Trout Zoo became the first place ever to breed the species. Zoo Director Gordon Henley was involved from the start. "When they laid these four eggs, they were enormous," says Henley - nearly 5 inches long and 1.5 inches thick. Turns out, they were the largest eggs of any snake in North America! Two months later, the eggs hatched into 2-foot-long snakes. The new knowledge made conservation an even greater concern: Animals that produce just a few offspring each year are more vulnerable to extinction since it takes their populations longer to recover from population declines.

The zoo discontinued breeding in the late 1980s until they re-initiated the program in 2006. So far, the two snakes the zoo placed together have not mated, but Henley suspects the female isn't mature. When the captive snakes do breed, it will be none too soon. One of the three populations in Texas may have already gone extinct. "For the last two years of trapping we've caught nothing [at Foxhunter's Hill]," Rudolph says. "We have concerns that population has been extirpated."

Recovering Louisiana pine snakes will be no easy task. "One of the real problems with pine snakes is that we have a landscape of disjunct forest fragments where it will be very difficult, at best, to recover this species," explains TPWD biologist Ricky Maxey. TPWD has a Landowner Incentive Program that provides incentives to create habitat on private lands. The program can be used to replant longleaf pine in East Texas and use prescribed burning, creating additional habitat, which benefits Louisiana pine snakes, among other species, and could ultimately reconnect forests in what currently is a fragmented natural landscape.

Louisiana pine snakes seem to be rare under the best of conditions because of

their biology. Recovering one of the most imperiled snakes in North America will be no easy feat, whether it gets listed as a federally endangered species, or not. "The biology of the species and its habitat management needs are reasonably well understood," says Rudolph. "It is now a question of agencies, private landowners and biologists cooperating in the restoration of landscapes that can support the recovery of Louisiana pine snakes." With continued research into the snake's biology and status, captive breeding, and the collaboration of various stakeholders under the CCA, the Louisiana pine snake may have a chance, but recovery will be a long and challenging road.

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