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Fire Ants and Wildlife

By L.C. Graham, Ph.D.

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Close up of fire ant worker. (Photo by Vicky Bertagnolli)

I grew up in Alabama and have always lived in the state. It is difficult to remember a time when fire ants were not a part of my life. When fire ants reached the area of West Alabama where I grew up, I was six years old. Probably the only people in Alabama that have not tangled with fire ants are visitors that go directly from their car to the hotel room and back. Most people who have strayed off concrete or asphalt have been attacked by imported fire ants, or will be. These creatures everyone loves to hate are very aggressive and cause painful stings to humans, pets, domestic animals and wildlife. Imported fire ants have been blamed for wildlife reduction, livestock deaths, crop damage, property damage (especially electrical equipment) and even human deaths. Economic costs across the Southeast are estimated to be in the billions. The effect that these ants have on wildlife, including insects and birds, is one area of research that needs more attention.

How did they get here?

When imported fire ants were accidentally introduced from South America during the early 1900's, no natural enemies came with them. The natural aggressiveness of imported fire ants coupled with this lack of natural enemies allowed them to expand throughout the Southeast and, within the last ten years, to other parts of the United States and the world.

Not one, but two species of imported fire ant made the trip to Alabama. They were first discovered in Mobile, Ala. The black imported fire ant entered in 1918, and the red imported fire ant appeared between 1930 and 1940.

Currently, the red imported fire ant occupies most of the Southeast (see hybrid map). A hybrid between the two species was discovered in 1985 and occupies most of the northern half of Alabama, Georgia, Mississippi and the southern portion of Tennessee. The black imported fire ant can be found in a small area of northwest Alabama, northern Mississippi and central and western Tennessee.

Our native fire ants, the tropical fire ant and the southern fire ant, are rarely seen now. As imported fire ants have spread, these ants along with other native ants have been displaced. Yet, some ants, such as the little black ant, get along with these invaders quite well and have increased in numbers and distribution.

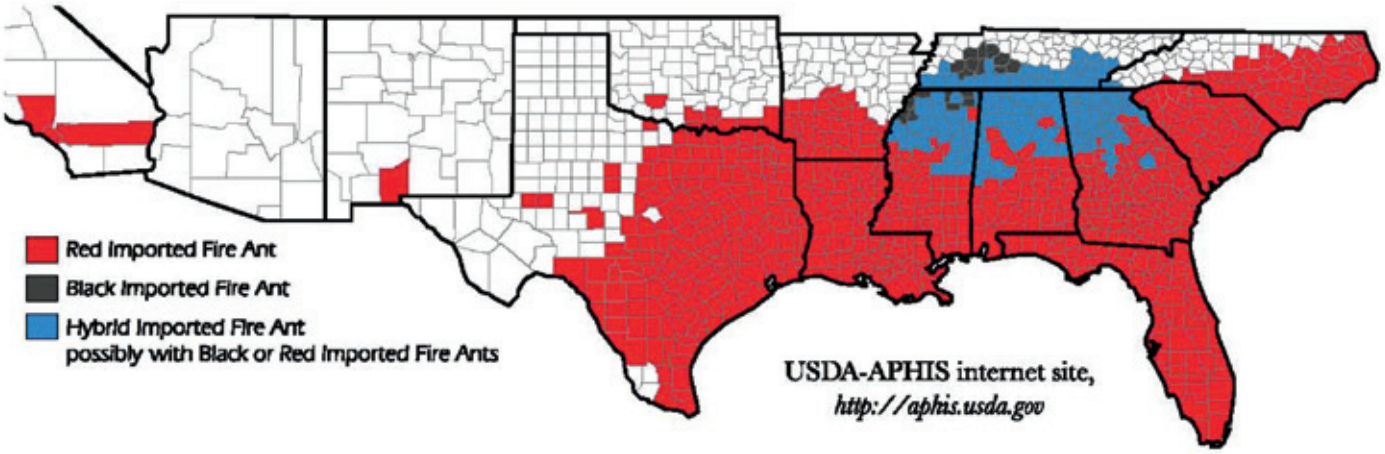
Most imported fire ant colonies in the Southeast are single queen colonies (monogyne), and the ants are territorial. In the early 1970's, a multiple queen form was detected and has become increasingly more common. This form is found in isolated areas of Alabama, but is more commonly found in Texas and Florida than other areas of its introduced range. Populations of this form have two to three times more ants in an area than the single queen form. These ants are not territorial and visit from mound to mound. Normal mound densities in Alabama range from 40 to 80 mounds per acre. But in one area of Talladega County, AL we have counted 267 mounds per acre in one of these multi-queen sites.

A pasture heavily infested with fire ants in West Alabama.

What problems can they cause?

In the 1960's, newspaper headlines such as "Dying Fish Populations Laid to Fire Ants" were seen. Fisheries experts still get two or three calls a year of fish killed by fire ants, but these are rare occurrences. Normally, bream that eat imported fire ants will spit them back out. But, if they eat enough, it is likely they will die.

During dry conditions, imported fire ants build their mounds on the sides of ponds. When heavy rains come, the ants may be washed into the pond. When in water, the ants will form a ball and float until they come to dry land. The conditions that cause bream to feed on fire



Location of imported fire ant species in the southeast.

Ant decapitation by phorid fly. From left to right: Ant with phorid maggot in head; Ant with head removed by maggot; Ant head with mandibles and antennae removed by maggot, Ant head with pupa formed inside

ants are not known, but some bream may find this floating buffet too irresistible to pass up.

The multiple queen, high density form of the imported fire ant has increased the debate on fire ants and quail. Early work on fire ants and observational data in the early 1970's convinced most that imported fire ants were not a threat to quail. Studies in Texas in the 90's showed that quail populations were affected in areas with multiple queen forms.

Work in southwest Georgia, where the single queen form is dominant, has found that about 10 percent of quail nest failures were due to imported fire ants. But, these percentages are similar to a study done 70 years earlier when only our native species of fire ants were present. So, the debate about imported fire ants and quail continues. Imported fire ants are not solely responsible for the decline in quail numbers, but more work is needed to define their role in the Southeast.

Phorid flies are very small. This is an adult Pseudacteon tricuspis female on a Lincoln penny.

Bob Mount, a former Auburn herpetologist, was first to notice effects of imported fire ants on reptiles and amphibians. He observed imported fire ants eating eggs of the six-lined race runner. They have been found attacking box turtles, toads, the nests of alligators, and can be found at the entrance to many gopher tortoise burrows.

Of course, imported fire ants have a direct impact on mammals, including humans. Newborn cottontail rabbits and white-tailed deer have been attacked. Two calves were killed in Chilton County, Ala. in 2002. The ants also have indirect effects on animals by reducing food availability which can change search patterns for food and increase the chance of predation. One friend here in Auburn swears that the fire ants in his field can find his downed doves before he is able to get to them.

However, fire ants can also be beneficial. Anecdotal evidence suggests that the tick population in the South was reduced as fire ants moved into an area. While serving as a major pest in hay fields, fire ants are more than welcome in cotton and sugar cane fields where they attack many

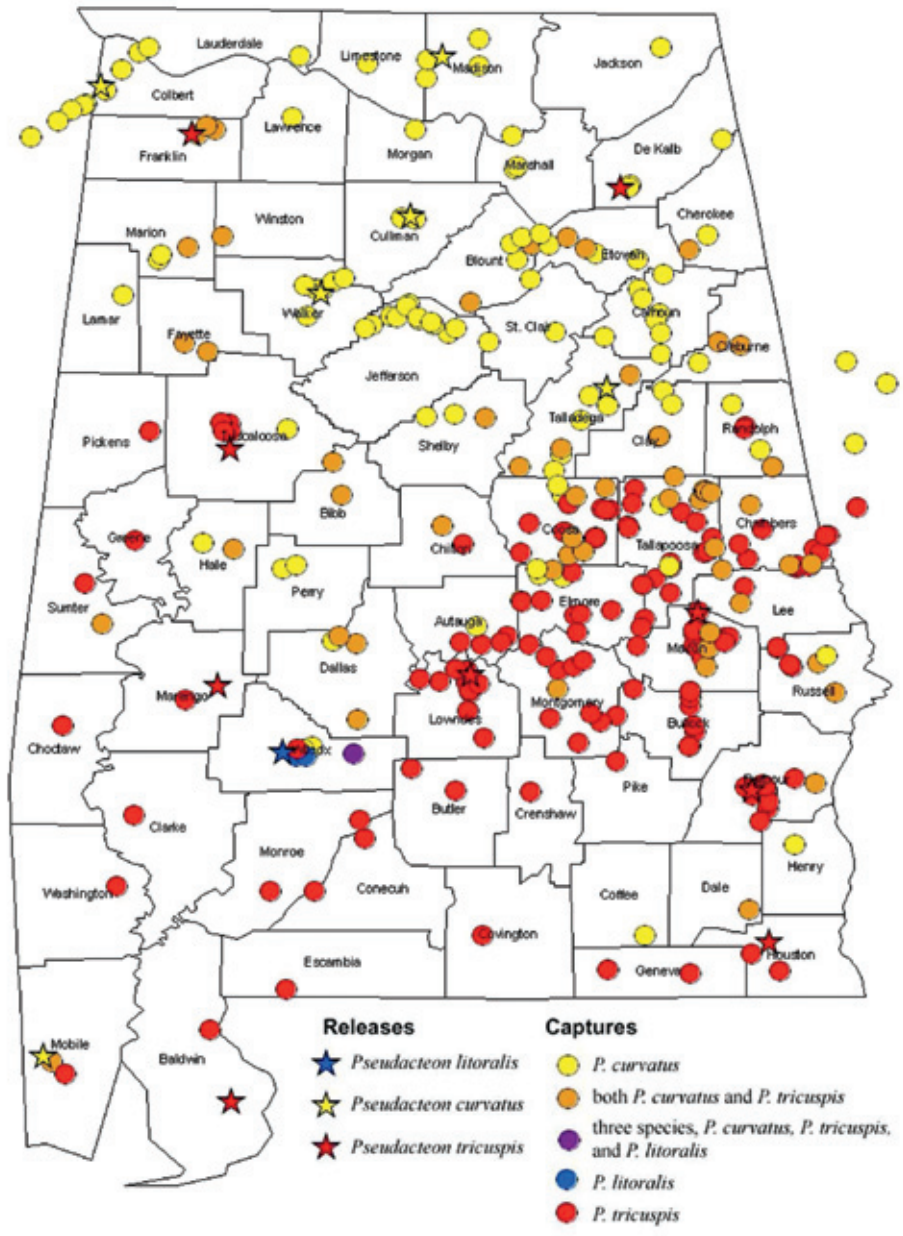
of the insects that damage these two crops and can reduce the number of insecticide applications in the fields.

Current Research

Past research on quail in areas with single queen colonies has shown that fire ants were only a minor problem with piping nests, but studies in multiple queen areas have shown other effects on nests. A research study underway at the LSU AgCenter is looking at the effect of fire ants on quail nests. The researchers are studying egg predation by fire ants.

Fire ants are omnivorous and predatory. A portion of their diet consists of captured insects. Insects captured on the ground are also a major portion of the bluebird diet. Most studies of fire ant impacts look at the direct affect of fire ants on a population. Researchers at Auburn University are taking a novel approach to look at the interaction between fire ants and blue bird foraging. This study will attempt to determine if fire ants have an effect on bluebirds by reducing their insect food source and affecting their ability to forage.

A new approach is underway to level the playing field against imported fire ants and give our native ants an opportunity to compete with these aggressive invaders. Natural enemies of fire ants from South America



Phorid Fly release and recapture sites in Alabama.

have been imported and are being established in fire ant populations across the southeast. These natural enemies are called decapitating flies or phorid flies.

These amazing little flies survive by eating fire ants. The adult female hovers over fire ant workers that are out of the mound foraging or repairing the mound. Once a worker of the correct size is located, the fly takes less than a tenth of a second to dive in and deposit her egg into the thorax of the fire ant. When the egg hatches, the maggot migrates into the head of the fire ant. Eventually, it eats the contents of the ant head, and the ant's head falls off. The maggot then uses the fire ant head as a pupal case. During the warm summer, a new fly emerges about five weeks after the egg was deposited. The newly emerged female fly mates and searches for worker ants. Male flies simply look for more female flies. The adults live only one to three days in the field, but females are capable of laying eggs in 2-300 worker fire ants.

An obvious advantage to these flies is that they are only attracted to imported fire ants and are not a threat to our native ants. The flies are actually so specific that they are only able to deposit their egg into fire ant workers of the correct size. There are around 20 species of phorid flies in South America that attack fire ants in their native habitat. The phorids select ant workers by attacking different size ants, attacking at different times of the day and attacking ants depending on the activity.

Phorids are currently reared at the USDA-Animal and Plant Health Inspection Service facility in Gainesville, Fla. They are the only source for the flies and only supply them to cooperating USDA or university personnel in 12 states. There are two species of fly in production at this facility. One species is in quarantine at the USDA-Center for Medical and Veterinary Entomology to ensure that it is safe for release. Releases are scheduled to spread the flies across the state and the Southeast, as flies are made available.

The first decapitating fly established in Alabama was *Pseudacteon tricuspis*. It was first successfully released in Alabama near Notasulga in Macon County in 1999. This fly is attracted to the red imported fire ant located in the southern portion of the state and prefers to deposit eggs in medium to large size workers. Other releases of this species were made in eight other counties across the state from 2000-2006.

In May of 2000, a second species of decapitating fly, *Pseudacteon curvatus*, was established in Talladega County and has spread over 12 miles from the release site. This was the first establishment of this species in the United States. This fly is attracted to the black imported fire ant and the hybrid found in northern Alabama. It prefers worker ants that are small to medium in size. Other releases of this species were made in Walker, Madison, Cullman and Lauderdale. There is a second biotype of this species that prefers the red imported fire ant. It was established in Mobile County in 2006.

These two species have been released in 12 Southeastern states from Texas and Oklahoma to North Carolina. They are spreading from the original release

Phorid Fly attacking fire ant worker. (Photo by Scott Bauer)

sites at a rate of 10 to 20 miles per year and have become well established in most Southeastern states and are spreading in the others. At least one of these two phorids has been found in every county in Alabama and approximately two-thirds of the counties in the state have both.

Alabama was the first state to have two species of phorid fly established and is the only state with the species *Pseudacteon litoralis* established This fly was released in three sites in Florida, one in Louisiana and one in Alabama, Alabama is the only site where *P. litoralis* has been recovered in the field. This fly prefers very large workers of the red imported fire ant. It is elusive, and few are found each year. But in the summer of 2008, flies were recovered 14 miles from the 2005 release site.

A fourth species of phorid, *Pseudacteon obtusus*, was released in Alabama in September 2008. It prefers large workers. Unlike the other species, it attacks ants along the foraging trail rather than at disturbances. It is established in Texas and Florida.

Is there anything I can do?

Current control measures for imported fire ants rely on chemicals. Chemical control options include baits, contact insecticides (sprays, drenches, dusts, granules, etc.) and a combination of these two. Eradication of the fire ant is not an option, but management of fire ant populations using sustainable technologies is possible, but can be costly.

Most of the calls I get for fire ant control want the problem gone yesterday. This is what I call the 'reactive' method of control. Fire ants are easier to manage if a proactive approach is taken. Fire ant baits are a safe, effective and relatively inexpensive way to manage a population. But they do not fit the mold of the 'I want them gone now' approach. Depending on the product and the time of year applied, baits can take from 2 to 12 weeks to work.

Fire ant baits are taken to the mound by foragers like any other food particle and must be fed to other workers in the mound. A large mound may have over 200,000 workers. Baits that inhibit metabolism will work in 2 to 4 weeks by killing adult and immature ants. Baits that have an insect growth regulator as the active ingredient will take 4 to 12 weeks to work since they only prevent immature ants and eggs from developing. Adult workers in these colonies die of old age and are not replaced so the mound dies slowly.

Most baits are broadcast at a rate of 1.5 pounds per acre. If you have a large area, baits may be purchased in 25 pound bags. The cost per acre for most will range $12 to $15 per acre for an application.

Baits are difficult to apply broadcast at this rate. Most broadcast seeders will put out too much product. The only bait spreader available to apply baits at this rate that I am aware of is the fire ant model GT-77 made by the Herd Seeder Co. Here in Alabama, the Alabama Fire Ant Management program has a program to make applicators available to stakeholders. Over 40 of these spreaders are placed in Extension offices across the state. Anyone wanting to apply fire ant bait to their property can go to the county Extension office and borrow one of these spreaders at no cost.

I don't have the space to go into different fire ant strategies in this article. I do think that bait applications, if done correctly, are an excellent management tool to maintain fire ant populations at a low level. If you want more information on how to manage your fire ants, there is now an excellent web site with information from all of the fire ant experts in the US. This site can be found at www.extension.org/fire+ants.

Are Hunters' Skills on the Decline?

Are we hunters relying too much on gadgets these days?

By Stephen Ditchkoff

Stephen Ditchkoff is an associate Professor at Auburn University. At Auburn, Steve teaches both undergraduate and graduate courses in Wildlife Science and conducts research with white-tailed deer and wild pigs. He can be contacted at 334-844-9240 or ditchss@auburn.edu.

A hunter slips through the brush, taking note of the light breeze, and formulating a plan to silently approach a stand of white oaks that are halfway up the slope of a small hill. The wind is in his face, ensuring that his scent won't reach his quarry before he is in place for the shot. The month is October, and this year acorns are plentiful on south facing slopes. The late freeze the previous spring significantly reduced acorn production, and it seems that only white oaks on south facing slopes were able to produce. The hunter's years of experience tell him that areas where acorns are available are prime locations to harvest a deer. The hunt should be an easy one…in theory. Assuming the deer are where he thinks they'll be, the only obstacle standing between him and venison for his family is a silent stalk down the slope, through the tangled brush lining the small drain at the bottom of the hill, and up through the relatively open red oak stand that lies between the drain and the

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white oaks.

As he silently slips from tree to tree, his eyes and ears are constantly searching for the tell-tale signs of a feeding deer: the white flicker of an ear or tail, the distinctive crunch of a deer chewing on an acorn, or the subtle rustle of dry leaves under a hoof. He is careful that his motions are near silent. His footsteps barely disturb the leaves, and he skillfully avoids stepping on any twigs whose distinctive "crack" would signal his approach. There…just ahead are two does and a fawn. His skills have served him well. Their heads are down, and as expected they are methodically searching for acorns in the white oaks. He slowly slips to a kneeling position next to a small tree, and uses the lower branch of a neighboring dogwood as a rest. He takes aim, ensuring the sights mounted to the barrel of the gun align with the front shoulder of the deer, and slowly squeezes the trigger. The shot of the gun shatters the near silence of the forest, and the hunter peers through the smoke that envelopes him following the shot. The state is Virginia, and the year is 1838.

I would hazard a guess that this is not the type of hunt with which most of us are familiar. The majority of hunters today, if envisioning a deer hunt, would picture a tree stand, rifle, and high powered scope: the tools of the modern deer hunter. Today's deer hunt is obviously far different than that which occurred 170 years ago. Hunting has become a recreation, rather than a form of subsistence. Today's deer hunt is immersed in technology, and enveloped in comfort. Hunters are armed with a cadre of products designed to improve their hunting proficiency and to make their hunt more relaxing and enjoyable. Sadly though, the evolution of recreational hunting has resulted in a steady decline in hunters skills. There is no question that today's hunters can't be asked to pit themselves against outdoorsmen of earlier centuries: men who spent their entire lives in the woods and whose lives depended on their hunting skills. But, surely we could expect the average hunter in 2008 to compare favorably with hunters from 30 or 40 years ago. Sadly, we can't.

This article discusses the evolution of deer hunting, and how it has served to dull our skills as hunters. I'll list what I consider to be the things that have contributed most to our decline in skills, and discuss a few things that hunters can do to keep their edge. It should be noted that I do not consider myself a great woodsman, and I lump myself into the group of hunters whose skills have declined. But, I am striving to work against the tide of popularity, and I believe that my hunting success in recent years indicates that my skills as a hunter are on the rise. By listing the following causes for decline in hunters' skills, I am not trying to point a finger at anyone or anything, but rather high-

light how hunters have allowed themselves to be led.

The Popular Media

It wasn't too long ago that the only outdoor magazines were *Field and Stream* and *Outdoor Life*: the only hunting show was *The American Sportsman*. I still laugh at Patrick McManus, and I will forever get goosebumps when I hear the voice of the late Curt Gowdy. Many of you likely feel the same, and it is this passion and love for the outdoors that has fueled the explosive increase in magazines and television shows dedicated to hunting during the past 15 years. While the number of hunters is declining each year in the United States, the passion of hunters is ever on the rise. We crave the experience and the excitement, to the point that when we can't actually be in the woods we want to read about it and watch it on television.

But what has been the result of this explosion of hunting and outdoor activities among the outdoor media? I believe that first and foremost, it has changed our perception of reality and success. For many of us, the antler pornography that has become the focus of the majority of these outlets has perceptibly changed our ideals. Twenty-five years ago, the majority of deer hunters went to the woods with the primary goal of harvesting a deer and enjoying the experience. Today, a steadily growing number of hunters go to the woods with the primary goal of harvesting the big one. We, as a hunting fraternity, have become so obsessed with antler size that we are beginning to lose sight of the simple pleasure of the hunt. In other words, the end product (the kill) has become more important than the process (the hunt), and it is causing a decline in our skills.

Throughout history, hunters have always been obsessed with large antlers. Antler/trophy displays have been around for centuries, so we are no different than our forefathers in this regard. But today, we have expectations of instant success, and are willing to do whatever we think it will take to increase chances of that success. We read about the big one being harvested, and we see the big one being harvested on television. The perception is on the rise that harvesting these trophies is the norm, and we expect it to be true for us as well. As a result, we employ all of the techniques and gadgets discussed in magazines and on television, and we expect them to work for us. In short, we are relying on the expertise of others to fuel our success, rather than increasing our chances for success by building our own foundation of experience.

If a television personality says do A, B, and C, we find ourselves doing these things without question. I would contend that we are coming to expect A, B, and C to work, and we are losing our understanding of why these things work. In essence, deer hunting is taking on a cook book type process, where if we follow the recipe described by oth-

ers, we will be successful in our endeavor. But, the reality is that A, B, and C are based on deer biology, and without an understanding of deer biology (which is not gained overnight), we will in the end be rather unsuccessful as hunters.

My advice is this…learn what you can about deer hunting from whatever sources are available. But realize that it is more important to know WHY, than it is to know HOW and WHAT. Take the time to understand why something works, why deer do what they do, etc., and you will rapidly increase your own knowledge base. In the end, your track record as a hunter will shine much more brightly.

Food Plots

Food plots might just possibly be the Achilles heal of hunters. But first, let me make a few statements for the record. I am not opposed to planting food plots, nor hunting over food plots. I believe that food plots can be used to improve hunting success, and I believe that food plots are beneficial to deer management programs. I sometimes hunt on food plots, and I will continue to do so in the future. But, I believe that food plots have contributed more to a decline in skills of deer hunters than any single thing.

Food plots are perceived to be locations of high deer activity. The reason for this perception is multi-faceted. First, the simple fact is that we tend to see deer on most hunting expeditions when we are sitting on a food plot: this may not always be true when hunting in the woods. But, what we don't realize is that the deer we see on food plots tend to be young and inexperienced: not the deer we normally are interested in harvesting. Second, since we tend not to shoot at these young and inexperienced deer, they will return to the same food plot day after day, thereby increasing the number of deer that we think we are seeing. So we return to the food plot again. And these same deer come out again, further fueling the perception of the food plot as being an oasis of deer activity. Third, as we become accustomed to hunting food plots and spend less time familiarizing ourselves with deer movement patterns away from these plots, our hunting success declines on those occasions when we do actually hunt in the woods. As a result, our perception of deer activity on food plots is bolstered even more.

Now let's consider comfort. There is no question that on a cold, windy, or wet day, comfort can be a rare commodity in the woods. But, in a permanent shooting house overlooking a food plot, comfort is plentiful. The walls of the house block the wind, the roof keeps out the rain, and small portable heaters are easily employed

in these structures. Also, consider the types of benches and chairs that can be used in shooting houses: maximum comfort is close at hand! There is no denying that these comforts are attractive, and that they tend to draw us to shooting houses. The result is that we further increase our use of food plots, thereby reducing the time spent in the woods and further diminishing our skills as a hunter. Additionally, we unfortunately create more human disturbance around food plots, thereby further decreasing the chances that mature deer will utilize these areas during daylight hours.

The result is that we come to rely on our skill as a farmer to ensure that we are successful as a hunter. Because we spend less and less time in the woods, our hunting skills slowly decline and we become even more reliant on food plots to ensure that we can see deer while hunting. This situation becomes painfully obvious during years when deer use of food plots is low: such as during years of high mast production or warm, wet winters when there is considerable natural vegetation available in the woods and the deer are not strained from an energetic perspective because of the warm temperatures. During these years, deer sighting on food plots are low, and harvest numbers decline.

The solution? Understand the shortcomings of food plots. View them as a hunting tool, rather than as a

hunting necessity. Hunt trails leading to food plots. Position yourself along travel corridors between food plots where mature bucks will roam in search of potential mates. You may see less deer, but the quality of deer that you see will probably increase. If you limit your hunting of food plots to infrequent times, you will reduce the human disturbance at those sites and increase your chances of seeing quality deer when hunting those areas. Finally, we tend to focus our hunting efforts on food plots when introducing children and novice hunters to the sport. The reasons are obvious: they see more deer, and the types of stands on food plots (buddy stands and shooting houses) lend themselves well to two hunters sitting side-by-side. But, don't be afraid to take these new hunters to the woods. Their hunting skills will progress at a faster rate, and they won't come to learn that the only place to successfully harvest a deer is a food plot.

Final Thoughts

This past year was very successful for me as a hunter...and guide. During a year that most in Alabama considered a tough year hunting, I was able to harvest my share of deer, witness my son shooting his first deer, and guide/witness my girlfriend to the successful harvest of five deer (one of which was a 5.5 year old buck) during her first year hunting. While many hunters in Alabama complained that "we had overharvested the deer" and "we needed to reduce doe harvest," my party and I had ample opportunities to harvest deer. Between you and I… if we could shoot straight (myself included… remember, I never claimed to be a great hunter), we would have harvested close to 50% more deer this past year. The key to our success was getting away from the places that we normally hunted. We used our knowledge of deer movements in the area and sought out likely spots where we felt that deer might be moving from bedding to feeding areas. There were quite a few days that we didn't see deer, and we didn't see large numbers. But, compared to most hunters we spoke with, we were very successful.

Don't be afraid to change things up. Try something new. Go to an area that is a biologically-sound hunting area, rather than one that the media says will work. Remember, you're the expert on your property. If you don't think you are, then get out there and make yourself the expert. I'll be honest, most of the deer that I killed were during exploratory hunts: those times when I went into a new thicket, hunted a new trail, or went into a new section of woods. I was trying to learn what the deer were doing so that I could better place my fellow hunters during upcoming hunts, and unbeknownst to me, I was setting myself and my hunting partners up for success. I'll be sure and discuss the data that serves as the basis for this hunting strategy in an upcoming article in *Wildlife Trends*.

High Fences: State-by-State Regulations Across the Southeast

High fences remain a controversial subject. To some, they are an expensive management tool used to improve the quality of their habitat and deer herd. To others, these fences are simply a means to privatize wildlife and promote canned hunting.

By Jed DeZelle

Jed DeZelle is a wildlife biologist and consultant for Westervelt Wildlife Services. Jed assists private landowners and hunting clubs in developing and implementing wildlife management plans throughout the Southeast. Jed holds a bachelor's degree in wildlife management from Stephen F. Austin State University.

Like many people, my job, hobbies, and other activities often cause me to spend the greater part of a day in my truck. As a hunter I often find myself searching every pond, pasture, and woodlot for ducks, turkeys, deer, and other wildlife. As a biologist, I notice different habitat types, management practices, and the chronic spread of suburbia. Over the past several years, as I have navigated countless interstates, highways and county roads that dissect the South, I have noticed an increasing number of eight-feet, woven-wire property lines. Based on these observations, there is no doubt that in some parts of the country, the use of high fences to confine and manage deer herds are becoming more common.

Working as a wildlife consultant, I have the privilege of traveling and working with many different landowners across the Southeast. Some of these properties are high fenced. Perhaps this is the reason why I tend to notice high fences and spend time talk-

ing and debating with others about them. On a recent trip from Alabama to Texas, I began noticing high fences along Interstate 20. I began to think about the states in which our company manages high-fenced properties and out of curiosity, that ultimately led me to begin researching high-fence regulations within each state throughout the Southeast.

Within the Southeast, regulations governing the use of high fences are as diverse as the states themselves. Acceptance of high fences among states and the general public is a controversial subject. For many landowners and wildlife managers, high fences are the ultimate management tool and a solution to their problems and/or frustrations. To others, they are an eye sore that restrict wildlife movement and a means for canned hunts. A recent survey conducted by the Quality Deer Management Association indicated 73% of QDMA members oppose, 20% remain neutral, and only 7% approve of the use of high fences to enclose native deer herds. Most state agencies are forced to find a balance between preserving landowner rights, reducing habitat loss, maintaining wildlife as a public resource, monitoring fair chase, and preventing disease outbreak. Although high fencing remains controversial, the purpose of this article is not to provide arguments for or against high fences, but instead to outline regulations for high fences, provide insight to the number of fences and acres enclosed within individual states, and define state agency positions on high fence management.

In the Beginning

According to data collected by The Wildlife Society, high fences were first used to restrict ungulate movements in Texas in the 1930's (TWS 2002). Since then, high fences have become more common, occurring in 49 of 58 American states and Canadian provinces. High fences have been used for many different purposes. Not only are they used as a management tool for white-tailed deer, but also for exotic species, game breeding operations, research facilities, drive-through zoos, and even safety and security purposes. As a result, a variety of names have been developed to describe high fences including, hunting preserve, game ranch, shooting preserve, enclosure, pen, etc. Thus, it is sometimes difficult to interpret state agency regulations concerning high fences, simply because of the terminology used to describe the enclosure. For the purpose of this article, I am referring to high fences used to enclose a property for the purpose of white-tailed deer management and hunting. Since some states have different regulations dependent upon the management practices within an enclosure, I have also provided regulations for "hunting preserves". Based on the definition of several Southeastern states, a "hunting preserve" can be an enclosure that is hunted commercially, or has been stocked with deer from an outside source. This article does not include any regulations for whitetail breeding facilities, commercial dealers, deer pens, or any enclosure used for other purposes, as these are a completely different topic. As a disclaimer, although I have made an attempt to research and understand the laws for each state described, it is important to check with your state wildlife agency and/or local law enforcement official for more specific information concerning high fence regulations.

State-Specific High Fence Regulations

Alabama

The Alabama Division of Wildlife and Freshwater Fisheries does not have an official stance on high fence enclosures.

Depending on what part of the country you live, long stretches of deer-proof fencing may become more common.

Alabama does not have regulations governing high-fenced properties. There are no minimum acreage requirements or permits required to maintain a high fence. Hunters are required to follow all state hunting regulations related to seasons, weapons, and bag limits. According to 2007 surveys conducted by the law enforcement division, 104 high fence enclosures existed in the state of Alabama, encompassing 79,116 acres.

Arkansas

The Arkansas Game and Fish Commission does not have an official stance on high fence enclosures. Arkansas regulations make it lawful for individuals to enclose their property with high fences for the purpose of deer management. There are no size restrictions and deer can only be hunted non-commercially in accordance with applicable private land hunting regulations. For commercially hunted enclosures, individuals must possess a Commercial Wildlife Hunting Resort permit and the property must encompass a minimum of 500 contiguous acres. The fence must be a minimum of eight feet high and cannot be cross-fenced in a way that would reduce the size of the fence below 500 acres. Additionally, a minimum of 60% of the total acreage must be in "forest cover", which is classified as timberland by the local county tax assessor. Currently, less than ten Commercial Wildlife Hunting Resorts exist in Arkansas and permits for new facilities are not issued.

Florida

Any landowner in Florida can enclose their property with a high fence. Free-ranging deer captured within the fence can be managed like any other deer herd, including hunting. Deer enclosed within a high fence remain property of the state of Florida, therefore, hunters must comply with all state hunting regulations regarding methods of take, seasons, and bag limits. Under these circumstances, there are no minimum size or fence requirements.

Any landowner wishing to hunt the property commercially or planning to release deer (released deer must be captive-raised) into the herd is required to obtain proper licensing. Licensed hunting preserves for deer must be a minimum of 200 acres, with a minimum of 100 acres in woody vegetation and posted every 500 feet. The preserve must be completely enclosed with an eight-foot deer-proof fence and cannot be located within one mile of any wildlife management area, refuge, or park.

Georgia

Georgia laws do not allow an individual to confine native white-tailed deer. However, Georgia does not consider deer to be confined if the property is larger than 640 acres. Therefore, individuals are allowed to high fence their property for the purpose of deer management and hunting, as long as the property is a minimum of 640 acres. Within high-fenced properties, deer are

*Current High Fence Regulations in the Southeast
(with regard to white-tailed deer)

State	Legal	Minimum Size	Restrictions	Permit Required
Alabama	Yes	No	No	No
Arkansas	Yes	No**	No**	No**
Florida	Yes	No**	No**	No**
Georgia	Yes	640	Yes	No
Kentucky	No	N/A	N/A	N/A
Louisiana	Yes	No**	No**	No
Mississippi	Yes	300	Yes	Yes
North Carolina	Yes	No	No	No
South Carolina	No	N/A	N/A	N/A
Tennessee	No	N/A	N/A	N/A
Texas	Yes	No	No	No
Virginia	No	N/A	N/A	N/A
West Virginia	No	N/A	N/A	N/A

* Information provided is for current high fence regulations. It is important to understand that high fences managed for deer exist in all states listed, but were established prior to current laws and were grandfathered in. Also, terminology used to describe enclosures may vary among states and regulations would apply accordingly.

** Regulations different for enclosures classified as hunting preserves.

considered state property and normal hunting regulations must be followed. Properties less than 640 acres must be permitted and are only approved for exhibition/education purposes and cannot be hunted. The Georgia Department of Natural Resources is in the process of locating high fence enclosures and considers the number of enclosures to be increasing significantly.

Kentucky

Regulations in Kentucky make it illegal to erect a fence that prevents the ingress/egress (movement) of native white-tailed deer. This inhibits anyone from enclosing a property with a high fence for the purpose of deer management, security, or any other purpose. Currently, four high-fenced properties exist in Kentucky, which were grandfathered to allow deer hunting. Although other high fences exist in Kentucky, these enclosures are classified as captive cervid facilities. These facilities contain only captive born and raised white-tailed deer/elk and are not managed by the Kentucky Department of Fish and Wildlife Resources but rather by the Kentucky Department of Agriculture.

Louisiana

As a response to the chronic wasting disease issue, the Louisiana Department of Wildlife and Fisheries does not officially approve of high fences. Louisiana currently does not have regulations pertaining to high-fenced enclosures. Any individual may erect a fence around their property as long as all state hunting regulations are followed. The Department of Agriculture will issue a permit if the landowner desires to stock their high-fenced property with deer from another location. However, if native deer are present, no animal can be taken out of the fenced area unless it is dead. The estimated number of existing high-fence enclosures in Louisiana is 300, encompassing 29,573 acres.

Mississippi

Mississippi is probably the latest state to implement regulations for high fences. The Commission on Wildlife, Fisheries, and Parks adopted new regulations in November 2007 which became effective in July 2008. Any person owning a high-fenced property is required to obtain an annual Facility Permit. The cost of this permit is $300 per year for any enclosure up to 300 acres. For any enclosure larger than 300 acres, the cost of the permit is $1 per acre. Any property fenced after November 2007 must be a minimum of 300 contiguous acres and at least 50% of the total enclosed area must contain suitable habitat for white-tailed deer and must not be susceptible to flooding under normal conditions.

In addition to a permit, all high-fenced enclosures in Mississippi must be enrolled in the Enclosure Management Assistance Program. Under this program, the owner is required to work with an approved wildlife biologist from the Mississippi Department of Wildlife, Fisheries, and

Parks (MDWFP) to manage the deer herd within the enclosure and submit an annual management plan by May 1. Owners/operators are also required to consent to periodic inspections by the MDWFP, with a minimum of one visit annually. Any deer exhibiting clinical symptoms of chronic wasting disease must be tested and deer are not allowed to be transported from the wild into an enclosure. Finally, any enclosure less than 10 acres, registered before November 2007, are required to turn over any offspring produced to the MDWFP within five days.

North Carolina

The North Carolina Natural Resources Commission (NCNRC) has very strict regulations for existing captive cervid facilities and a very strong stance against commercial high fenced enclosures. The agency also has a strong stance that wildlife resources are held in the public trust and any animal native to North Carolina held in captivity is not privately owned. There are no laws that prevent a landowner in North Carolina from high fencing their property. Deer enclosed within the property during construction of the fence can be managed and hunted in the same manner as a free-ranging deer herd. Therefore, all state hunting regulations apply within the enclosure. Landowners cannot, however, in any manner attempt to attract or import deer during or upon completing construction of the fence. Any attempt to do so is considered an attempt to capture those animals for possession, which requires a captivity license. Based on captivity regulations, no deer held in captivity can be hunted. The NCNRC encourages landowners to keep fence heights below four feet or leave sections of the fence open so as not to prevent movement of deer or other wildlife.

South Carolina

The South Carolina Department of Natural Resources does not officially support high fence enclosures. In 2000, the legislature passed a moratorium on the construction of high fence enclosures for the purpose of hunting. Under these laws, a high fence is defined as being taller than six feet high. Landowners are still allowed to construct a fence higher than six feet, but deer hunting is not allowed in the enclosure. As part of the law, 28 high fence enclosures that existed prior to legislation were "grandfathered" in to allow hunting. Additionally, registered enclosures less than 700 acres are allowed a one-time expansion up to 15% of the registered acreage. For properties greater than 700 acres, landowners are allowed to enlarge the enclosure up to an additional 400 acres. The total acreage enclosed in South Carolina is 14,445 acres.

Tennessee

Laws in Tennessee have prevented any person from possessing white-tailed deer since 1948. This prevents any landowner from high fencing their property for the purpose of containing deer. Landowners are, however, allowed to high fence their property for the purpose of security. If in the process of enclosing the property for security purposes, deer are captured within the high fence, the landowner is allowed to manage the deer herd under normal practices, including hunting. All hunting must be in accordance with statewide regulations and license/permit requirements. Although Tennessee does issue permits for hunting preserves, wildlife indigenous to Tennessee, including white-tailed deer, may not be held, released, or hunted under these permits. According to the Tennessee Wildlife Resources Agency, the number of high fences erected for security purposes is increasing, but strict captivity regulations strongly discourage any landowner from erecting the fence with deer management as the primary purpose.

Texas

As previously mentioned, high fencing got its roots in Texas. Currently, no regulations or statute limits concerning the height or size of fences exist in Texas. In 2002, an estimated 1,000 high-fenced properties existed in Texas, encompassing nearly 4 million acres (TWS 2002). The Texas Parks and Wildlife Department does not have an official stance on high fences. TPWD is concerned more about management practices inside or outside of a fence, but believes that high fences can provide responsible landowners an opportunity to be better stewards of the land.

Virginia

According to Virginia wildlife personnel, it is illegal to erect a fence that prevents or impedes the free movement of deer from the enclosed area with the intent to confine deer. It is also illegal to hunt deer within any enclosure. Attributes that have been defined as impeding the free movement of deer include a fence height greater than five feet, or a combination of a fence and any topographic or physical barrier which would prevent free movement of deer. The only exception is high-fenced enclosures registered before August 2001. These properties are required to annually register with the Virginia Department of Game and Inland Fisheries (VDGIF). In addition to registration requirements, these facilities are required to operate using acceptable hunting and wildlife management practices as determined by the Director. All state and local hunting laws and regulations must be followed, and hunting with dogs, man-drives, or over bait within enclosures are prohibited. Any known non-hunting mortality that occurs within an enclosure must be reported to the VDGIF within 48 hours in order to be tested for diseases. Additional hunter-killed samples are also requested for CWD testing. Any high-fenced enclosure is required to allow inspection of facilities and records upon request by the VDGIF at any reasonable time. Only four registered high-fenced enclosures exist in

Virginia, encompassing 1,700 acres. Although the VDGIF will continue to work with existing high-fenced properties, they oppose the establishment of new enclosures.

West Virginia

The West Virginia Division of Natural Resources does not support high fences. Laws in West Virginia make it illegal to prevent the movement of white-tailed deer. This inhibits landowners from high-fencing their property. There are four existing high-fenced, hunting preserves in West Virginia, which encompass 1,925 acres.

Regardless of where you stand, high fences for deer management have become more common and regulations concerning these enclosures vary greatly across the Southeast. Based on the latest trends and concerns about diseases, it is likely that state agencies will receive more pressure from the public to more intensively regulate high fences. Although it is difficult to predict the future of high fences, it is certain that they will continue to remain a topic of conversation and a dividing line among wildlife managers, hunters, and the non-hunting public. In the meantime, high fences (where legal) will continue to be used as a management tool and if you find yourself traveling across the Southeast, you may catch yourself noticing them more often.

Literature Cited

The Wildlife Society. 2002. Biological and social issues related to confined wild ungulates. The Wildlife Society Technical Review 02-03, 29pp.

Fertilizing Oaks for More and Sweeter Acorns: Fact or Fantasy?

By Craig A. Harper

Craig A. Harper is a professor and the Extension Wildlife Specialist in the Department of Forestry, Wildlife, and Fisheries at the University of Tennessee. Craig and his graduate students work on a number of applied habitat management issues.

There are no data to support the notion that fertilizing oaks leads to increased acorn production. There are only 1 or 2 good mast years out of 5, and this is not related to soil nutrients. Poor pollination, late frosts, drought, and acorn weevils limit acorn production, regardless of whether a tree is fertilized or not.

Commonly, recommendations are provided landowners to fertilize oak trees for increased acorn production. Some even claim fertilization leads to sweeter acorns. For many people, this may seem intuitive. However, there are no data to support such claims. Many factors affect acorn production, and they should be considered carefully before spending time and money on a fertilization program that may produce no effect whatsoever.

Natural variability and genetics

Mast crops are extremely variable. In fact, among white oaks, data show there is, on average, only one or two good mast years out of five. Variability in acorn production is attributable to poor pollination following continuous rain and/or insufficient wind, late frosts, and drought. Later in the season, acorn weevil depredation can also

be a significant factor in sound acorn availability.

Among individual oak trees, there are good producers, moderate producers, and poor producers. There are also genetic differences in reproductive maturity among individuals. During any given year, the good producers will produce the majority of the acorn crop.

In 2006, two of my graduate students (Michael McCord and Marcus Lashley) identified 120 white oaks in east TN for acorn production sampling. Acorn production per square foot of crown coverage averaged 0.06 acorns in 2006, 0.70 acorns in 2007, and 5.70 acorns in 2008. Obviously, 2008 was a bumper acorn year. During all three years, however, there were trees that never produced an acorn, even in 2008. Among individual trees, 25% of the white oaks produced 90%, 87%, and 67% of the acorns, respectively, 2006 – 2008. There were many trees that did not produce any acorns 2 out of 3 years. Overall, approximately 33% of the trees qualified as good producers, 19% moderate producers, and 48% poor producers. That means nearly ***half*** the white oaks out in the woods produce very few acorns, or none at all!

Fertilizer requirements

In production agriculture, there are very specific fertilizer recommendations with regard to various soil conditions for each crop grown. What are those needs for oaks in relation to acorn production? No one knows. What *is* known is that various oak species are adapted to various soils (rich sites as well as poor sites). And various oak species produce acorns wherever they are found. Forestry research has documented increased tree growth on better sites (more moisture, more nutrients), but a comparative increase in acorn production has not been shown. Regardless of site, there are still good producers, moderate producers, and poor producers among all species.

For row crops, fertilizer recommendations are fairly precise, and determined after soil testing. Off-the-cuff, general recommendations are not prudent and often lead to wasted time and money. If the application is too low, yield may not be improved. If the application is too high, plant growth may respond negatively; the plant may even die. Weed control is another major consideration. Without weed control, the crop receives relatively little of the

We measured acorn production from 120 white oaks, 2006 – 2008. Interestingly, only 25 – 30% of the trees produced 80 – 90% of the acorns each year. Most individual white oak trees are relatively poor producers. For management and hunting, it is important to identify the good producers.

The surest way to increase acorn production is to enable a tree's crown to expand, not by fertilization. Here, adjacent competitors have been killed around two red oaks, which will enable their crowns to better develop.

added nutrient and crop yield may decrease as a result of increased weed competition.

Fertilizer applications are much less efficient and effective in acid soils unless soil pH is corrected. Phosphorus, for example, plays a key role in fruit and nut production. Phosphorus, however, forms insoluble compounds with aluminum at soil pH <5.5 and with calcium at soil pH >7.5. Forest soils are often acidic, requiring 2 or more tons of lime per acre to correct pH. Thus, fertilization alone shouldn't necessarily be expected to improve acorn production. Applications of lime may be necessary as well. Of course, pH and nutrient availability are not known unless a soil test is conducted. Even with a soil test, a fertilizer recommendation for oaks would be difficult at best because nutrient requirements, especially as related to acorn production, are not known. Further, it would be a complete waste of time and money to fertilize the inherently poor producers. Thus, identifying the good producers would be essential, even if fertilization was effective.

So, what can you do?

Acorns are produced near the ends of twigs in an oak's crown. Thus, *by default*, a larger crown has the capacity to produce more acorns than a smaller crown. To help increase acorn production among individual oaks in a closed-canopy stand, kill or remove adjacent competitors to allow the selected oak's crown to expand. The additional sunlight entering the stand will also stimulate increased groundcover, which provides additional browse, forage, and soft mast, and enhances nesting and brood cover.

This does not mean trees with the largest crowns should necessarily be chosen for release. Some trees with relatively large crowns may be inherently poor producers. Also, relatively large-crowned trees may not respond as much to release as a tree with a restricted crown. Nonetheless, it is probably a

Increased sunlight entering the forest canopy doesn't just enable crown growth among selected trees, it also stimulates the forest understory, providing increased browse and cover for fawning, nesting, and brooding. After a retention cut in 2001, this well-spaced stand allows approximately 30 – 40% sunlight through the canopy. Every standing live tree is a mast producer. This stand was burned using low-intensity prescribed fire in April 2001, 2005, and 2007.

waste of time to thin around a spindly oak that has virtually no crown at all. The single-best-producing tree of the 120 white oaks mentioned above had a crown that was cylindrical in shape. Certainly, this tree has the potential to produce a tremendous acorn crop if its crown is released.

How do you select trees for release?

Only by checking for acorn production will you know which trees are the best producers. Trees can be evaluated for acorn production using binoculars in September, but more easily by simply noting which trees produce acorns while scouting or hunting, September through November. Mark acorn-producing trees with flagging tape, paint, or a numbered aluminum tag. Regardless of how you identify the trees, the most important consideration is evaluating them for at least 3 years before determining if they are a good producer or not. And it might not matter. Most hardwood stands have a diverse mixture of tree species. Thus, if there is a maple, elm, sweetgum, sourwood, poplar, sycamore, or other non-mast-bearing species competing with an oak you want to release, go ahead and kill it, or cut it down. At the least, you will allow more sunlight into the forest floor and stimulate more groundcover. Now, don't take this the wrong way—I'm not suggesting you kill or cut down all the non-mast-bearing trees in your woods. But if you want to release a specific oak tree(s), removing adjacent, less desirable trees is an obvious and easy decision.

Is this done stand wide, or on a tree-by-tree basis?

How much area to treat is determined by your objectives and the quality of surrounding habitat. For example, if the composition and structure of the understory in your woods are diverse and productive, stand-wide treatment is probably not necessary. However, if you are interested in improving your woods for deer and turkeys, and the understory is wide open, with relatively little groundcover for forage, browse, fawning cover, and nesting structure, then you should consider stand-wide treatment.

When treating the entire stand (implementing a retention cut), I recommend reducing crown closure to approximately 60%. That is, you want to allow approximately 40% sunlight into the stand. For upland hardwood stands, I then recommend a low-intensity prescribed fire two years after the cut. The cut may be commercial (if the trees you mark to remove will pay their way out of the woods), or you might kill/fell the trees yourself. It's not difficult and doesn't take that much time. Girdle-and-spray or hack-and-squirt methods work well. I have used both Arsenal AC and Garlon 3-A with great success (follow label directions for use and rates). And though it has been reported, I have never seen Arsenal AC kill non-target trees when used at label

Trees may be killed without felling by girdling and spraying the wound with an appropriate herbicide, such as Arsenal AC or Garlon3-A. These two white oaks were killed because they had poor form, no crown, and were poor producers. They were competing with an adjacent white oak that was a good producer with good form and crown shape.

rates. You and a buddy should be able to treat about an acre per hour.

When released properly, my graduate students and I have recorded an average 20 – 25% increase in crown size among white oaks in previously closed-canopy stands the first year after release. Thus, the tree has the *capacity* to produce 20 – 25% more acorns in only one or two years without fertilization! Beyond that, following stand-wide retention cutting and prescribed fire, we have recorded, on average, forb and browse production increase from 50 to 800 pounds (dry weight) per acre. This has led to a 10-fold increase in nutritional carrying capacity (considering only plants eaten by deer and a minimum nutritional requirement) for deer during the growing season. Not to mention enhanced fawning, nesting, and brooding cover for wild turkeys. All without fertilizer!

Should trees ever be fertilized?

If, for whatever reason, you cannot help yourself and you *must* spend money fertilizing mature trees, then certainly you should only fertilize those trees that, 1) are inherently good acorn producers, and 2) have been released so their crowns can expand. If trees are grown in an orchard setting and have

access to full sunlight, they may be fertilized to help maximize growth and development. But be aware, trees cannot utilize increased nutrients without adequate moisture. Probably more times than not, tree growth and production on upland sites is limited more by inadequate moisture than nutrients. When *planting* oaks on *relatively poor* sites, amending pH and fertilization may help ensure more rapid growth and development of the seedling, *if* adequate moisture and sunlight are available.

The final evaluation

There is no evidence that fertilizing oak trees in closed-canopy stands leads to increased acorn production. However, if fertilization did lead to more acorns, it would be necessary to identify the good producers and release their crowns to have any real effect. And then, any effect of fertilization would most likely be greatly reduced unless soil pH was above 5.5. Thus, liming would probably be necessary. And how much and what type fertilizer is needed? How often should fertilizer applications be made? Every year? Every other year? Regardless, given the natural variability of masting, fertilization would be a gamble because acorn production would still be susceptible to and limited by poor pollination, late frosts, drought, and acorn weevils. Any real effect of fertilization would be masked except during good mast years (at most, 2 years out of 5).

So, would the time and money spent be worth the return? With regard to nutritional carrying capacity, NO! There will **always** be more years of poor acorn production than years of good acorn production (even if fertilization did increase production), and this inconsistency, which is influenced by environmental factors beyond nutrition, would prevent any overall increase in nutritional carrying capacity. In terms of fertilization, time and money would be much better spent on food plots because of the consistent and reliable production from year to year. Likewise, time spent releasing selected trees and stand-wide retention cutting is certain to provide benefit, *without* fertilization.

Although sound reasoning does not suggest fertilizing oaks for increased acorn production is justifiable, recommendations for this practice still abound. To provide objective information on the issue, my graduate students and I plan to collect pre-treatment acorn production data for another year or two, then implement fertilization and release treatments to try and distinguish any effect of fertilization from release. Maybe we'll have some definitive results in 5 – 10 years!

The Evolving Market for Forest Carbon

By Jeff Main

Jeff Main is President of Land & Timber Services Group (L&TSG) and Forest Carbon, Inc. (FC), forestry, conservation easement, mitigation and carbon credit program consulting firms operating throughout the Southeast. Active participants in the carbon credit and eco-asset markets since 2007, the firms experience encompass the full schedule of program design from inception to revenue realization. Successful L&TSG programs include both CCX and private placement projects. They recently signed a contract with the Florida DEP to determine the carbon stocks and potentials on 3.4 MM acres of state-owned land. The company's primary office is in Tallahassee, Florida (850- 668-8333).

All species of trees store Carbon

In June of 1992 at Rio de Janiero, what has come to be known as the Earth Summit set in motion the mechanisms of the New Green Economy. It was at that venue that the United Nations Framework Convention on Climate Change addressed the international desire to reduce and stabilize atmospheric greenhouse gases (GHG). Contained within the magnitude of that Treaty are the building blocks of worldwide emissions reduction, the Clean Development Mechanism (CDM), Joint Implementation (JI) and emission trading (Cap and Trade).

The CDM allows industrialized nations to sponsor reduction projects in developing nations as an alternative to outright reductions within their own boundaries. A UK sponsored project to modernize a dilapidated chemical plant in India is an example. The modernization will reduce worldwide gross GHG emissions and provide the sponsor nation with "allowances" the country applies to its own emissions goals.

Joint Implementation involves the cooperation of developed countries in reduction projects. Kyoto arranged countries into tiers or "Annexes" based on their development status. Countries within the same Annex can use JI to the benefit of both parties in that the country that receives the project improves its infrastructure and shares in the GHG reduction while the country that sponsors the project receives more allowances for its investment than if they had invested domestically. A French project in France will cost more and generate less allowances than a French and Russian project in Russia. (Note: more than one critical observer has pointed out the irony of this situation. As part of the Soviet Union, Russia became one of the worse environmental offenders on the planet. Under Kyoto they reap both infrastructural and financial benefits from their past abuses.)

The third leg, Emission trading, or Cap and Trade (CNT), provides some element of a free market solution to the GHG concern. It has the most potential for meaningful, long-lived and on-going reductions in GHG's and is the only avenue for wide-spread private participation in the GHG reduction process. Under CNT, industry groups are assigned (by government agencies) "business-as-usual" emissions caps or standards. Individual businesses within the groups must measure their particular GHG output and determine if they are above or below the cap. Companies above the cap must reduce their emissions, companies below the cap can sell or use their excess allowances internally.

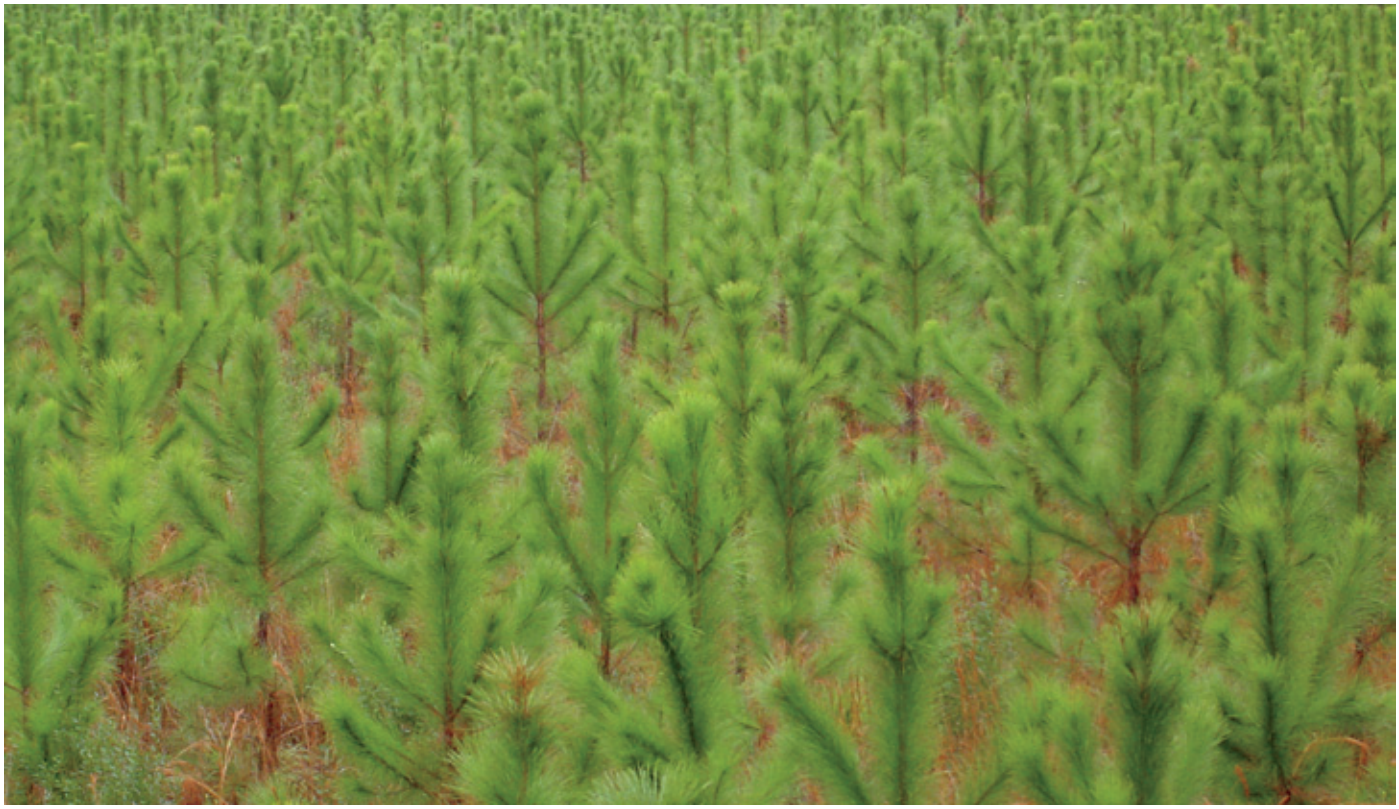
$$6CO_2 + 6H_2O + Energy \rightarrow C_6H_{12}O_6 + 6O_2$$

The photosynthetic equation showing the conversion of Carbon Dioxide and Water to Glucose and Oxygen. One result is stored terrestrial Carbon.

Companies above the cap may reduce their emissions in several ways. The most obvious is the application of new technology and investment applicable to the task. However, within many industry groups the technology for further GHG reduction is not feasible, cost-effective or is non-existent. Furthermore, municipalities and other public institutions desiring to become "carbon neutral" have a limited ability to offset their emissions in this manner. For these entities the option to purchase allowances on a defined market permits them to meet their emissions caps.

Market Creation

The need for a standardized trading scheme was apparent from the beginning and multiple attempts were made to fill that need. One such scheme is the Chicago Climate Exchange (CCX). The CCX is the brain-child of Richard L. Sandor a financial markets guru and current CCX Chairman and CEO. CCX allowance trading (officially "CCX Carbon Financial Instrument or CFI") began in 2003. In 2005, the CCX launched a sister exchange, the European Climate Exchange (ECX) which operates in the European Union. The CCX, ECX and the related Chicago Climate Futures Exchange (CCFE) are owned by Climate Exchange Plc. with Sandor as Chairman.



Carbon sequestration is directly related to tree growth. Young, fast growing planted pines exhibit high rates.

Hidden virtue: Conversion and storage of atmospheric carbon has been a hidden virtue of all types of forests.

The US signed but did not ratify Kyoto, therefore allowance trading here is purely voluntary. The CCX was created on the speculation that sooner or later, the US will join the EU and much of the rest of the world in government mandated CNT. The CCX desires to be the trading platform of choice when US mandated CNT is reality.

The operation of the exchange provides for the award of CFI's to projects that follow a CCX protocol applicable to the particular activity (such as growing trees or methane capture). These offsets are placed on the exchange for sale and emitter members buy the offsets at market prices. Current volume on the voluntary exchange is low when compared with the anticipated volumes under a government mandated CNT scheme, however the CCX has operated well to date and set a good basis for the future.

One of the advantages of the CCX is its comparatively un-intrusive and liberal participation standards. Credit is due to the developers of the respective protocols which respect private rights and initiative. Other schemes are far more restrictive and in some cases draconian in their participation requirements.

California Climate Action Reserve (CCAR)

By its own definition, CCAR "is a program of the California Registry which tracks and registers voluntary projects that reduce emissions of GHGs." Primarily designed for California based projects and exhibiting quantum leaps of additional complexity and control from the CCX, CCAR is beginning to move outside the state and may be more user friendly as time goes on. CCAR embraces the concepts of permanence, additionality, leakage and risk measures. It is a registry, not a market. Participants follow the CCAR protocol to have their projects listed on the California Registry. Allowance buyers then review the project and enter into purchase negotiations with the program owner.

Due to its strict participation standards and higher cost to prepare, allowance sales under CCAR will generate higher sales revenues than CCX programs. Without knowing the particulars of a program however, it cannot be determined which scheme provides the highest return on investment.

CCAR is the only US GHG program approved by the Voluntary Carbon Standard (VCS), a Geneva based group that is hotly pursuing the imprimatur of the World's standards making organization. It is favoured by high-end, private firms and requires landowners willing to make a deeper and longer-lived commitment of their property.

Other registries are developing throughout the country. Most are still in their development phase and many do not have adequate or any forestry protocols. One that is unique and immediately accessible to Southeastern forest landowners is the Georgia Carbon Sequestration Registry. The protocols for the GCSR are user friendly and easily understood for forest-based proj-

ects, having been largely developed by members of the faculty at the UGA School of Forestry and the Georgia Forestry Commission. Once mandatory CNT is a reality, the registry may become an advantageous place to market a program.

In the meantime the CCX will maintain its popularity as the primary market to sell forest based credits. Under a CCX program, a Southeastern forest owner can reasonably expect to receive allowances of approximately three tons, per acre, per year (the unit is a metric ton equivalent of CO_2). Actual allowances vary according to a variety factors on the subject forest and must be evaluated individually. Multiplied by the current voluntary-market price of around $2.00 per allowance, revenues in this scenario are $6.00 per acre. However, the increasing probability of mandated CNT is fueling speculation that allowance prices will go much higher. There is some precedence for this view. In June of 2008 a climate change bill was introduced known as the Warner-Liebermen bill. It did not go far in the foment of that political season however, prices rose to over $7.00 per ton on the CCX purely on the debate of the legislation. If common wisdom prevails, the advent of mandatory CNT will harbor in significantly higher prices and provide a steady source of income for participating forest owners.

The cost of getting into a CCX program is relatively low but varies with the size, stand structure and location of the subject properties. The cost of not getting into a program is the loss of the sequestered carbon for every year of non-participation. The ability to back-capture credits from years past is being discontinued and is not expected to be part of the mandated market. Programs do not encumber the property, can be passed on to new owners without cost, have little effect on property managed under sustainable principles and have evolved to durations as short as two years.

With increasing participation, additional standards and closer scrutiny, the forest carbon marketplace is losing its perception as a wild west show. Many landowners have benefitted from the revenues generated by their programs and can attest to the reality and legitimacy of the market. As more landowners see the benefits and get comfortable with their understanding of the sale of carbon credits, the market can only grow.

One final note of caution is appropriate however. Any enterprise based upon government fiat and the whims of politics and politicians rests on less shaky ground, especially one that transcends national borders. As an example, China, the world's biggest polluter and GHG emitter is not a Kyoto participant and has been given a "free pass" by the member nations. So let the landowner beware that while elements of a free-market exist in the system, this enterprise began as a political solution to a problem not everyone agrees is real. It is also obvious to the casual observer that GHG reduction and the lessening of global warming is only part Kyoto's agenda. The rest is tied up in the international give-and-take that has gone on for centuries.

Associated Websites

Land &Timber Services Grp.
landandtimberservices.com/

CCX
http://www.chicagoclimatex.com/

ECX
http://www.europeanclimateexchange.com/

GA Carbon Registry
www.gfc.state.ga.us/ForestMarketing/CarbonRegistryDocs.cfm

CA Action Registry
http://www.climateregistry.org/offsets.html

Regional GHG Initiative
http://www.rggi.org/

Western Climate Initiative
http://www.westernclimateinitiative.org

Approximately 50% of the dry weight of a tree is Carbon.

Management Calendar

By Dave Edwards
Westervelt Wildlife Services

June/July 2009

Controling weeds in summer food plots will maximize the wildlife and nutritional value of your plots and planting efforts

Monitor and control weeds in summer food plots

If you planted summer food plots (which I hope you did), it is important to monitor weed encroachment to ensure you get the most benefit out of your food plots. If you are new to planting summer crops, you will soon become an expert at weed identification and herbicides. Just by nature of the warmer conditions and excellent growing conditions, food plot managers have a tougher weed battle to fight during the summer. There are many summer weeds that will take advantage of the lime and fertilizer you applied to the soil for your summer food plot plants. If left unattended, these weeds can, and will, take over your summer food plot resulting in less quality forage for your wildlife. Make food-plot-specific notes of the weeds you are having problems with so you can adjust your planting the following year. For example, if you have grass type weed problems (such as Johnson grass), plant a broadleaf crop on that plot so that you can spray grass-selective herbicide to control the problem grasses without harming your crop. Vice versa, if you have broadleaf weeds, plant grass or grain crops so that you can spray broadleaf-selective herbicides. While weeds are persistent, we are smarter!! Anticipating your site-specific weed problems, and planning/planting accordingly will help you make the most of your summer food plots and efforts….It is also less frustrating when you are winning the weed war!

Establish mineral licks to photograph deer

While the nutritional benefits of providing mineral licks for deer have not been well studied, they are cheap to create, deer use them, and they do not appear to have any negative nutritional effects. In fact, most deer biologists think there are nutritional benefits for providing minerals for deer. Deer tend to use mineral licks the heaviest from summer through early fall. With the price of corn getting so high, mineral licks are a good alternative to attract deer to camera sites. The key however, is to establish the mineral licks early in the summer to allow deer time to find them and begin using them. My experience with mineral licks has been that the longer they have been established,

the better they are. Rains dissolve the minerals and saturate the stump or area they are placed at. Evidently "leftover" minerals or salt that attracts them lingers and deer often come back to the same site the following year. Having said this, corn is still the "go to" attractant if you are conducting a true camera census on a property, but mineral licks offer a cheaper way to get deer in front of cameras for "casual" photographing.

Conduct summer quail call counts.

Call counts conducted in June provide an estimate of the number of males available for breeding and an evaluation of winter survival. This information allows you to monitor the quail population's response to habitat management efforts and quail production. To obtain an index of male birds, set up several "listening points" on your property that can be used each year. Listen for whistling males for 1-2 hours after sunrise. In June, nesting by females is at its peak in many regions, so males will be actively calling. To standardize the call count, arrive at the first station at sunrise, wait one minute to allow vehicle disturbance to settle, then listen for five minutes and record the number of male quail heard. Count the number of different individuals you hear. Continue until all stations have been monitored. You will need to conduct the call counts at least 5 different days for the most accurate estimates. The more counts you conduct, the more accurate your estimates will be (statistically speaking). We often conduct 10 call counts (10 different mornings) each June. After completing the call counts, calculate the average number of calling males heard per station. This is your "index" and the number in which you will compare against future call count data to assess increases or decreases. The key to accurate year-to-year counts is to be consistent about everything you can control: same people listening, same locations, same kind of weather (clear, windless days) same week of the year, and the same time of day.

Start preparing and planting dove fields.

Dove field preparations should begin by July. Planting dates will depend on the soil moisture, crops you are planting, and the time required to produce seed. Common dove field crops include dove proso millet, browntop millet, Japanese millet, sunflowers, grain sorghum, corn, and wheat. For best results obtain soil samples and apply required lime and fertilizer before planting. Be sure to allow enough time for your crop to produce seed before dove season arrives. If you are in a pinch or running behind on your planting, browntop millet is a good choice for dove or ducks because it only takes about 50 days to produce seed. One trick that we often implement on dove fields to create hunting blinds is to plant strips of Egyptian wheat or sorghum Sudan. These plants can grow 8-10 feet tall and will provide adequate cover for hunters. Another option is to simply hand sew the seed where you want hunting blinds to be. This will create small "islands" for hunters to use. These tall crops also provide shade for hunters during the early part of dove season when temperatures can be hot.

While seeds of planted grains offer attractive food sources for dove, maintaining a clean disked strip or two through the field offers dusting areas for dove. These are strips that you do not plant, rather simply keep plowed through the summer and into dove season. Dove find these bare dirt areas attractive which will keep them in and around your field until grain seed is mature. It also offers access to seed once it matures as well.

Establishing mineral licks is a cost efficient way of attracting deer to camera sites

Monitor and control competing weeds around fruit trees or other plantings.

Herbicide is a great tool to combat weeds and grasses that compete with young fruit trees. Using herbicide to reduce this competition is often overlooked, but is a critical step for success, particularly during drought conditions. Young fruit trees have a hard enough time obtaining adequate nutrients and water without other plants fighting for the same resources. Reducing competition will significantly increase tree growth and survival. Glyophosate, or Round Up, is the herbicide of choice. Be sure to avoid getting the herbicide on the leaves of the tree you are spraying around. I highly recommend using tree tubes when planting seedling fruit trees. Not only will the tube enhance

tree growth by creating a “green house” effect, but will allow you to easily spray herbicide around the trees without the risk of getting it on the tree itself. Another helpful tip is to place 3-4” of mulch around the base of the trees. Mulching will reduce weed problems due to the unfavorable germination conditions under the mulch (no sunlight) and will also conserve soil moisture which will help your trees during the hot summer months.

Evaluate and repair existing roads & build new ones.

Unless all of your roads are paved, road maintenance is an annual activity for most landowners. June and July are often the driest months in the Southeast (other than those of you lucky enough

to get sea breezes and regular afternoon thunderstorms). Thus, this is a good time to work on or build new roads. Although you probably have a good idea of areas that need repair, the best time to identify road problems is during the wet season which is usually during late hunting season. Make notes during the winter then repair them when the property dries up in the summer. As you know, having all weather access to your property is important from a management perspective so that you can get tractors and equipment into areas of your property, but will also make life easier and more comfortable for you during hunting season. While working on roads, consider increasing the roadsides where possible to enhance wildlife habitat (see calendar item below). These areas can be planted or simply maintained as native grass/weedy areas that wildlife will use for food and cover. Wide roads also dry out quicker due to additional sunlight and wind.

Widen roadsides to create roadside management areas

Summer is a great time to create roadside management areas throughout your property. Creating roadside management areas can add wildlife and aesthetic value to your property. Regardless of how intense you manage these areas, they will create more "edge" habitat which is preferred and used by most game animals. To create a roadside management area simply clear the understory and undesirable trees along a roadside, lime/ fertilize as needed, and *periodically* mow to maintain control of encroaching trees species and maintain a relatively low understory (avoid keeping a "manicured" look by mowing roadways often – this does not offer as much wildlife value). How wide you make the area is site specific, but is generally 10-20 yards wide. Be sure to leave a few desirable mature trees within the managed area. These trees will provide shade to conserve moisture in the summer and will add aesthetics along the road. If you desire to intensively manage your roadsides you can seasonally disk or burn them to promote desirable weeds, and/or install wildlife plantings such as clovers, sorghum, or wildflowers. Wildflowers provide both esthetics as well as bugging areas for turkeys. Managing roadsides not only increases the aesthetics of the property and adds wildlife value, but will increase wildlife viewing opportunities. For more detailed information see the Roadside article in the April – May 2007 issue of *Wildlife Trends*.

Before (top) and after (bottom). Example of creating a roadside management area in a recent clear cut. This area is now managed for turkeys with wildflowers on one side of the road and chufa on the other.

Road maintenance – "limb" roads through herbicide applications

Late summer is a great time to "knock back" vegetation along interior roads of your property. While you can use loppers, saws, and other tools to

physically remove overgrown limbs and brush from roads, this method is labor intensive. Applying herbicide along roadsides is a great way to accomplish the same results. When choosing the herbicide method, it is important to make sure you use an herbicide that will kill the intended species you are trying to control and that it is not "soil active" meaning that it gets transported to the soil and will kill entire trees or shrubs (unless of course this is your goal). I often use Garlon (triclopere) or RoundUp (glyphsate) to "limb" roads. These herbicides only kill the portion of the tree or shrub you spray. That is, it does not kill the entire tree. Parts that are sprayed generally die within a few weeks or a month after the application and limbs will drop shortly afterwards. The herbicide method generally results in a cleaner roadside because it gets sprayed on all the vegetation within the zone you are trying to control, whereas using the pruning method, only the limbs that are physically removed are taken out. Again, it is very important to read and understand the label of any herbicide before application.

Limbing roads not only removes limbs and brush that scratch your truck and equipment, but it makes traveling roads safer by increasing visibility, allows more sunlight to reach the road to reduce time needed to dry, and it results in better quality wildlife habitat along roads due to the regenerating vegetation.

Complete draining duck ponds and prepare for planting.

If you are managing a moist soil area/duck pond (native vegetation vs. planting agricultural crops), you should have started your spring drawdown around 45 days after the last frost. Slow drawdowns, those that take 2-3 weeks, are desired because they result in a more diverse wetland plant community than rapid drawdowns. A diverse community of wetland plants will result in many different types of food sources (seeds and insects). By May or early June, your drawdown should be complete and native moist soil plants are starting to establish. Herbicides can be a useful tool to remove undesirable vegetation if it becomes a problem and is dominating

Limbing roadsides with herbicides is an easy and cost efficient way to remove encroaching tree limbs and shrubs

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the pond. Button bush and sesbania (wetland shrubs) can be beneficial, but should be kept in check and not allowed to comprise more than 25% of the pond.

If you plan to plant an agricultural crop rather than manage the native vegetation, leave the pond flooded until closer to planting time. That is, drain ponds you plan to "plow and plant" a few weeks before you start plowing and preparing the soil for planting. Leaving the pond flooded until this time will provide weed control and will reduce tractor time later. Drying time will vary depending on your soils. It is better to drain early than to wait and not be able to work the ground because it is too wet and chance running out of growing season. My personal favorite crop for duck ponds is rice. Rice, however, requires more time and effort to manage and takes about 120 days to produce seed (depends on variety used) so you need to plant early. For best results obtain soil samples and apply required lime and fertilizer before planting. Japanese millet is also a favorite of ducks and is easily grown by duck pond managers. In fact, Japanese millet can be top dressed or broadcasted onto mud flats of a wetland or beaver pond. Japanese millet is a strong re-seeder, meaning that it will produce seed that will germinate the following year.

Conduct warm season or summer prescribed burns.

Warm season burns are an exceptional tool for managing quail habitat. Warm season burns are generally conducted from June through August. However, extreme caution should be used when conducting summer burns. Due to higher ambient air temperatures and low relative humidity, summer fires can get very hot and difficult to control. If the area you plan to burn has a heavy fuel load (understory shrubs, grasses, and thatch) or has not been burned in over 3 years, I recommend initially conducting a cool season burn (December – March) to reduce fuel loads before attempting a summer burn. Fire rotations (interval of time between burning the same area again) for summer burns vary depending on your goals and habitat types but are generally every 1-2 years to promote quality wildlife habitat. Regular warm season burns will often promote native warm season grasses that are desirable for quality quail habitat. It is also a good idea to strategically plan your burns so that you always leave some areas unburned. This will help to maintain diverse habitat types which will enhance the wildlife value of the area. Always check local burning laws and consult with an experienced burn manager before lighting a woodland fire. The U.S. Forest Service or your state forestry commission are great sources for obtaining more information regarding burning in your area.

Plant chufa for turkeys.

Chufa can be planted in May or June in the Southeast, but most plantings occur in June when summer rains start. Monitor chufa plots for competing grasses and weeds and apply herbicide accordingly to control. Adding chufa to your planting program can be quite rewarding if you like to see or hunt turkeys. Turkeys primarily utilize chufa in the fall, winter and spring once the tubers have developed. If your turkeys have never been exposed to chufas, you may need to lightly disk a strip through the patch in late fall to expose tubers. Once turkeys find them, you will not be able to keep them out. A word of caution – raccoons and hogs like chufas as well and can pose problems in some areas. Chufa patches can often be regenerated the following spring by lightly disking the areas. There has to be adequate chufa seed remaining to regenerate an adequate stand (there's often more left than you may think). To regenerate the stand, lightly disk the plots once in April, again in May, and once more in June. The key is to continue disking each month regardless of how nice your plot is growing with chufas – it's going to kill you, but do it. Herbicide applications can be used to enhance chufa plots by controlling competing weeds and grasses. Be sure to rotate your chufa patches every 2-3 years to avoid nematode problems.

Identify and control invasive exotic plant species.

Exotic species are very competitive with native plants and can take over your property and compromise habitat quality. The best time to control or eradicate exotic plants is during the growing season. Strategies to control these plants vary depending on the species at hand. However, herbicide will likely be the tool of choice. It is much easier to control exotic species if you catch them in the early stages of colonization. Once they have a foothold, eradicating can sometimes be impossible. Some of the common invasive exotics in the Southeast include Cogongrass, Chinese tallow tree, Kudzu, Chinese Privet, Chinese Lespedeza, and many others. If the common name has a foreign country in it, I would get rid of it. A great field guide to keep on hand is "Nonnative Invasive Plants of the Southern Forest" by James H. Miller. You can get this publication from the USDA Forest Service – Southern Research Station at Auburn University or visit http://www.bugwood.org/weeds/forestexotics.html. This guide has information regarding identifying invasive exotics as well as methods of controlling them. Another resource is the Florida Pest Plant Council - www.fleppc.org.

It is also wise to consult with a professional herbicide applicator before deciding which herbicide and method to use. Besides the complex world of herbicides themselves, mixing and applying them can be complicated as well.




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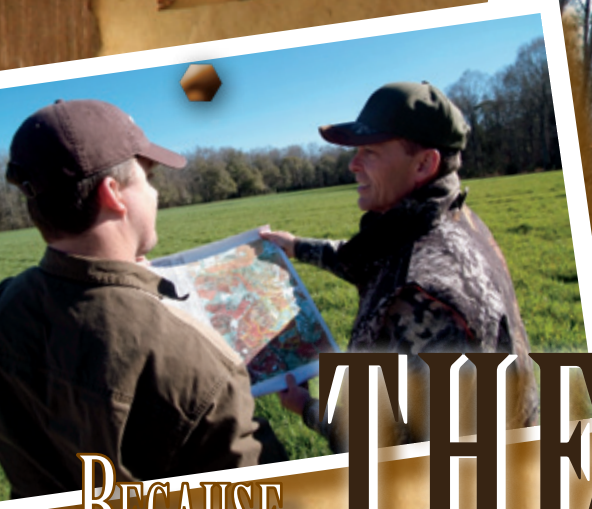

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