A Note from the Editor

REBECCA JONES

Most *Upland Gazette* readers will read this edition just prior to the beginning of spring as birds of all shapes and sizes begin to ramp up their courtship and mating behavior. Spring always brings my thoughts to the most common bird in North America: the mourning dove. The ubiquitous mourning dove lives in almost every habitat found in America.

Biologists would agree that the mourning dove is one of the most adaptable birds to the activities of humans. Doves are just as at home in a remote Hyde County corn field as they are in the backyards of the capital city of Raleigh or in a clearcut choked with pokeberry along the Blue Ridge Mountains.

Whenever I think of these wonderful habitat generalists, I am quick to turn my thoughts to more "specialized" species that don't do quite so well with the activities of humans. These "specialists" include species like bobwhite quail, Bachman's sparrows, loggerhead shrikes, red-cockaded woodpeckers, many shorebirds and a laundry list of other birds, mammals, reptiles and amphibians. We write about many of these species in the *Upland Gazette*.

Managing habitat for many of these specialists is, at best, a difficult proposition. Sometimes, we simply don't have enough money, manpower or land to do the things we need to do to make these species as abundant as we want them to be on as large an area as we want to have them.

When I get discouraged, I go back to thinking about the mourning dove. That little bird seems adaptable to everything. For proof, over the course of several summers, a pair (not necessarily the same birds) raised a clutch in a low hanging pine branch hanging over my fenced-in yard. This fenced yard was patrolled by three very "birdy" German wire-haired pointers who loved to retrieve any game bird on a fall hunt. Oh, and there was also a tiny little poodle who came with the wife— think it was in the marriage contract somewhere. Anyway, these four very determined canines caused little concern for a pair of tenacious mourning doves.

If doves can raise a clutch in a "Jurassic Park" environment like my backyard, then it is no wonder they are America's most abundant bird. In this world where many species struggle with the loss of wildlife habitat, it is comforting to know the mourning dove defies the odds and thrives almost anywhere.

Mark D. Jones

Wildlife Research Program Supervisor
Private Lands Wildlife Habitat Group

THE Upland GAZETTE

WILDLIFE CONSERVATION AND HABITAT MANAGEMENT

MELISSA McGAW/NCWRC

Because of careful management, the diverse understory in this pine stand contains native grasses, wildflowers and forbs providing excellent wildlife habitat.

Living His Dreams in Retirement

Former Commission Biologist Terry Sharpe Continues to Make a Difference for Wildlife

By Mark D. Jones, Wildlife Research Program supervisor and Upland Gazette *editor, N.C. Wildlife Resources Commission*

Almost anyone who has worked for the Wildlife Commission in the last 25 years has heard of Terry Sharpe. Terry had a long and distinguished career with the Commission, serving as both a district biologist and as a small game project leader for many years. He wrote many publications still in use today, so even some of our younger biologists are aware of Terry's accomplishments before his retirement in 2005.

During the spring of 2018, Terry added another feather to his cap when he was recognized as the recipient of the Commission's Lawrence Diedrick Small Game Award. The award serves to recognize efforts in habitat management, education, research, the Hunting Heritage Program, or other meaningful contributions for small game and associated species. Terry was recognized because of his efforts to manage his own lands for wildlife and because of his continual efforts to work both as a paid consultant and a volunteer making a difference for wildlife across our state.

In August of 2018, I visited with Terry and toured his properties located in Richmond, Montgomery and Moore counties along North Carolina's southern Piedmont. I had a chance to catch up with the man who served as my first supervisor with the Commission and taught me a lot about what it means to serve our state's citizens in the role of wildlife biologist. Terry survived those four years as my boss, and we both went on to different roles within the agency for many years before he retired. After all these years, it is clear that Terry's passion for wildlife and land management hasn't changed since I first met him a quarter century ago.

One of the things Terry grasps better than most is the role of economics in wildlife management. Many of us are quick to assume a landowner or land manager should do something for wildlife because it is "the right thing to do." However, as we mature in our professional development, we learn that most folks who control lands are strongly influenced by economic considerations. Largely, landowners are trying to pay their bills, send their kids to college and save a little for retirement. Often, the key to getting things accomplished for wildlife can be finding the right mix of land management techniques that allow landowners to help wildlife while also protecting their economic interests. On his own lands, and the lands of many of his clients, Terry promotes forest management activities like thinning and burning, the use of herbicides and many others commonly in use today. But he does this with a careful eye to cost and feasibility for a landowner's bottom line.

One special way Terry contributes to wildlife conservation is tied to his knowledge of native plants.

Another one of Terry's unique characteristics is his ability to find new and innovative ways to get things done. I smiled when he showed me his latest pioneering technique: spraying herbicides on fire lines to kill vegetation that might carry a fire. He then drags the lines with a holly tree or heavy brush behind an ATV to loosen up any dead vegetation and leaves which he then blows off with a leaf blower. This allows Terry to conduct prescribed burns without having to use costly heavy equipment to disturb the soil and remove flammable debris. He doesn't use disks or other machines unless he absolutely must, and this technique doesn't result in erosion problems like those sometimes seen on lines created by heavy equipment. I am sure Terry isn't the first landowner to use this technique, but it is the first time I have encountered it in all my travels and work with prescribed fire.

For a retired man, Terry seems to stay busy with one new project after another. One special way Terry contributes to wildlife conservation is tied to his knowledge of native plants. He has used this remarkable plant knowledge to develop a seed collection business marketing 40 to 50 different native plants to landowners who want to develop unique and high-quality wildlife habitat. Most of these plants are fire-tolerant or need fire on a regular basis, and Terry sells these in a specialized niche market. These seeds allow North Carolina landowners to establish native plants on their lands without having to buy seed from faraway places in the Midwest where commercial plants often originate. These native seeds often perform better in the North Carolina environment than their cousins from thousands of miles away.

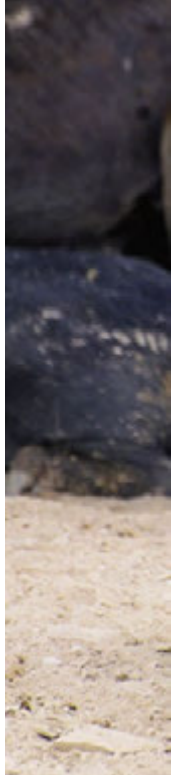
Terry has defied the conventional wisdom that a person retires and slows down. It seems that he is just as busy as when he worked for the Commission for three decades. As we drove along his driveway, through forests he has managed intensively, and as I listened to him describe seeing deer, turkey and a variety of wildlife, it was apparent Terry continues to live his dreams by making a difference for wildlife each day.

MELISSA McGAW/NCWRC

MELISSA McGAW/NCWRC

Left: Terry Sharpe collects native seed from many different plants for habitat management projects. This native seed often performs better than seed grown commercially thousands of miles away. Above: The gulf fritillary is a striking butterfly with an interesting defense mechanism: when threatened, it emits a distinct odor to deter lurking predators. This is one of many pollinating insects attracted to plants found in well-managed forest understories.

NASA



Feral Swine—Ecosystem Engineers

By Jason Allen, regional wildlife biologist, N.C. Wildlife Resources Commission

The presence of feral swine and the impacts they have on the natural systems in North Carolina is not a new issue. Pigs were first introduced by Spanish explorers in the 1500s along the Carolina coast as a reliable source of meat. In later years, after colonization, free-range husbandry practices along with additional releases reportedly gave North Carolina more pigs than any other colony in the new world. Severe economic hardship, utilization of these "domestic" pigs as a food resource and other factors would help keep free-range eastern North Carolina pig populations in check throughout the first half of the 20th Century.

In western North Carolina, pigs could be found in many of the same free-range conditions along with numerous fenced hogs on family farms. However, in 1912, a new "breed" of swine was introduced into the state. Fourteen "Eurasian wild boar" were released into a 500-plus acre hog lot in Graham County enclosed only by a split rail fence where the pigs mostly remained until the early 1920s. Controlled hunts were held for these wild boar, and many escaped the fences and thrived in the surrounding mountains. They persisted there on native plants and animals, and interbred with free-range domestic hogs.

The first official open hunting seasons for pigs were held in the Cherokee National Forest in 1936 and in the Nantahala National Forest in 1937. However, it was not until 1979 that the "wild boar" was designated a game animal by the North Carolina Legislature, and from 1979 through 2006 "wild boar" were protected as a game animal through regulated hunting seasons and bag limits. From 2007 to September 30, 2011, "wild boar" were only protected under game laws in six mountain counties where they were originally established while they were hunted and trapped freely in the other 94 counties as feral swine.

Terminology as it relates to "pigs" can be confusing. No matter what you call them; feral swine, wild boar, Eurasian wild boar, pigs, and all hybrids between these types are all in the same taxonomic family *Suidae* and species *sus scrofa.* In other words, all pigs are the same species with domestic animals being descendant from the Eurasian wild boar. Domestic pigs, when allowed to roam wild, can quickly revert to the habits and physical characteristics of their wild ancestors and look nearly identical to "wild boar."

In 2011, this lack of distinction was recognized in North Carolina, and the status of all free ranging swine was changed declaring them a non-game animal with no closed season or bag limits. Feral swine are now considered by most people in the state to be a nuisance to property owners and a dangerous liability to naturally occurring wildlife communities.

Population Expansion

Feral pigs are arguably the most prolific large mammal on earth. Over time, domestic pigs have been selectively bred to favor large litter sizes, and this trait is also prevalent in feral populations. Sexual maturity comes at an early age for pigs. While most female pigs reach puberty at 6 to 10 months, studies have shown that some females in the wild reach sexual maturity as young as 3 months of age. Young males are developmentally ready for breeding at about the same time but are often prohibited from doing so by older, larger, more dominant males. Females can give birth to multiple litters annually with litter sizes depending on the breeding female's body size and condition as well as overall habitat quality. Litter sizes in the wild vary greatly but generally range from three to eight piglets.

Feral swine have few predators in North Carolina, and natural mortality rates are relatively low when compared to native species. This fact alone can cause a population of any given species to spiral out of control. Combine this with their high reproductive potential and an average lifespan of around five years, and it is easy to see how a relatively small isolated population of pigs can and will eventually expand into an enormous problem with real ecological and economic impacts.

Escapes or losses of domestic pigs from fenced areas due to storm damage or poor fence construction often contributes to or helps establish feral populations. Additionally, there are many verifiable reports of feral swine being illegally imported from neighboring states as well being transported and released within North Carolina to establish huntable populations.

LAURIE PAULIK/USDA

Wild pigs are native to Europe and Asia. Here in North American, they often drastically change ecosystems by destroying native plants and directly killing and competing with native wildlife for resources.

Impacts

Feral swine have been labeled by some scientists as, "the greatest vertebrate modifiers of natural plant and animal communities." Simply put, feral swine are a non-native invader in North America capable of severe and extreme impacts on our native wildlife and plants. Through habits such as rooting, wallowing, trampling and feeding behaviors, feral swine contribute to water quality declines by causing erosion and bacterial contamination. Feral swine activity in waterways and wetland communities can impact a variety of plants and animals, such as endangered and threatened freshwater mussels, fishes and other aquatic invertebrates. Fecal coliform levels in waterbodies frequented by wild pigs routinely exceed human health standards.

Native plant communities are not immune to the activities of the feral pig. Direct feeding on plants and rooting for tubers and insects alters the successional stages of plant communities and often alters the overall diversity of plant species. This can open the door for invasive plants to take root.

Mast is made up of nuts, seeds, buds and fruits of various trees and shrubs that are eaten by wildlife. Wild pigs compete directly with our native wildlife for valuable food resources, such as hard and soft mast. Many of North Carolina's iconic species of native wildlife, such as black bears, white-tailed deer and wild turkey, rely heavily on mast producers to get them through tough times.

Feral swine are opportunistic feeders and are omnivorous, meaning that they will feed on most anything. Diet studies show that pigs will feed on both plant and animal material depending upon availability. Insects, worms and a wide range of vegetative matter are common in a feral pig's diet. Larger animals are also fair game, like snakes, turtles and lizards, as well as the young of ground nesting birds like quail and turkey, and the occasional deer fawn.

Forest restoration or regeneration is often difficult when and where feral pigs are present. Rooting activities may damage or dislodge young seedlings. Also, rooting in forested areas increases decomposition rates of leaf litter, resulting in drier soils and leaching of nutrients from the forest floor. In heavily rooted areas, lack of leaf litter and soil disturbance can lead to erosion issues.

Feral swine may carry and shed a number of viruses, bacteria and parasites. Brucellosis, leptospirosis, salmonellosis, toxoplasmosis, sarcoptic mange, E. coli and trichinosis are all potential hazards to humans and should be cautioned against when dealing with wild pigs or when working in an environment impacted by feral swine activity. In 2006, people nationwide were infected with E. coli after consuming bagged spinach, and feral pigs were identified as the likely source of contamination. In addition to potential human health impacts, the commercial pork industry would experience detrimental economic impacts if diseases from unvaccinated feral populations were introduced into production pork facilities.

Addressing the Problem

The most important tool for addressing the feral pig problem in North Carolina is education. Many people do not understand the harmful effects this species can have on the environment or the potential economic damage that could be sustained to the commercial pork industry if the current population of feral pigs is left unchecked and allowed to spread. Some people have the false idea that wild pigs are an asset or resource that should be protected and given game conservation status like native bear, deer or turkey.

State and Federal agencies like the N.C. Wildlife Resources Commission (NCWRC) and the United States Department of Agriculture (USDA) have professional staff available to offer free technical guidance to individuals about dealing with feral swine issues and often offer free public seminars about this problem. Along with the NCWRC and the USDA, the North Carolina Department of Agriculture and North Carolina Department of Health and Human Services are collectively working on a unified message to the public and developing methods to prevent the illegal transport and release of feral swine and the associated diseases and parasites carried with them. The goal of this cooperative is the promotion of systematic efforts that work toward the eradication of localized populations of feral swine.

It is important for private landowners to understand that they may remove feral swine themselves through the legal application of hunting and trapping techniques. Hunting and trapping of feral swine may be conducted year-round. There is no closed season and no bag limit. Feral swine may be shot at night with the aid of artificial lights, and electronic calls may also be utilized to attract feral swine. All persons hunting feral swine at any time must have a valid hunting license or must be exempt from having a license pursuant to North Carolina General Statute 113-276. Hunters should reference the *Regulations Digest* for all rules associated with hunting feral swine.

Feral pigs will be a conservation challenge for many years to come. The cooperation of hunters, landowners, and other conservationists is critical if we are going to get a handle on populations of pigs across North Carolina. If you would like to know more about controlling feral pigs on your property, or if you would like assistance with feral swine issues, call the NC Wildlife Helpline at 866-318-2401. Sightings and damage reports should also be reported to this number.

What Drives Private Landowners to Manage Wildlife Habitat?

By John Isenhour, technical assistance biologist, N.C. Wildlife Resources Commission

As a technical assistance biologist for the N.C. Wildlife Resources Commission (NCWRC), my main goal is to promote management of critical habitats on privately owned properties across the Piedmont region. While it is easy to make science-based habitat management recommendations, making recommendations that are likely to be implemented by private landowners is a much bigger challenge. The reason for this is simple: private landowners make the final decision on their properties. To have the highest likelihood of implementation, management recommendations must first and foremost meet the landowner's objectives and secondly be feasible within their abilities and limitations.

Often, the question is asked, "why promote the management of privately owned lands?" The answer is simple: There is a lot of privately owned land in North Carolina, and our agency has a responsibility to serve the owners of these lands and conserve the wildlife found there. Depending on which source you consider, the total North Carolina land in non-governmental ownership is somewhere around 85 percent. In our rapidly growing state, the ability to manage declining species and keep common species common is significantly tied to privately owned property.

When faced with this explanation, many citizens respond with something like this: "But our wildlife is doing great, I see critters all the time. Stuff is always getting run over on the highway over by town, and the deer and groundhogs won't leave my garden alone."

I certainly cannot argue that North Carolina is blessed, and in some cases overly blessed, with many species of common and watchable wildlife. While game species are important to our state's economy and outdoor heritage, we are also home to many often overlooked species which have more narrow habitat requirements and are experiencing population declines. The Commission has a responsibility to manage them all.

As an example, I recently received a call about the Eastern whip-poor-will. Many outdoor enthusiasts pleasantly recollect the call of this bird just after dusk, while some campers cringe at the memory of being kept awake by what seemed like an endless chant of "WHIP-POOR-WILL" from a nearby bird. The North American Breeding Bird Survey estimates a 69 percent drop in whip-poor-will populations between 1966 and 2010. This small, well-camouflaged forest bird may over-winter in the Southeast or migrate to South America. So, habitat conditions in North Carolina, on public and private lands, can impact populations of this once common iconic bird.

The NCWRC's Private Lands Program does not pressure private landowners to manage their property in a certain manner. We have no enforcement authority when it comes to private land management, and it is safe to say we do not want any. However, we do strive to identify willing landowners and assist them to meet their habitat goals when and where they match-up with NCWRC's State Wildlife Action Plan objectives.

Survey Says…

NCWRC Private Land Program staff often discuss and test more efficient methods to reach private landowners. Our primary goal is to engage folks whose land management goals are compatible with agency goals and are willing to manage their property to meet compatible objectives. Discussions with our human dimensions biologists and outreach staff have led to recommendations for focus groups, mass mailings and phone surveys, but the complexity of landowner motivation has been a major stumbling block in developing a statically significant research project. To keep the process of exploring landowner motivation moving forward, we evaluated survey work already done to learn what motivates, and just as importantly, hinders landowners from managing their property to improve habitat for wildlife.

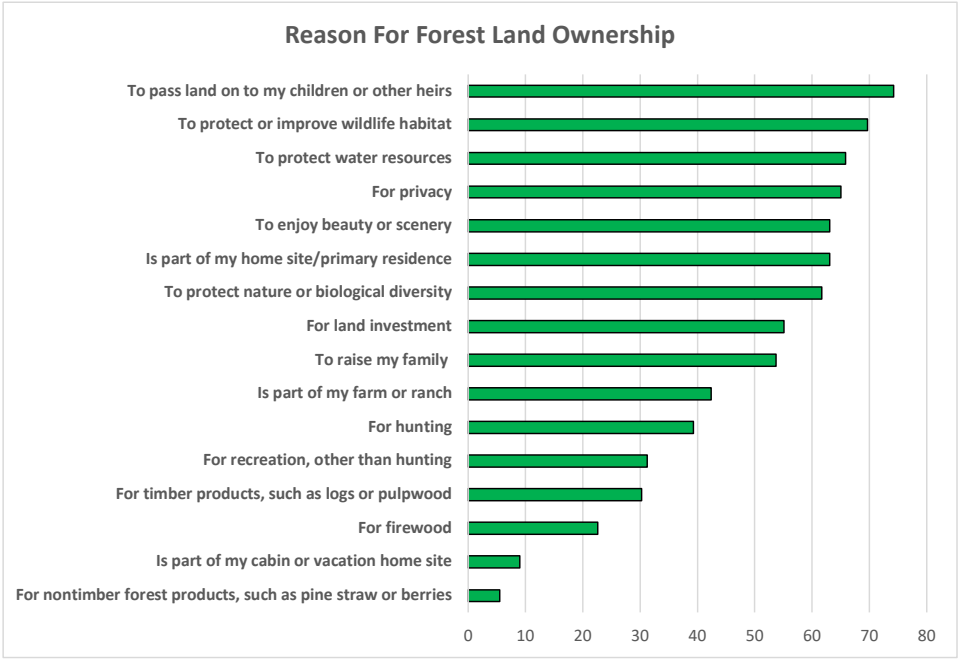
One well-respected source of data collected from private forest landowners is The National Woodland Owner Survey (NWOS). This long-standing project is a joint venture between the U.S. Forest Service and University of Massachusetts at Amherst. Surveys are sent to randomly selected individuals, private companies and organizations that own 10 or more acres of forestland across the country. The results from this national survey are compiled and published roughly every five years, and data can be analyzed at individual state levels. This is a very thorough survey that collects anonymous information to evaluate ownership trends, level of management, land use and other factors that impact forest landowners. Some questions are straightforward, such as a landowner's age, while others have a less-quantitative slant.

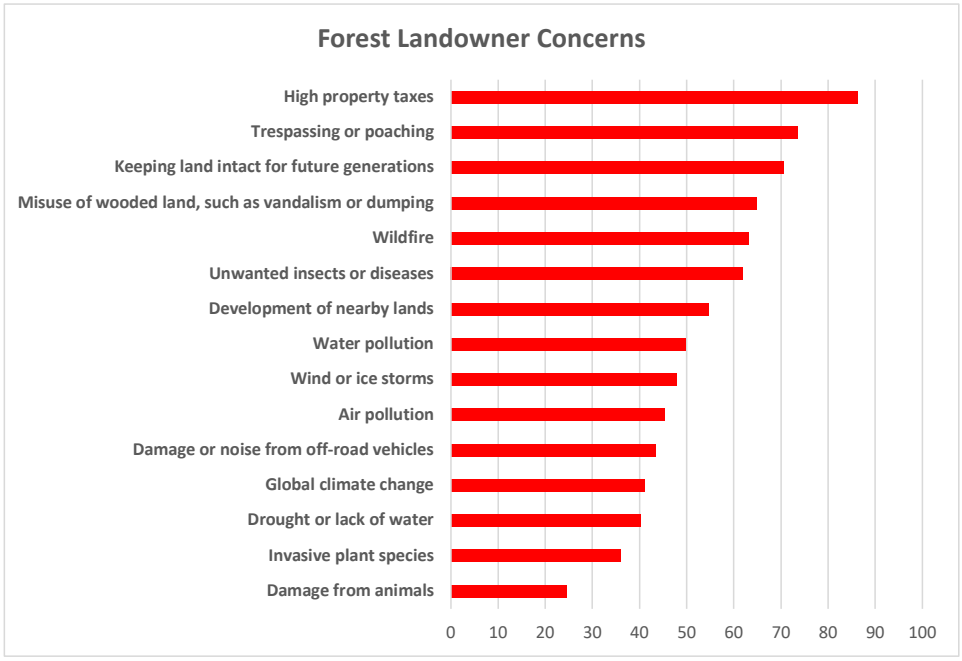
One question that really excites NCWRC technical assistance biologists is, "How important are the following as reasons for why you currently own your wooded land in North Carolina?" The categories to choose from are: very important, important, moderately important, of little importance or not important. The graph to the right shows how survey participants answered this question.

At first glance, this data would seem to indicate that recruiting landowners to implement wildlife habitat enhancement should be an easy task since 70 percent of landowners identified wildlife habitat protection/improvement as a reason for land ownership. But digging deeper we must ask the question, "What is wildlife habitat improvement?"

The NWOS does not make landowners identify which reason for ownership is more important. They can answer "very important" to every reason if they so choose. There is no specific definition given for the listed reason other than what is seen in the graph. Much like privacy, nature, recreation and, of course, beauty, these factors are gauged "in the eye of the beholder."

What is beautiful to some is an eyesore to others. What some folks define as privacy, others may call isolation. The same can be said for wildlife habitat. To some landowners, installing bird houses is an improvement to wildlife habitat while to others heavily thinning and burning their forestland is habitat improvement. While both of these scenarios do offer some level of improvement, each





impacts habitat at a different scale. On private lands, the level of management is based on the landowner's objectives, concerns and capabilities.

Facing Reality

In this day and age, there are few landowner fairy tales. Concerns come along with landownership. The NWOS gathers information on these concerns by asking the question, "Please indicate your level of concern about each of the following topics for your wooded land in North Carolina." Response options included great concern, concern, moderate concern, of little concern or no concern. The graph above shows how survey participants responded to this question.

It is clear from the above graph, that when it comes to concerns, much of the emphasis is on the monetary impacts of land ownership. High property taxes are a concern to just under 90 percent of respondents, but many of the other high-ranking concerns have economic impacts as well. While trespassing, vandalism, wildfire, disease and wind damage may all change the esthetics of the property, they all can have financial consequences in lost timber revenue or possible liability. Again, landowners can interpret these concerns as they see fit and can assign any level of concern to each of the choices.

While the lack of detail in the Reason for Ownership and Ownership Concerns portion of the NWOS is a little frustrating, the survey does give a realistic picture of what most landowners I meet face when addressing land management. Most conservation-minded landowners only weigh the value of their land by dollars per acre when they are buying or selling property, harvesting timber, questioning their tax valuation or planning their estate. Dr. Brett J. Butler, research forester and NWOS coordinator with the U.S. Forest Service, summed it up pretty well when reflecting on the 2006 NWOS. "Most family forest owners have a deep love of their land and a strong desire to do what is right, but they need help in knowing what their options are and what is best for them and their woods."

If you are a private landowner, please take some time to identify your objectives for your property. Seek guidance from natural resource professionals who can best help you meet your objectives. If wildlife habitat enhancement is one of your objectives, reach out to N.C. Wildlife Resources Commission private lands program staff listed on following pages in the Upland Gazette. Or, if you just want to share some of your landownership motivations or concerns, feel free to send me an e-mail with "My Land, My Way" in the subject line.

John Isenhour can be contacted at john.isenhour@ncwildlife.org. *Much of the information in this article came from the following Survey: Butler, Brett J., Jaketon H. Hewes, Brenton J. Dickinson, Kyle Andrejczyk, Sarah M. Butler and Marla Markowski-Lindsay. 2016. "Family Forest Ownerships of the United States, 2013: Findings from the USDA Forest Service's National Woodland Owner Survey." Journal of Forestry 114 (6): 638–47.*

GABRIELA GARRISON/NCWRC

GABRIELA GARRISON/NCWRC

The North Carolina Pollinator Conservation Alliance

By Gabriela Garrison, Eastern Piedmont habitat conservation coordinator, N.C. Wildlife Resources Commission

The importance of pollinators to our food supply and natural ecosystems has received intense national attention in recent years. Simply put, pollinators are declining at alarming rates across most of our nation, and many natural resource professionals and governmental agencies are scrambling to improve habitats for these critical species.

Nearly two years ago, a fellow biologist and I were discussing a pollinator habitat enhancement project we had been planning for months. During this conversation, it became evident that other conservation organizations had been developing similar projects across the state. We realized the need for a common forum supporting pollinator conservation where agencies and organizations in North Carolina could collaborate and share ideas.

That brief and casual conversation became the foundation of a statewide, multi-organization partnership to promote pollinator habitat conservation in North Carolina. Through careful coordination, countless phone calls and diligent planning, the first meeting of the North Carolina Pollinator Conservation Alliance (NCPCA) was convened in the fall of 2017. Since then, the NCPCA has grown to include over 30 organizations representing local, state and federal governments, non-governmental organizations, utility companies and private entities.

Partners of the NCPCA have met multiple times and formed committees to address specific issues in pollinator conservation. These committees include Outreach, Plant Resources, Energy, Habitat Assessment, Research and Pesticide Stewardship. A website (ncpollinatoralliance.org) has been created along with a presence on several social media outlets (Facebook, Instagram and Twitter).

With the intent of raising awareness, we have been involved in numerous outreach events and engaged in activities, presentations and workshops across the State. In September 2018, partners of the NCPCA hosted the first Pollinator Field Day at the Piedmont Research Station in Salisbury. There were multiple stations including insect identification, native plants, pesticide stewardship and habitat establishment. We are also in the early stages of planning native bee identification workshops, a much-needed tool in North Carolina.

In addition to outreach, the NCPCA strives to support the health and diversity of pollinators in North Carolina through protection, restoration and creation of pollinator habitat. North Carolina is home to over 500 species of native bees, 2,200 species of moths and 170 species of butterflies. This does not include the countless species of beetles, flies and wasps that also function as pollinators. A healthy pollinator population is an excellent indicator of the overall health of most terrestrial communities. Maintaining species diversity is crucial to providing ecosystem resilience in the face of expected environmental change.

A Call to Action

In the North Carolina Wildlife Resources Commission's (NCWRC) State Wildlife Action Plan (SWAP) (ncwildlife.org/plan), there are seven species of bumble bees and 18 species of butterflies and moths that have been identified as Species of Greatest Conservation Need (SGCN). This includes the rusty-patched bumble bee (*Bombus affinis*), a species that has recently been listed as federally endangered under the U.S. Endangered Species Act (ESA).

In addition, the yellow-banded bumble bee (*Bombus terricola*), an SGCN in the SWAP, has been petitioned for listing under the ESA. There are also several species of butterfly that are considered imperiled due to loss of host plant habitat. These include the frosted elfin (*Callophyrs irus*) and monarch butterfly (*Danaus plexippus*), which are

Left to Right: A long-tailed skipper feeds on chaffhead nectar, one of the few blooms remaining in late October as it migrates south. This honey bee has been collecting pollen in the 'pollen basket' on her hind leg. Mixed with small amounts of nectar, it will get carried back to the hive to sustain developing larvae.

currently under review for ESA listing by the U.S. Fish and Wildlife Service. The primary threat to these species is habitat loss and fragmentation.

It is crucial to place emphasis on the creation and maintenance of pollinator habitat and early successional areas that benefit a broad array of wildlife species. Early successional habitat includes grasses, forbs and shrubs. This habitat type provides excellent cover and food for numerous species yet requires some form of disturbance (such as burning, mowing, grazing) to avoid transition to forest over time. Biologists with the Commission have been restoring and enhancing early successional habitat for many years.

Making A Difference

Benjy Strope is a NCWRC management biologist working primarily on corporate-owned swine farms and private lands in the southeastern Coastal Plain. He recently completed a project with Smithfield Foods and Bayer Crop Science's 'Feed a Bee' Program to increase the amount of pollinator habitat on Murphy-Brown's Holmes Farm in Bladen County. Seventeen species of flowers and one species of grass were planted in various locations totaling 13 acres throughout the farm.

NCWRC Technical Assistance Biologist John Isenhour works in the Piedmont and Sandhills region of the state. On a privately-owned tract of land in Randolph County, he has worked with the landowners to control non-native grasses in retired pastureland to promote diverse, early successional habitat. In this field, a single herbicide treatment and prescribed burn released large stands of common milkweed that had been suppressed by tall fescue for decades. Milkweed and other volunteer species have flourished and now support an extensive diversity of insects, including the nationally imperiled monarch butterfly.

On Sandhills Game Land, a 65,000-acre NCWRC-owned property in Richmond, Scotland, Moore and Hoke counties, prescribed fire is used to maintain a healthy longleaf pine ecosystem and promote a diverse, herbaceous understory. NCWRC foresters burn an average of 20,000 acres per year on a two- to three-year cycle. In these conditions, up to 40 species of flowers and grasses can be found in nine square feet of forest understory. This quantity and diversity of plants can provide both forage and shelter for a wide array of insects, including several SGCNs in the SWAP.

NCWRC staff with the Habitat Conservation Division have fostered relationships with local governments and private corporations to create pollinator habitat on their properties. This work has included trial plantings on solar farms and reclamation plantings at a mining operation. There is an existing partnership with the City of Raleigh to plant 25 acres of pollinator habitat adjacent to a local greenway. This project will be in the public spotlight and can serve as a vital, educational tool. Signage will be installed along the greenway to highlight the importance of pollinators and share ways the public can help conserve beneficial insects.

In addition to pollinator benefit, planting native species and creating habitat has countless advantages for the public. The management of diverse, native vegetation (particularly in riparian corridors) can improve water quality and aid in stream bank stabilization. Densely planted and deep-rooted vegetation can help slow the flow of storm water across the landscape, thereby allowing for increased soil infiltration. Native bees provide free pollination services and are specialized for foraging on flowers, such as squash, berries or orchard crops. This specialization results in more efficient pollination and production of larger fruit.

JOHN ISENHOUR/NCWRC

Monarch caterpillars feed solely on milkweed plant species. They absorb a toxic compound found in the plant, making them unpalatable to many predators.

More than 70 percent of crops require either insect pollination or have higher production because of pollinating insects. Native habitat also acts as a 'carbon sink' with most carbon absorption happening below ground in deep root systems. For projects that are on commercial or government-owned property, the obvious benefit of increased aesthetic appearance and decreased maintenance costs cannot be measured.

Whether inter- or intra-agency, communication is key to pollinator conservation. Though still in its infancy, the NCPCA continues to gain interest and support. We are working to foster communication among our partners, stakeholders and interested parties. We hope to develop and disseminate best management practices to enhance habitat and pollinator diversity as well as act as a clearinghouse for pollinator science and information. Our goal is to collaborate and coordinate with all levels of government to establish protective mechanisms for pollinators and their habitat in North Carolina. We have some ground to cover but are excited for the challenge. Stay tuned for more information about these important efforts to manage and conserve habitat for our State's essential pollinator species.

MELISSA McGAW/NCWRC

SARAH ROSCHE

Northern bobwhite were once abundant across most of the Southeastern United States, but populations have steadily declined for decades. Inset: Female bobwhite with necklace-style radio transmitter attached.

TONY KROEGER

Less Is More

The importance of low tree density for Northern bobwhite

By Sarah Rosche, Chris Moorman, and Chris DePerno North Carolina State University

Once common, the whistle of the Northern bobwhite is heard less and less as populations have declined range-wide since the late 1960s. Concurrent with those declines, the landscape that once supported bobwhites has changed.

Most notably, high-quality grass-forb-shrub dominated plant communities with limited tree cover have disappeared from most areas. The right mix of grasses, forbs, and shrubs contributes to nest concealment, offers cover for birds to escape predators and maintain the correct body temperature, and produces seeds and insects important as food. The reasons for the loss of habitat are many but include fire suppression and maturation of forest with dense tree cover that shades-out the forbs and shrubs that are important for quail.

We studied habitat selection by bobwhite on Fort Bragg military installation during the breeding season to better understand what factors favor bobwhite abundance where forests are maintained with prescribed fire and where population declines have mirrored regional declines. The declines on Fort Bragg are surprising to some because the installation frequently burns its forested areas, and bobwhite often are linked with the fire-maintained forests of the Southeast. Hence, our goal was to better understand what vegetation characteristics may be important to the remaining bobwhite on Fort Bragg to help us understand reasons for multi-decade declines on Fort Bragg and elsewhere in the region.

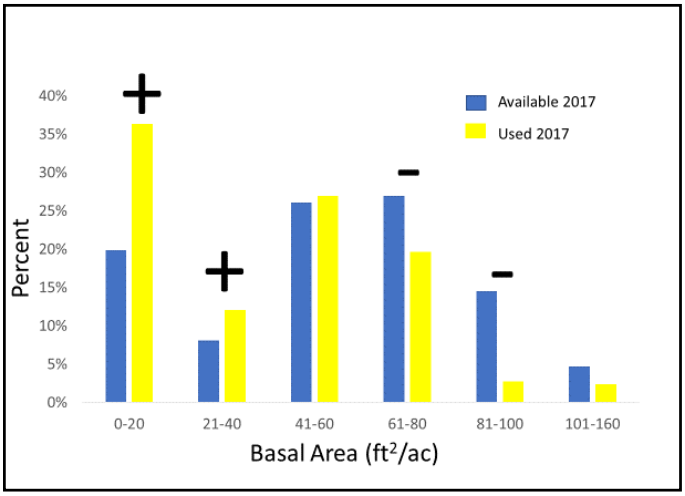
We captured bobwhite during the late winter and early spring months (January–April) in 2016 and 2017 using wire, walk-in funnel traps baited with corn. Once captured, we attached a necklace-style transmitter on each quail. The transmitters emitted a unique frequency that allowed us to locate each individual bobwhite and record a GPS location. We paired each used location with a control location that was a random distance and direction away. The paired locations allowed us to compare vegetation that bobwhites were using to the vegetation conditions that were available randomly.

At each used and paired control location we recorded vegetation measurements including cover of grasses, forbs and woody understory. We also recorded cover of tree canopy, number of years since last controlled burn and basal area of hardwoods and pines. Basal area is the area that is occupied by the cross-section of tree trunks and is closely related to the density of trees on a tract of land. Basal area directly impacts tree canopy cover, thereby impacting the amount of sunlight making it to the ground to stimulate plants needed by quail and associated species. High basal areas generally cause too much shade and poor plant growth in the understory while low basal areas contribute to more sunlight and lush understories.

SARAH ROSCHE

SARAH ROSCHE

In our study, Northern bobwhite quail used areas with shrub cover (left) more often than areas without shrub cover (right).



This graph shows bobwhites preferred areas on Fort Bragg Military Installation with basal areas of less than 40 ft²/acre and bobwhites avoided areas with basal areas greater than 61 ft²/acre.

SARAH ROSCHE

Components of ideal cover required by Northern bobwhite throughout the year.

We determined the best predictor of bobwhite habitat selection on Fort Bragg was tree basal area. Bobwhite selected areas with less than 40 ft²/acre of basal area and avoided areas with more than 60 ft²/acre. Also, bobwhite selected areas with a greater cover of woody understory, which included shrubs and small trees.

Our results show that the persistent low bobwhite populations on Fort Bragg are linked to too many trees on the landscape to allow a quality understory to develop—even in the presence of frequent prescribed fires. In other words, the trees compete with quail-friendly forbs, grasses and shrubs for moisture and light and prevent them from growing. This, in turn, eliminates critical food and cover for bobwhite, which spend most of their lives on the ground. Forests with lower basal area, and thus fewer trees, allow more sunlight to reach the forest floor—promoting forbs and shrubs that provide food and nesting and brood-rearing cover for bobwhite.

The key message from our research is that bobwhite populations cannot be restored or maintained without substantial reduction in basal area of forests (for example, tree cover). The good news is that tree cover can be reduced using commercial thinning that generates income for the landowner. Our research shows that basal area must be reduced to less than 40 ft²/acre to create quality habitat for bobwhite in the Sandhills region of the state where Fort Bragg is located.

The Sandhills is characterized by nutrient-poor soils, so plant cover can be sparse, especially in the drier uplands. Where soil quality is higher than in the Sandhills, bobwhite may use areas with greater tree cover than on our study site because quail-friendly plants can grow with less sunlight. In fact, quail biologists typically recommend maintaining the basal area below the local site index for pines (base age 50) minus 25. For example, the target maximum basal area where the site index is 75 would be 50 ft²/acre.

Landowners should contact a biologist with the N.C. Wildlife Resources Commission (See contact list on page 68) to discuss thinning options to reduce basal areas to suitable levels for bobwhite or other wildlife. Managing for quail on the modern landscape is challenging, but the results from this research provide insight into how better forest management can be one tool in a landowner's toolbox for bringing back the iconic call of the bobwhite quail to North Carolina.

We thank Jeff Jones, Alan Schultz and other staff with the Wildlife Branch at Fort Bragg for financial and logistical support for the research.

DENNIS CHURCH/FLICKR

Better Management of Bottomland Hardwood Forests for Wildlife

By Jeff Marcus, The Nature Conservancy

Bottomland hardwood forests are a key habitat for many game and non-game species. They also play an outsized role in maintaining water quality and flood control due to their proximity to rivers and wetlands. Bottomland forests tend to get the extremes of forest management—either intense management through clearcutting or high-grading of the forest or no management at all.

A recent project led by the North Carolina Forest Service and The Nature Conservancy is exploring whether there is a middle ground. Are there management actions we can take that enhance habitat, provide some revenue and do not negatively impact water quality or other forest resources?

To explore this question, we first selected a group of indicator species that would represent the habitat needs of the game and non-game species that depend on bottomland hardwood habitats. We chose birds that nest in canopies such as bald eagles, birds that utilize the midstory such as Acadian flycatchers, birds that utilize the understory such as Swainson's warblers, bats that depend on large tree hollows and cavities such as Rafinesque's big-eared bat, game species that feed on hard mast and succulent browse such as white-tailed deer and wild turkey, and amphibians that depend on small wetlands such as marbled salamander. A forest that meets the needs of these species should support many of the animals and plants that depend on bottomland hardwood forests.

To manage for these species, we needed to consider the four basic components of wildlife habitat: shelter, food, water and space. Shelter comes from the structure of the forest. Large-diameter canopy trees provide perching, nesting and foraging areas for birds. Trees with hollows provide roost sites for bats and denning areas for mammals. Standing dead trees provide nesting sites for woodpeckers and a whole host of secondary cavity nesters such as prothonotary warblers and squirrels while the sloughing bark of recently dead trees provides cover for bats, lizards and many insects. Dead trees on the ground provide habitat for snakes, lizards, small mammals, Kentucky warblers and wrens. Patches of dense undergrowth with grasses, wildflowers and vines provide cover for sparrows and rabbits and nesting spots for hooded warblers while some forest openings will be used by woodcock. Special habitat features such as steep slopes, rock outcrops, seeps, floodplain pools and oxbow lakes provide the conditions needed for many plants, reptiles and amphibians.

In addition to providing cover, we wanted to provide food for wildlife. Hard mast trees such as oaks and hickories, and soft mast trees and shrubs such as paw paw, blueberries, and black gum, provide food for deer, turkey, bear and a wide variety of wildlife. Patches of grasses, wildflowers and vines provide browse for rabbits and deer, "bugging" areas for turkey poults and many songbirds, and nectar for pollinators. Some trees, such as black cherry, oaks, willow and birch, are particularly favored by caterpillars. Caterpillars are a critical food source for most songbirds especially while feeding young and during migration. Native trees and shrubs support vastly greater diversity and abundance of caterpillars than exotic species such as Chinese privet. For a list of those plants most beneficial for caterpillars in your area, go to bringingnaturehome.net.

To sustain a healthy forest, it is necessary to not only have mature trees but to also have seedlings and saplings to ensure that the next generation of forest is growing to eventually replace those older trees. Several of the tree species we wish to promote require more sunlight to grow during their early stages and are most successful in small forest openings created by the death of an older tree.

Bottomland hardwood forests play a critical role in helping to maintain water quality in our rivers, control flooding and support small wetland habitats (such as seeps, floodplain pools and oxbow lakes). Bottomland forests naturally filter water that runs off from the uplands before it reaches the river. The soils, leaf litter and vegetation serve as a natural sponge helping to slow the run-off from storm events and reduce downstream flooding. To best serve these functions, we recommend maintaining natural forest cover at least 300 feet but ideally 600-plus feet wide on both sides of the river, and we recommend that forests are located in watersheds with less than 10 percent impervious (paved) surface.

The final habitat factor of "space" means that we want our forests to be large enough to support area-sensitive species like the wood thrush plus connectivity to other habitats for wide-ranging species like black bear. We ideally would like to see more than 10,000 acres of contiguous forest, including

JEFF MARCUS

ANNE OUTLAW

Opposite page, top: A prothonotary warbler with an insect. Left: Marbled salamanders use floodplain pools in bottomland hardwood forests and are a good indicator of quality habitat.

adjacent uplands, with a mix of younger and mature forest.

Conservation Tips for Your Property

If you wish to improve habitat on your own property, it is important to first assess how close the condition of your forest is now to these "desired future conditions." A formal or informal forest inventory can assess the presence of desirable tree and shrub species in multiple age classes, the presence of areas with grasses, wildflowers and vines, the availability of hollow trees and snags, the presence of invasive species, and many other factors. This assessment will help you decide whether active management may be helpful to achieve the desired conditions.

Depending on what your forest needs, there are several management options that may help improve wildlife habitat while generating some income through commercial timber activity.

- Use patch clearcut harvests between 1 and 10 acres in size, in addition to group selection removals, to provide early succession habitat and improve regeneration of shade-intolerant trees.

- Leave large diameter trees (with at least two emergent or "supercanopy" trees per acre), trees with hollows, snags, and those species you wish to encourage. Selectively cut smaller diameter trees and less desirable species such as sweetgum.

- Clearcuts should not exceed 10 percent of the area of a bottomland hardwood stand. You should aim to reduce the overstory to 60–70 percent canopy closure across the entire stand, leaving greater forest cover closer to the river to protect water quality.

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JEFF MARCUS

Commission Makes Changes to Ruffed Grouse Monitoring to Better Understand Population Trends

By Chris Kreh, upland game bird biologist, and Mark Jones, Wildlife Research Program supervisor and Upland Gazette *editor, N.C. Wildlife Resources Commission*

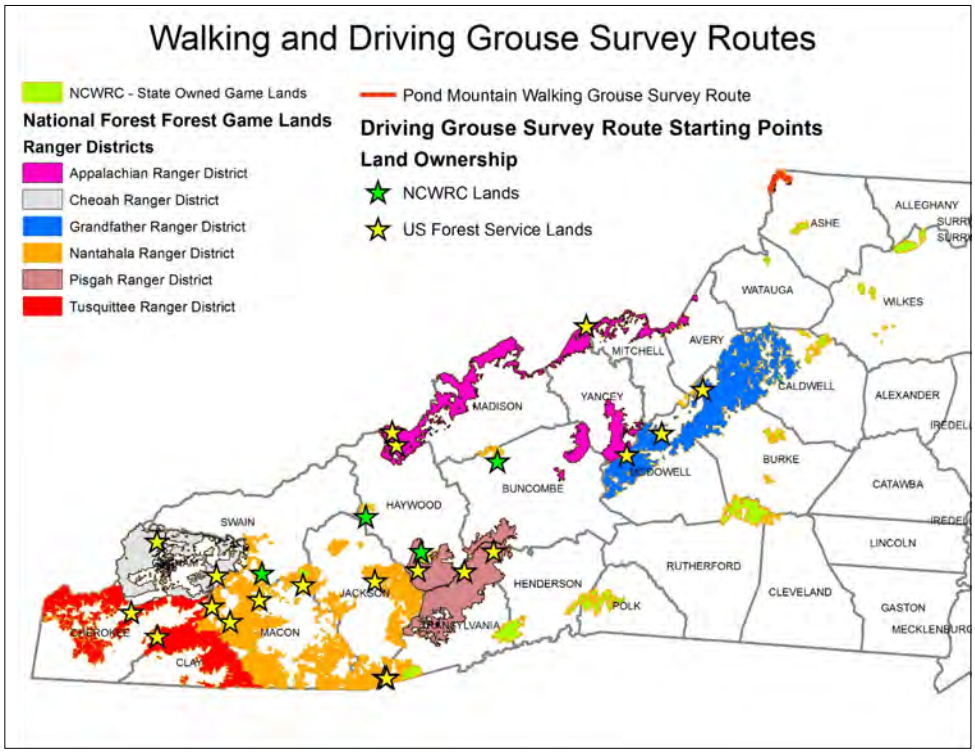
Ruffed grouse are considered the king of game birds by many hunters and are the principal upland game bird of the forests of the Southern Appalachian Mountains. Though they are superb flyers, grouse spend most of their time on the ground feeding, traveling, roosting and resting—usually in dense vegetative cover that protects them from predators. Their diet includes everything from leaf buds to insects to acorns. They nest and raise their young on the ground as well.

In spring, male grouse stake out their territory and announce it to the world by "drumming." To drum, the grouse latches onto a fallen log and beats his wings in a fast-paced pattern which results in a very low frequency "drumming" sound. He repeats this drumming every few minutes all morning long with the sound carrying up to a quarter of a mile or so, depending on terrain. This display is wonderful to hear (and see on rare occasions if you are lucky enough to get close), and it offers wildlife biologists an excellent opportunity to count grouse and monitor the population. Unfortunately, drumming grouse are becoming scarce and need all the attention we can give them.

New Approach to Surveys

Ruffed grouse are identified as a Species of Greatest Conservation Need in North Carolina's 2015 Wildlife Action Plan. They are one of only three resident game animals (the others being bobwhite quail and elk) with this designation. Additionally, grouse have been declining throughout most of the Southern Appalachian Mountains for decades due to a loss of young forest habitat on the landscape. As such, information about grouse in North Carolina is vitally important, and N.C. Wildlife Resource Commission (NCWRC) staff strive to make the most of our time and resources. We want to learn as much about grouse as possible and be as efficient as possible with how we set up our surveys.

Figure 1: Locations of NCWRC grouse surveys on NCWRC Game Lands and Nantahala-Pisgah National Forests, March 26–April 11, 2018.

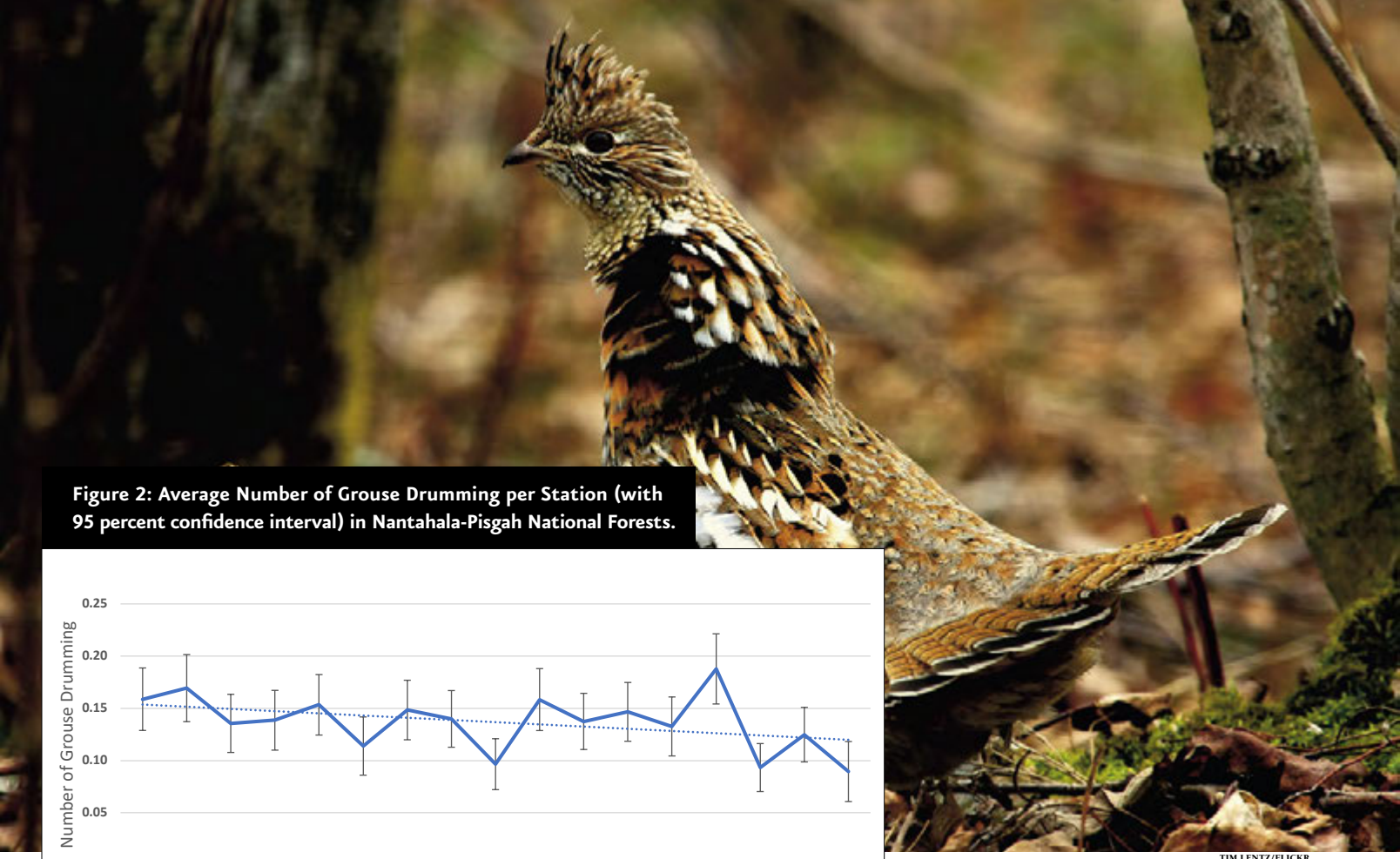


In 2018, NCWRC biologists and technicians took steps to gain better information about ruffed grouse in western North Carolina. Our goals were to continue to monitor grouse on U.S. Forest Service property in western North Carolina and to increase the scope of our survey work by beginning to monitor grouse populations on state-owned game lands in western North Carolina.

Since 2002, NCWRC has surveyed drumming grouse across all ranger districts of the Nantahala and Pisgah National Forests. This survey was initiatied by the U.S. Forest Service with the goal of providing precise annual estimates of grouse abundance for each of the six ranger districts across both national forests. We thoroughly evaluated all drumming grouse survey data collected from 2002 through 2017 to see how our survey efforts could be improved. The old survey involved more than 700 listening stations each year, which provided detailed information but was limited by the fact that all stations were located on national forest lands in the southern mountains.

We saw a need to reallocate some survey effort to other areas and regions. Analysis of the number of stations, confidence intervals and the survey's ability to identify population trends revealed that we could reduce the number of stations and routes on national forest lands by approximately one-half and still have precise estimates of grouse abundance for the Nantahala-Pisgah National Forest as a whole.

Therefore, we dropped 29 routes (348 stations) from the grouse drumming survey on Nantahala-Pisgah National Forest. The remaining 20 routes (391 stations) are representative of the national forests and can



TIM LENTZ/FLICKR

Figure 2: Average Number of Grouse Drumming per Station (with 95 percent confidence interval) in Nantahala-Pisgah National Forests.

be accomplished with better logistics and efficiency (see Figure 1). We were very deliberate in choosing to continue routes that would offer reliable and representative data and did not simply choose routes based on how many grouse had been heard on those routes in the past.

Reducing our survey effort on national forests allowed our biologists and technicians to establish new survey routes and efforts on state-owned game lands and on other areas of the region. NCWRC biologists and technicians were able to establish grouse survey routes on Cold Mountain (21 stations), Needmore (12 stations), Sandy Mush (10 stations) and Silver (18 stations) game lands plus a special walking survey route on Pond Mountain Game Land. This represents the maximum number of stations possible given the size of the areas, road configuration and spacing requirements. We have the flexibility of adding new routes to additional areas in the future if agency resources and staffing time allow.

What We Learned

In 2018, under our new protocol, we listened for ruffed grouse at 391 listening stations distributed across 20 routes on the Nantahala-Pisgah National Forests. These National Forests are distributed throughout the southern mountains and represent a great deal of potential grouse habitat and hunting opportunity. A total of 35 drumming males were heard at the 391 stations, yielding an average of 0.09 grouse drumming/station (95 percent confidence interval 0.06 to 0.12 grouse/station). This is the lowest annual estimate since the survey began in 2002 and continues to suggest an overall declining trend in the grouse population (see Figure 2).

NCWRC biologists and technicians surveyed 61 stations on game lands. Two grouse were heard at stations on Needmore Game Land, and one grouse was heard on Sandy Mush Game Land. No grouse were heard at stations on Cold Mountain or Silver game lands. Thus, the overall average number of grouse drumming per station on these state-owned game lands was 0.05 grouse/station (95 percent confidence interval 0 to 0.10 grouse/station). No trend information is available since this is the first year of surveys on these areas. As on the Nantahala-Pisgah National Forests, our surveys suggest that the game land grouse populations are very low.

The future of ruffed grouse in North Carolina and the southern Appalachians is uncertain. Grouse are on the southern fringe of their range in this region and depend on quality young forested habitats. These habitat types have declined in our state and many others in recent decades. Additional pressures on grouse populations could include extraneous factors like West Nile Virus, which could be amplified in poor quality habitat where grouse populations are less resilient. The new survey methodology and protocols we have established should allow us to better monitor grouse across the western part of North Carolina and give us better insight into population trends through time. Stay tuned for more information about ruffed grouse as we develop better data and continue to study this iconic game bird in North Carolina's mountains.

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- The rotation age for patch clearcuts should be 100 to 150-plus years, meaning that these small harvests can occur every 10 to 15 years.
- Protect isolated wetlands, steep slopes, and rock outcrops. Reducing tree canopy around rock outcrops can benefit basking reptiles, but be sure to avoid damaging the outcrop.
- Ideally, conduct timber harvests from Oct. 1 to Dec. 1 and March 1 to April 1 to minimize negative impacts for breeding bats, and do not use heavy equipment in bottomlands when the soil is wet and saturated because the equipment may cause deep rutting.
- Be prepared to deal with privet, Japanese stilt grass and other invasive species that often respond favorably to disturbance.

It may be a challenge to hire a forester willing to oversee such a sale and to attract a commercial logger to conduct a timber sale under these conditions, and you can expect to invest more time and glean less revenue than from a traditional clearcut of the entire stand. Adding these patch clearcuts in your bottomlands to a larger timber sale in the uplands may be a way to make the project more attractive financially. On a smaller scale, it is possible to achieve these same outcomes through hand cutting or "hack and squirt" herbicide application.

The North Carolina Forest Service (NCFS) has implemented a demonstration area of these techniques on Bladen Lakes State Forest along the Cape Fear River near Elizabethtown. After a timber inventory to identify needs, NCFS set up a timber sale to cut a "chain of pearls"—a series of four approximately 2-acre patch cuts with selective thinning at the edges.

NCFS and The Nature Conservancy will monitor the results in the coming years to determine if we achieved the desired outcome. We hope that the results will help to inform wise management of bottomlands and provide options for landowners who desire to generate some income from their forest while protecting and enhancing habitat for a wide variety of wildlife.

THE Upland GAZETTE

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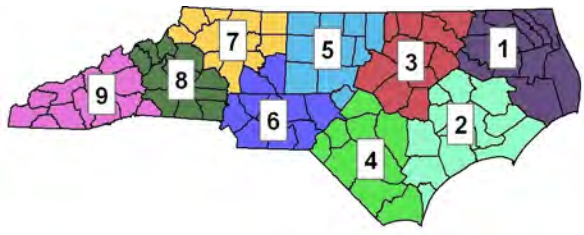

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