PRACTICAL WILDLIFE MANAGEMENT INFORMATION

Wildlife Trends JOURNAL

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Earl Says…

As I write this, it's just a few days till Thanksgiving and I'm feeling especially thankful for all the blessings the Lord has given us.

Thankful seems like such a small word for what we have. Family, great friends and the rights we have to hunt and enjoy the great outdoors are just a few of the reasons I feel so blessed. And it's our responsibility as sportsmen and women to ensure the next generation will have the same rights and environment to enjoy hunting for years to come. That's why *Wildlife Trends Journal* is proud to offer the latest research-based information to our subscribers to improve the wildlife habitat on your property.

Thank you all for your support and I'm hoping you have a safe and successful hunting season in the future.

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Wildlife Trends Journal is published to provide landowners, land managers and wildlife enthusiasts the latest research-based information in wildlife and game management. Article authors are carefully selected for specific expertise in their respective fields. Subscribers receive six bi-monthly issues and a handsome library binder to save their past issues.

Cover Photo by Dave Edwards

Comparison of Two Farms

By Matt Petersen

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This buck is a trophy in any part of the country but in the mid-south he is in the top 5%, as far as antler quality, of free-range deer. This buck is a great example of the type of deer Farm A has produced in the past and what's possible in regard to quality buck population in the area.

I have two farms that I manage that are within a quarter mile of each other in my area of Central NC and Southern VA. Both farms have more in common than they differ in terms of soil quality, topography, neighbors, etc. Both farms share a similar soil type of red clay with a dash of loam in the upland areas that make up the majority of both farms. They also both have areas of super rich bottomland soil that borders a major river that they both have running through the property. Both farms have timber management taking place and both are actively planting food plots in spring and summer. They also share similar goals such as producing trophy bucks 4.5-years-old plus and prioritize a healthy turkey population as well. Also, both are similar in size with both farms being around 400 acres. They have plenty in common here so what's the story you may ask.

The first farm, which we'll call Farm A for the purpose of this article, is a perennial producer of high scoring mature bucks, and lots of them, as well as being able to boast having a healthy turkey population that uses the farm year-round. What do I mean when I say high scoring bucks and plenty of them? Think Kansas or Illinois quality – 6-10 bucks over the age of 4.5 ranging 140"-175" on any given year. Farm B right down the road is a different story when it comes to deer. Although it does support a decent turkey population, the quality of bucks that live here are average to poor for the area. To my knowledge, the largest buck that's been harvested there was barely 130" and mature bucks aren't commonplace. In this short article I'll do my best to point out the differences in each farm in an effort not to demean either landowner but to make a few observations that, in my opinion, set them apart when it comes to producing quality bucks in the same area and better and more wildlife overall.

One thing I mentioned is that both farms were planting food plots in both spring and fall. That's great and something I encourage all my landowners to do, but the difference is what, how, and when we were planting. Farm A was originally made up of old hay fields that had been poorly managed for many years. The first step to making these fields into food plots was to do soil tests. We did so and applied the appropriate lime ASAP and fertilizer at planting. The next step was to ID what was growing there now – a monoculture of tall fescue with some broomsedge, dog fennel, sweetgums, and persimmons. As soon as conditions allowed, we treated the fescue and other vegetation with glyphosate and, in order to not lose any organic matter that had accumulated from the years of hay management, planted with a no-till drill. The first spring planting was a planting of milo with a pre-emergent to prevent grass followed by a fall burndown with glyphosate to kill any regenerating fescue and another no-till planting of fall blends to continue to build up the soil, smother weeds, and feed wildlife. This continued on Farm A until the pH was balanced, unwanted weeds and grasses were under control, with an emphasis on soil health, preserving organic matter, limiting erosion, and matching appropriate plantings to sites that would allow them to thrive

and produce accordingly, providing wildlife with quality food year-round.

When I was brought on to work Farm B it had been planted in various food plot crops for many years. It had been soil tested repeatedly and been limed and fertilized appropriately always but had seen many years of repeated heavy tillage with very little to no weed control. This heavy tillage led to perpetual erosion, extreme compaction in the red clay sites, and a healthy seed bank of various agricultural weeds such as pigweed, marestail, cocklebur, carpetweed, and others. As you can imagine this often led to poor plots due to low water infiltration on the compacted soils and choked-out plots due to extreme weed pressure. Also, Farm B is one of the worst cases of not matching specific crop species to the correct site I've ever seen. For example, it was common for the landowner to plant perennial clover on upland sites that were full sun and sloped – both of which lead to low moisture retention due to rains tending to run off a sloped field and also to quickly dry on a site that receives full sun all day. Perennial clover prefers a moist site that holds its moisture well and allows it to persist for many years. On wet years, the perennial clover would do well on those upland sites but as soon as a drought hit the dry, compacted, and sloped upland sites would turn hard as concrete and the clover would go dormant quickly and, more often than not, die. On the bottomland sites with heavy moist soil, the landowner would often plant his annuals. On wet years these annuals could drown in those moist sites and be stunted by excess water or even choked out by moisture loving weeds/grasses due to lack of an herbicide program and luck of pre-planning and matching the planting to be able to control the weed pressure present on the site. A simple plan of matching plantings to the proper site and matching the weed species to the planting would have prevented these common plot failures.

Another huge difference between these farms was Farm A always did its best to plant according to conditions versus a set date, meaning Farm A planted ahead of impending rain or into good soil moisture after a good rain – obviously during the proper planting window but always in the best conditions possible. This ensures you get good initial germination and your plantings off to a good start. As long as I have helped with Farm B it's always planted based on dates. The landowner is very busy and would schedule the planting date three months ahead of time! If that date got rained out it was common that it may be a month before the next planting date. Too wet, too dry, no rain in sight, it doesn't matter – we have two days to plant and we are planting. Obviously, this roll of the dice can get you into trouble and lead to poor germination and bad food plots.

The third large difference between Farms A & B was the mindset and goals of each food plot program. Farm A prioritizes feeding deer and wildlife year-round above all else and plants species that are always overlapping in maturity and providing quality food even in the off season. Farm B's main goal is to attract deer and turkey during hunting seasons. Every planting is viewed through the lens of what they will be eating and attracted to when we can hunt them. Farm B's food plot program often leaves major gaps of quality forage and the quality of bucks in the way of antler size and body weight is proof of it.

A fourth big difference between the two farms is how they interact with the neighbors on bordering properties. Farm A has worked for years to contact and build relationships with all the hunters and landowners that have tracts that border or are in close proximity to his place. He shares his trail camera pictures with those folks and gives his thoughts on ages of specific deer, doe numbers, predator populations, and when he harvests deer or sightings while hunting. Although landowner A isn't close with all his neighbors, he does have the ability to contact them and a decent working relationship that has been built over time. This has led to increased communication with neighbors, which has helped to raise the age structure of the deer herd significantly. Turns out that when those neighbors realized that the 2- or 3-year-old bucks they were seeing on trail cam weren't going to be harvested by a hunter on Farm A or other neighbors they were much more willing to pass on the deer, allowing it to reach upper age

Another measurement tool I like to use to see if the habitat and management practices are dialed in on a farm is to look at the antlers of my young bucks. If I see 9-point plus frames with good mass and extra points on young bucks, I know we are doing something (and often a lot of things) right. If you guessed that this buck came from Farm A you are right. Farm B, although situated just down the road, has very few bucks over 8 points both past and present.

Blue ribbon food plots such as the one pictured are possible when the proper steps are taken and you plant based on conditions versus the calendar alone.

Keeping tabs on doe numbers, buck ages, and overall deer density can be an excellent way to set doe harvest and buck harvest criteria for the fall. This will keep deer populations managed in accordance to food availability and ensure the right bucks get harvested based on their age and antler quality.

classes and ultimately increased antler growth. It also helped with deer retrieval if a wounded deer crosses property lines and helped to know if a buck was alive somewhere if not seen by cameras on Farm A.

Farm A has had similar results sharing information on turkeys. By letting the neighbors know that Jakes are off limits on the farm they feel comfortable passing them on their properties as well. The neighbors also know that Farm A sets a limit of two long-beard Toms being harvested off the farm in a season. This helps build the mindset of leaving game to hunt the following season and a respect for the resource. It appears to have caught on because all game populations are flourishing in the "neighborhood" of Farm A. Also, Farm A introduced a good trapper that works his farms to the neighbors. This allows the trapper's work to take place across multiple farms in the area, allowing predator populations to be managed across a much larger footprint than just the 400ish acres of Farm A. Farm B takes a bit more of an isolationist approach. In my opinion, the landowner looks at his place more like an island. He seems to know little about his neighbors and shows no interest in getting to know them or their hunting habits and management practices. He's made the comment before that the deer and turkeys that live on his place have very little reason to leave and they don't step off his 400ish acres. Fact is that's highly unlikely. I've hunted, ran many trail cameras, and managed many properties in similar areas and terrain as his. Even on much larger and better managed properties that have an abundance of food and cover and are lightly hunted, deer and turkeys frequently use other properties to varying degrees. One of my good friends killed a large and very unique buck in early November of this year. He and few other friends had the buck on cameras spread out on various farms that spanned over 6.5 miles from one another. This deer had access to well managed property with food plots and was lightly hunted and yet he still roamed widely. Treating your farm as a piece of a greater puzzle, regardless of size, is always a good idea. Looking to build relationships with neighbors in an effort to elevate age structure of a deer herd and prevalence of all game can work and Farm A's quality and quantity of game is proof of that.

Another separating factor between the farms is willingness to track specific bucks from year to year and managing doe numbers. Both farms utilize trail cameras heavily and have their farms well saturated with them. What I've noticed between them though is Farm A saves his pictures from year to year, allowing him to better age bucks at present. This allows Farm A to confidently be able to discern if they are looking at a great 3.5-year-old buck that could really be a giant the following year if passed this fall or a mediocre 5-year-old that needs to be harvested. This allows bucks with the best genetic potential for antler growth to reach older age classes and continue to spread their genetic material, and at the same time, removing lower quality antlered bucks, stopping the spread of their genes, allowing the space and resources they consume being left to better deer. The years of past picture data let us know how old these deer are so we aren't guessing. Farm B rarely saves pictures from year to year and if questioned on how old they thought a deer was, comes back with a wide range of answers that are often based on antler size. This typically leads to "high grading" where the best genetic bucks for antler growth are killed at a young age, removing their ability to grow a larger set of antlers the next year and spread their genetic material. Even worse, they often leave the smaller antlered bucks of the same age to live to see the next season, further spreading their genetic material and consuming resources. Yet another reason you can have a

wall full of 100-130" deer from over the years and just down the road they are hunting and harvesting 150" plus bucks regularly.

Also Farm A keeps close tabs on the doe population from year to year and works hard to keep the population balanced and below the farm's carrying capacity. Shooting does can be fun but it's work and can be time consuming. It's vital though to ensure deer populations stay low so that there is an abundance of quality food for the remaining deer. Farm B doesn't prioritize killing does and couldn't give you an educated guess on how many are on the farm. This has led to an extremely high population of deer that are in constant competition for resources. They eat food plots to the ground and, in dry years, can completely wipe out highly preferred native browse. Not to mention that they make the farm hard to hunt due to deer bedding everywhere and lots of old smart does living there.

Although both farms actively manage timber, Farm A separates itself here as well. Farm A prioritizes sunlight reaching the forest floor and the creation of quality browse and cover through the management of early successional habitat. Farm A has forgone future timber income by not planting back areas of clear cut and allowing constant early successional regeneration with the use of prescribed fire. Farm B has had timber harvests in the past but is looking to maximize timber returns versus creating quality wildlife habitats. That's fine but you'll certainly see a difference in habitat quality and that will corelate directly with the abundance and health of the wildlife each farm is producing.

Also, Farm A is flat out hunted better, as well as being laid out properly for hunting. Factors like wind and thermals, where the deer will bed and feed during parts of the hunting season, are all taken into consideration on Farm A. This directly leads to deer, and even turkeys, spending significantly more time on the farm and being harvested there or allowed to reach another year of growth safe from the neighbors. It's also hunted lightly and under the appropriate conditions. Farm B is hunted hard and based on the calendar, not on the conditions. ATV's are used to move across the property, alerting deer and sending them to the neighbors' farms. Wind directions and thermals don't get considered much and stands are located based on the view versus access and undetectability. This leads to poor hunts, spooked deer, and increased time that deer spend in safer areas on neighboring tracts.

Farm A has also shown a great willingness to take advice and learn. This allows Farm A to be responsive and make changes for the betterment of the farm and the animals that live there. Farm B is more stuck in its ways and continues to do things for no other reason than that's how they've always been done. This mentality can leave a property stuck in a rut and never realize its true potential.

The last difference is very apparent between the two landowners is their use of state, federal, and local programs and funding. Landowner A studies all available programs that provide cost-share money or direct payment for habitat or conservation practices. This has led to monies being issued that can be used to plant food plots, build roads, conduct prescribed fire, etc. Some of these programs include the planting and management of pollinator habitats, planting of certain trees, reforestation of fields, etc. and all have fit nicely into the farm's existing habitat plan and management program. Landowner B isn't interested in these programs and is admittingly too busy to learn. Staying on top of these programs has allowed Landowner A to receive funding to increase the habitat on the farm that he otherwise would not have been able to afford.

I hope this article has left you with a better understanding of how utilizing the proper strategies, being thoughtful, having a plan, working with neighbors, and being willing to learn and take advice can affect your farm and its abilities to reach its full potential and ultimately your goals. Also, I want to make note that I'm not bashing Landowner B or his farm. I'm simply pointing out the differences in each landowner to illustrate some of the reasons one farm can perform so much better than a similar farm in close proximity. Take the time this year, as deer season winds down, to access your plans and management practices and see if you have fallen into any of these pitfalls. If so, work this next year to correct these issues and your farm will be on the right track to meet its full potential.

Utilizing a no-till drill when planting your food plots is an excellent choice to prevent soil erosion, death of soil life, aid in soil moisture retention, and more. Remember healthy soil equals healthy plants, that in turn, make healthy wildlife.

Building Your Small Dream Pond

By Scott Brown

Small pond does not necessarily mean small fish. Bass like this can be grown in small ponds, and be pleasurable to catch. This 16.5" under two-year-old bass weighs 3.7 lbs.

Occasionally we meet a landowner already with or builds a small pond (under two acres) who does all the recommendations we provide to make the very best pond possible under their specific environmental conditions. As most of you know, fish and wildlife management is not cheap. From high quality consulting, to equipment, to products. As a lake manager we often have to work within the landowner's budget. We provide a list of options and prices and then the landowner, with our advice, can pick and choose which options they can pay for at that time. But with a small pond, more things can be accomplished with less costs. The largemouth bass is usually the target species, since it is the most highly sought after freshwater fish and most researched and managed across the country. We currently have a long-time client with a new 1.7-acre pond that is two years old and he has accomplished incredible numbers and growth in just two years.

Physical Traits

Physical aspects of a pond are important to creating the optimal sport fishery. In my opinion the optimal size water body where all management techniques can be implemented is 10 - 20 acres in size. Any larger and it starts becoming harder to manipulate water chemistry and vegetation, remove the proper number of small bass, and a few other parameters. However, some landowners only can afford to build a pond of a couple acres or take over an existing pond on a newly purchased property. Whether you are building a new pond or can drain and modify your existing pond, creating as much shoreline as possible is the goal. Largemouth bass, and many of the forage species are literal zone (edge/shoreline) species, and the more shoreline present the better. Straight shorelines are undesirable. To increase shoreline presence, islands can also be added to big lakes, but usually not in small ponds, because there is not enough room.

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If building a small pond, create a design and game plan before breaking ground. Just winging it will leave you with headaches down the road either with water chemistry or habitat issues. Photo Credit: Ryan Engel

Shoreline slope can vary, but do not make a lot of it less than 1-to-3. The more gradual the slope, the more shoreline plants you will have, farther out into the pond. You want some vegetation, but not to where frequent herbicide treatments are necessary. Allow the water depth and water color to manage the plant growth, not spraying.

It's always a big day when your bass are stocked. They can be under an inch if no bass are already present. These went in in May 2024 and were almost 17 inches, weighing 3.8 lbs. in 17 months. Photo Credit: Ryan Engel

Pond depth should be no more than 15 feet. The bottom should not be like a bath tub. The bottom should be irregular with rises and drops. If you or nature maintains a four-foot visibility, water four feet deep or less will have vegetation problems. When creating this perfect bottom, do not isolate deep holes, but interconnect them all with canals so the water does not become trapped and moves around the lake and can be mixed with sub-surface aeration.

Adding a small boat ramp (gravel), that can be used during wet weather as well as dry is advised. Clear any trees and/or stumps that may hinder launching boats that may scratch vehicles or damage tires. Also, adding a small dock for access to water, swimming, fishing and lounging is always nice. Docks can be places for inexperienced anglers to fish where fish are congregated at a feeder or nearby fish attractors where getting snagged is less likely. Have electricity at the dock for boat battery charging, edge and railing lights, and/or an aeration system or fountain.

With a small pond, placing various nesting boxes around it will draw various species of birds nearby, such as wood duck, bluebirds, bats and owls.

Planting fruit trees up the hills from a small pond allows them to receive a lot of sunlight, are aesthetically pleasing when in bloom, and attract wildlife into the open when the fruit is ripe and falling.

Water Chemistry

When having water chemistry sampling performed, have it done in both morning and afternoon, and during all four seasons to understand the fluctuations during the day and between seasons. Large fluctuations in pH can stress fish and may be a limiting factor in fish growth if this occurs. Extreme daily pH fluctuations can also kill fish. The pH, alkalinity and hardness are all interrelated and affect the ability to manipulate or naturally have an algae bloom and dictate what kinds of plants will grow. The presence of an algae bloom has shown a waterbody can have an increase of up-to 400% more fish

than one without. But it is harder to manage a good algae bloom in small ponds, as they can become super saturated with a bloom, risking a low Dissolved Oxygen (DO) die-off. Once we have pH in the desirable ranges, fertilization can begin. Depending on the influence (water coming in) of your waterbody, pH should be checked every two-to-five-years.

A fertilization program needs to be conducted in a disciplined manner and monitored closely in small ponds, and in most situations, we recommend not doing one in a small pond. If you choose to begin a fertilization program, first you must check the pH in the pond and adjust as necessary prior to starting to add fertilizer. A pH of 6.5-8 is desired. Add two tons per acre of agricultural limestone to raise pH one point. This should be spread into the pond from shore and deposited under water on the lake bottom in fall. Some can be spread at the inflow, so as water comes in, it flows over and dissolves lime and is added to the water. Once fertilizing is started in the late winter/early spring, it has to be checked every three weeks, without gaps and not stopped until late fall/early winter when the growing season ends and water begins to clear.

Planning everything before construction starts is important. This pond may be small, but it is the landowners dream with amenities and an outstanding fish population. Photo Credit: Ryan Engel

There are many pond fertilizer brands on the market, or you can still perform it old school with a regular mix as opposed to a specially formulated pond brand. Since it will not take a lot of fertilizer in a small pond, I recommend a fertilizer specifically designed for ponds where application is much easier than using regular fertilizer. Either way, follow the instructions. More is not better than the label prescribes. Maintain visibility between 18 and 36 inches. Any time you check visibility and it is ≥ 36 inches, add the prescribed amount per acre. Always have a lot more on hand than you will need. You do not want to need for it and it not available on site. While you wait for fertilizer that was ordered the water will begin to clear and nuisance shoreline and submerged vegetation and filamentous algae will begin to grow and require spraying when it is unnecessary with the prescribed visibility.

Creating good offshore habitat when building the pond helps both forage and bass. Photo Credit: Ryan Engel

Maintaining a good DO level is critical. During summer and winter lakes stratify (become layered) where higher DO water is at the top and lower or non-existent near the bottom. To prevent this layering and add DO to the water, bottom aeration can be added. Besides adding DO, this mixing will create good water quality throughout the water column and allow fish to use all the depths, not just the top 6-7 feet during summer and winter. This mixing opens more acre feet of area and habitat to fish, increasing the waterbody's carrying capacity. How big an aeration system required will be determined by how many acres and how deep it is. The deeper, the less bubblers you will need. This is a good practice on small ponds, as it can add a lot of acre feet usable by fish all year long in your pond.

Maintaining constant good water quality and eliminating stress to fish promotes better growth and longer life. It will also allow your lake to support more fish/forage to aid in largemouth bass growth.

Habitat

Shoreline and offshore habitat aids in harboring all sizes and species of fish at some point throughout the year. Desirable, native plant species that are easily controlled are best. With a new lake, you have the opportunity to plant what you want where you want it. Aquascaping a lake is no different than landscaping, but it's around and in water. The exact same rules apply with creating a layout where plants grow best and together creating both quality fish habitat and aesthetics around the lake. As soon as you start to dig a lake, plants will start

to grow around it. Usually, these species are undesirable, and in some instances, exotic species. Trying to control what species will grow around a lake from the beginning is easier than managing undesirables after they move in and switching to desirables. These plants can be obtained from specialized aquatic nurseries or from nearby donor sites. Create a planting map on which species will go where, considering each species required water depth, amount of daily sunlight needed and soil requirements. Since it is a small waterbody, planting more individuals (denser) is recommended so it fills in quicker, along with buying larger plants, that tend to have a higher survival rate. Be careful not to relocate any exotic or nuisance species into your lake. Establishing routine aquatic vegetation treatments will help keep any potential problem vegetation, including filamentous algae in check. With a fertilization program there is always some filamentous algae growth and not allowing that to become an issue is best. If submerged vegetation becomes an issue, pond dye can help shade out sunlight and reduce plant growth on bottom, in deeper water.

To enhance spawning for bass and bream place gravel beds throughout the pond in 2-5 feet deep water. Placing areas of #57 gravel three inches deep, covering 4X10 foot areas will add quality nesting areas. It will also add areas for small invertebrates to thrive and small fish to feed. It is easier to add these when the lake is drained and dry, and you can drive on the lake bed, but they can be constructed from a boat if necessary. If there is a high organic sediment on the bottom, placing gravel in plastic kiddie pools and lowering onto the lake bottom, works well also in ponds. Rip-rap underwater along the dam can create habitat for small fish, aquatic insects, and crayfish.

Offshore fish attractors also increase habitat presence. With an aeration system in place, you can place these in all depths around the pond. Creating a group of 3-4 artificial trees or Christmas trees, marked with a solid foam duck decoy does well. Artificial materials are more expensive but work better because they never decompose or have to be refurbished. Approximately 1-3 of these small groups per pond will be a good start. Dropping a large tree or two with root ball or partial trunk on shore, 90° from shore, with crown mostly underwater creates great habitat.

Another monumental day, the first bass caught from the dream pond. This bass is five months old. It grew on unlimited mosquitofish, fathead minnows and most recently young bluegill hatched in the pond. Photo Credit: Ryan Engel

A shoreline/dock fish feeder will help congregate fish for the novice angler while increasing growth rates of bream, shiners and channel catfish, and increase the lake's carrying capacity. Usually, one feeder on a dock or shoreline point, or possibly two, depending on pond shape (spreads the supplemental feeding around, reaching most of the fish population). With a small pond and feeding less, we recommend one of the better (higher priced) sinking/floating, multi-sized fish feeds.

Fish

Largemouth Bass growth and reproduction is partially determined by the environment they are in and their genetic makeup. If the pond is less than one acre, we recommend not stocking largemouth bass that will reproduce, and create a bream catfish pond, or bream, golden shiner and striped bass hybrid or female only largemouth bass pond. It is hard to control bass numbers when below one acre. If your pond is brand new, you have a decision to make. Do you stock Northern, Florida/Northerner cross (Tiger Bass) or straight Florida largemouth bass? The make-up and surroundings of your pond may decide for you which to stock. If your lake has the

This is the second-generation bluegill, whose parents were stocked just nine months earlier. High protein feed, good habitat and water chemistry grew the parents fast enough to reach maturity and spawn the first year, which is unusually fast. Photo Credit: Ryan Engel

chance of getting bass from another nearby waterbody or wetland system, then stocking what's there is probably the best action. Possibly stocking pure Florida's knowing someday Northerners may get introduced and for a short time you will have the Florida/Northern cross is to your liking. If your waterbody is isolated and no chance of local fish getting into it, stocking the pure strain Florida bass is another option. With unlimited forage it can reach double digits within eight years, but I would probably stay away from these, unless you try and stock with female only Florida bass. In small pond scenarios we recommend the Tiger bass where legal. It grows faster. In a two-acre pond, there is only so much room for big fish, so more 4-8 pounders is better than one ten-pounder, in our opinion for small ponds. Whichever genetic bass you choose, having unlimited forage throughout its life cycle and removing small bass is required to reach their full potential. Your stocking rates depend on which one above you stock. Normally in small ponds we stock the predators 6-12 months after the forage goes in. If stocking reproducing largemouth bass, stock at a rate of 25-50 per acre. The fewer stocked, the faster the initial bass will grow. If stocking non-reproducing largemouth bass, stock 40 per acre per every-other-year. Our case study pond in central Georgia is two years old with bass 18-month-old largemouth that are near 17" long, and weigh four pounds, with a Relative-Weight of near 150%. Where anything over 100% is excellent.

Besides Largemouth bass, you can stock the non-reproducing hybrid striped bass (Sunshine Bass, Palmetto Bass, Wiper) instead. Do not stock both the largemouth and hybrid striped bass. Striped bass hybrids grow to 5-7 lbs. are fun to catch, good table fare and live about 5-7 years. If stocking non-reproducing hybrid striped bass, stock 40 per acre per every-other-year. When stocking non reproducing fish, stagger the years so you do not experience boom and bust, but have fish always in the wings as the older ones die off.

Every species of fish stocked into the lake should be there to help reach your objective. In most dream ponds it's the largemouth bass. Do not stock crappie into a two acre or less pond. They will take over. All fish species present or stocked needs to help with the growth of largemouth bass or bream. Our goal is to fill the lake with a lot of high-quality bass. Providing forage (food) throughout a bass's life cycle is necessary for it to reach its maximum potential in growth and numbers. In the case of forage, more is better. We need forage for bass 1 inch long to 28 inches long, from January through December every year. Good bass forage species in small ponds include bluegill, golden shiners, fathead minnows, mosquitofish, tilapia, trout and crayfish. Some of these species may only need stocking once and others will need stocking annually. Bluegill is the main forage species for largemouth bass. I like the variety because the bass can feed in different areas, get different sizes, various protein levels and that alleviates some of the pressure off the bluegill to where it is self-sustaining. The golden shiner is another self-sustain species, but should it get over preyed upon it can also be stocked annually or when numbers get low. The shiners are also favorite forages in small lakes for the hybrid striped bass. Mosquitofish and fathead minnows will self-sustain under the right conditions. If mosquitofish (easier than fatheads) do not establish, I recommend stocking fathead minnows annually to help the bass under 10 inches grow. Again, these small fish will also benefit any large bream present. The tilapia and trout are stocked to provide forage during specific times of the year. Tilapia get stocked in early spring

Patience when creating your dream pond is required. This landowner did everything recommended and did not stock his bass until you could almost walk across the pond on all the forage fish present, which the feeder accelerated their growth and got them to spawn before the two-inch bass arrived.

and die-off in late fall or early winter. Trout are stocked in fall and die off in spring. When stocking trout remember the bass feeding will slow during colder weather, so overstocking is a waste as any non-eaten individuals will die the following spring. We have witnessed this too often where too many trout were purchased only for them to be wasted as a winter forage. Feed trained trout that are fed and grow over the winter can be harvested for table fare before they die off in the spring. In this case more is not better. Crayfish survive better with rocks, vegetation or cypress tree trunks and knees to hide and live around. They can be stocked annually or when it is noticed they are no longer part of the bass' diet. Again, with a small pond, the funding amount for stocking is less and more achievable than a larger waterbody.

With any intense largemouth bass management, harvest is necessary. Even more important in small ponds. In highly productive small ponds, the target size to harvest small largemouth bass will move and may include more size groups and include more individuals than typical recommendations. The harvest is to remove biomass (weight, not numbers) and target size for removing fish where the bottle neck occurs. Instead of the normal 20 per acre, it could be as high as 40 or 50 per acre in a small pond. Electrofishing and harvest data combined will identify the target sizes of largemouth bass needed to be removed. In a small pond, that target number is more achievable than in a 20-plus acre lake. Hook and line or electrofishing are the best ways to remove them. In our case study pond, next spring the bass will be two years old, and removing largemouth bass will begin. The males will be considerably smaller than the females and most removed will be males, which helps increase the numbers of big fish down the road. All the money and quality habitat cannot overcome lack of bass removal. Small bass removal is a task more important than anything previously mentioned. Bream will also flourish in a highly productive pond and their harvest numbers can be high with quality bream $\geq$ 9 inches). Species such as gar, bowfin, pick-

This bass is 18 months old, 17.0 inches long and weighs 3.8 lbs., with a Relative-Weight of 141%, which is excellent. But keeping those growth rates that high will require a lot of small bass removal and monitoring forage presence starting at the conclusion of year two. Photo Credit: Ryan Engel

Removing small bass has its benefits. It is a crucial task in small pond management. Numbers must be greatly reduced so the remaining bass can grow at accelerated rates.

erel and green sunfish should be removed when caught. These species only compete with the bass, and have no value being in the population.

In the past you have heard me mentioned all the management strategies here, but normally it is in different forms addressing individual issues. Most pond owners don't do or cannot afford everything that is required to improve their lake or pond. With a small pond you have the advantage of everything being smaller, less time-consuming and cheaper. Most clients with lakes pick and choose what to do, and that's understandable. There are a few lake owners out there that have implemented everything we recommend, and I commend you, as you are reaching your lake's full potential. If you do everything feasible, your chances of growing high quality fish in a pond or lake is greatly improved, you will produce the best individuals for the genetic make-up of your fish possible, and you will be pleased with your results.

Pinus: The Biology and Ecology of Pines

by Ryan Shurette

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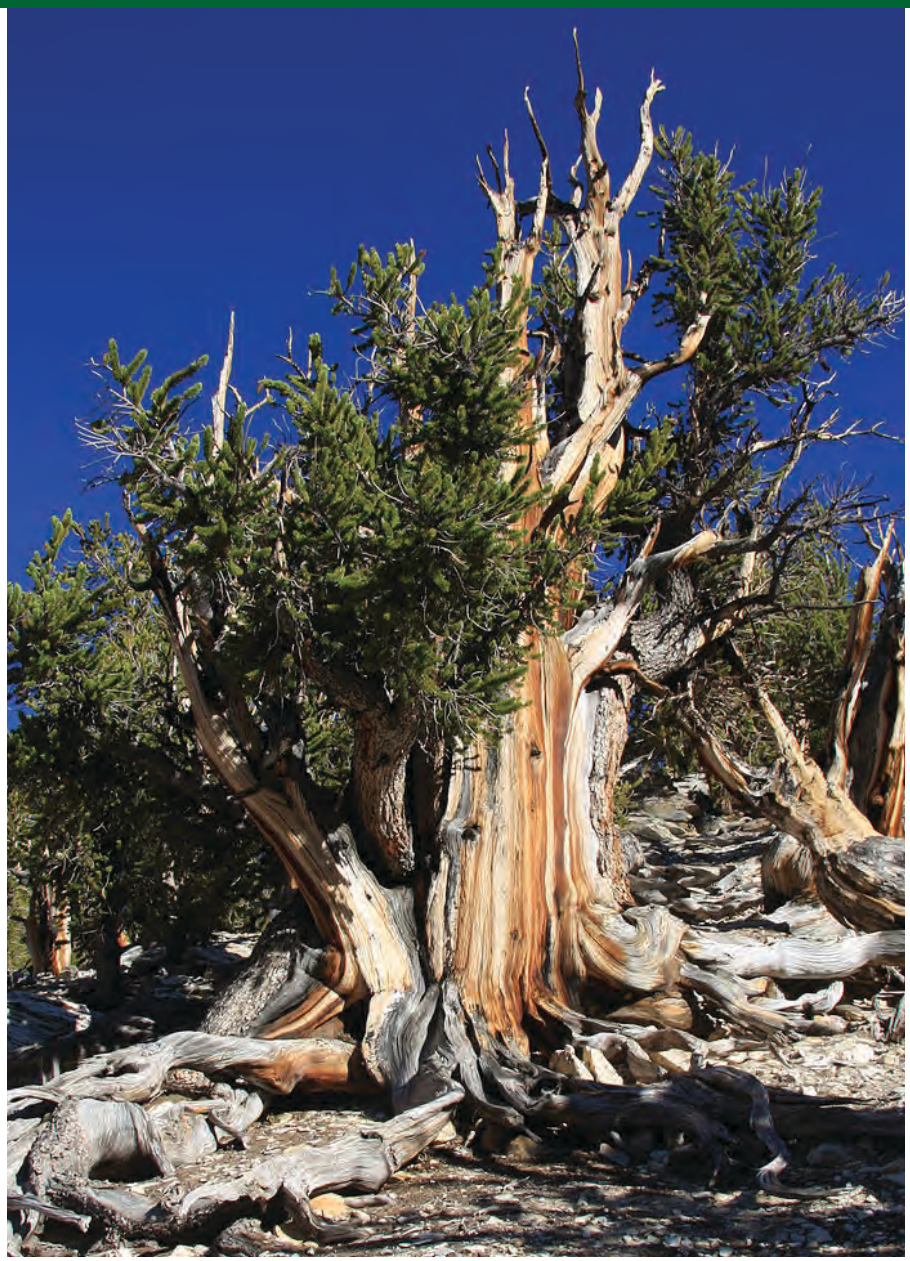

The Great Basin bristlecone pine holds the title of the world's oldest living individual tree. One tree in the Inyo National Forest in the eastern California Mountains was recorded as 5065 years old. Photo: Wikipedia commons

The year was 2833 BC. As the rising sun lit up the pale rocky hillsides of the White Mountains, on a piece of ground that would one day become the Inyo National Forest in eastern California, a Green-tailed towhee (cousin to the Eastern towhee) began his morning ritual. Since it was early spring this towhee was intent on singing from the highest perch he could find, a sentry position from which he could attract a female and warn other male Green-tailed towhees to stay out of his territory. His plot was situated in a sparsely scattered grove of gnarled Great Basin bristlecone pines (Pinus longaeva), and these are not tall trees. The meager understory consisted only of clumps of dwarf paintbrush, wax current, and western yarrow sprinkled here and there among the mostly barren rocky slopes. This place is a harsh environment with poor dry soil and cold winters. But to the towhee it was home. During his morning chorus, however, there were no signs of other towhees; no rival males and no lonesome females. So from the

tallest bristlecone on his turf (only about 25 feet high) he jadedly fluttered to the ground to scratch out a breakfast from whatever seeds or occasional insect he could find. A plump bristlecone pine seed, dropped from the parent tree above a few months earlier, lay helplessly on the dolomite rocks in front of the hungry towhee. He quickly spotted it and grabbed it up to swallow. Just as he plucked it from the rocks however he heard the soft call of a female a little ways down the slope, and in a nervous panic he took to the air, flying with high anxiety in her direction. In his frantic exodus he produced his best melodious song, and this allowed the lucky bristlecone seed to fall back to the ground and onto an open spot of loosely packed soil and slag fragments. The towhee pair went on to raise a family on that hillside, and in the meantime the pine seed germinated there in the poor desolate soil, with the assistance of a couple unseasonable rain showers. It grew at a respectable rate for the first few years and then slowed its development to a languishing crawl as it matured. Some 4848 years later, in the spring of 2015 I visited this grove of ancient trees with my family. I watched as Green-tailed towhees sang from the tip-tops of the old twisted bonsai-like relicts. There were young bristlecone seedlings and many juvenile (100-200 year old) "saplings" scattered around, as well as thousands of the old super-mature trees that have stood the test of time. The seedling from 2833 BC is still there somewhere too, and it is still alive! The exact location of the tree (named Methuselah) is kept secret since it once held the biologically significant title of the oldest non-clonal organism known to man. The new champion (5065 years old) was discovered somewhere in the same mountain system and it also remains anonymous for its protection.

Bristlecone pines certainly don't get in any hurry and the same can be said of many of our other North American pine species, including the ponderosa (~700 years), white (~500 years), longleaf (~400 years), lodgepole (~400 years), and shortleaf (~250 years) pines. Each species has its own unique characteristics, physiology, and niche in the regions it occupies. In this article we will examine some of the most common pine species and discuss their ecology and management with regards to native plant and wildlife communities.

Pines date back to the pre-Mesozoic Era, although a great deal of speciation has occurred since then. Within the genus Pinus itself, there are approximately 120 species (including trees and shrubs) and they are the most abundant type of conifer. Pines are found almost entirely in the Northern Hemisphere, especially in seasonally cool and cold climates. Photo: R. Shurette

First things first. A "pine" is technically a coniferous tree in the genus Pinus, within the family Pinaceae. The family contains about 250 species worldwide, including cedars, spruces, and firs. Many in this group date back to the pre-Mesozoic Era, although a great deal of speciation has occurred since then. Within the genus Pinus itself, there are approximately 120 species (including trees and shrubs). Pines are found almost entirely in the Northern Hemisphere, especially in seasonally cool and cold climates. Pines are evergreen and resinous, and they are among the most commercially significant tree species in North America, as they are prized for their timber and wood pulp value. In warmer regions like the Southeast, pines are typically fast-growing softwoods (at least for the first few decades of their lives) in nutrient rich soils. However they can be very slow growing on poorer sites. Many pines are often managed in short rotation artificially stocked plantations, primarily for pulp production and the paper making industry.

Thirty six species of native pines occur in North America. They are the most abundant conifer in the United States, and in many regions, they are the most abundant tree type. Pines are gymnosperms, as opposed to flowering plants (angiosperms), and therefore they typically do not rely on bees and other traditional pollinators for their survival. Instead, they are mainly wind pollinated. The Greek word "gymnosperm" means "naked seed". Pines, like all gymnosperms, have two types of cones. Smaller male cones are generally produced on new growth shoots and they are

Open fire-maintained shortleaf pine stands can provide the same high quality wildlife habitat as longleaf stands. This is directly related to the herbaceous understory associated with these systems. Bobwhite quail as well as many of the longleaf pine associates are just as content in these systems as they are in longleaf. Photo: R. Shurette

partly responsible for the copious clouds of yellow pollen each spring. The larger female cones are usually attached directly to heavier limbs and produce the winged seeds (originating between each scale) that spiral to the ground when the time is right for their dispersal. In some species, seeds are held until after a fire event. The fragrant resinous leaves, or needles, persist for two years and new needles are produced each year, allowing pines to remain evergreen. Pines typically have thick protective bark that offers protection from fire and other elements, but this varies also depending on species.

As we established earlier, the species of pines one may expect to find in a particular region will vary depending on soil type and climate. And so will the plant and wildlife species associated with the certain kinds of pine forests. One of the best known ecosystems in the southeastern US is the Longleaf pine (Pinus palustris) forest system, which historically extended from Virginia to Texas. As a species, the longleaf pine has three needles per fascicle that average 10-16 inches long. Female cones are large, ranging from 6-10 inches long. Due to the drastic reduction in its native extent, many now-rare species are tied to this tree species and its ecology. Lots of articles and research papers have been written about the importance of longleaf pine ecosystems, especially those forests found in the coastal plain regions. This species is indeed most common in low elevation, sandy soils. In fact the species epithet (palustris) actually means "swampy". This name is a little misleading however since longleaf actually thrives in dry and well-drained soil types, even sometimes growing in seemingly solid rock. There are actually significant forests of longleaf pine in the mountains of the Ridge and Valley ecoregion and throughout the hills of the Piedmont. These longleaf systems are sometimes referred to as "montane longeaf pine" forests. Montane longleaf pine is typically very slow growing due to poor site indices and harsh conditions. Studies have shown that montane longleaf also produces more abundant and frequent cone crops than the flatwoods longleaf pines.

The Red-cockaded woodpecker, Northern bobwhite, Eastern fox squirrel, Brown headed nuthatch, Eastern cottontail, Bachman's sparrow, Henslow's sparrow, Eastern diamondback rattlesnake, Eastern indigo snake, and Gopher tortoise, are all associates of healthy longleaf pine forest systems, with the latter three species restricted to the coastal plain regions. Healthy longleaf systems are generally those that are regularly exposed to, or maintained with, consistent fire. Longleaf pines are obviously very tolerant of fire. They have insulating bark and long insulating needles that protect meristem shoots from mortality during a burn event. In fact, many other pine species are also dependent on periodic fires for their long-term survival and reproduction, whether by promoting successful germination of seed, controlling competing vegetation, or both. As a seedling, the longleaf pine patiently sits in a low stature grass stage, typically for two to five years, building the carbohydrate energy reserves in its main tap root. Then when fire or some other disturbance comes along it bolts upward to take advantage of the available sunlight. Longleaf needles are resinous and very flammable and therefore can increase the likelihood that a lightning strike will ignite the stand. Any pine forest system (not just longleaf) that is fire adapted typically has abundant fine fuel understories. A grassy understory is made possible by the fire's control and/or elimination of the woody midstory (saplings and mid-canopy sized trees), thus allowing ample sunlight to reach the ground. Longleaf pine systems are known for their extremely high grass, forb, and legume diversity, and some

rare plant species (such as several pitcher plant species, Venus' flytrap, Panhandle lily, American chaffseed, Hairy wild indigo, and Barbara's buttons) also rely on these habitats. Therefore, one of the most effective and cost-efficient treatments in longleaf pine forests is prescribed fire. Once heavily utilized in the naval stores industry, longleaf pine is also highly prized for its timber value. Although it can be relatively slow starting on some sites, it is a prime timber species, and is important in the pole market in some regions. It has excellent structural timber quality and is moderately to very rot resistant at maturity when there is significant heartwood in the lumber. Although there were challenges in restocking longleaf up until a couple of decades ago, the high survival realized through containerized seedlings, as well as a better understanding of site preparation techniques, has made longleaf a much safer investment for managers. Due to its longevity most longleaf stands are managed at relatively long rotations (for financial and wildlife reasons) as compared to species like loblolly pine.

Shortleaf pine *(P. echinata)* is somewhat similar in its biology to longleaf pine. Shortleaf, however, is easily distinguished by its short (3-4 inch) needles in bundles of 2 or 3 per fascicle. They typically have numerous small (around 2 inches long) cones. With a historic range of 22 states, its habitat is similar to the longleaf. Shortleaf occurs on several acidic soil types including well drained sandy loams to rocky sites, and also sometimes on clay soil types. Like the longleaf ecosystem, shortleaf systems were also shaped largely by periodic fire on the landscape. It is believed that Shortleaf pine systems evolved with a fire return interval of 2-18 years (Pickens, 2019). As a larger sapling and a mature tree it can tolerate fire fairly well. However, small seedlings and saplings are not as fireproof as longleaf and typically do get top-killed during a burn. However, shortleaf is a re-sprouting species. Therefore, when regenerating shortleaf, fire is often excluded for a few years so that the seedlings can establish a significant root system from which to re-sprout, or until they can withstand the thermal stresses of the fire. From a timber management perspective, shortleaf is very similar in its quality and form to longleaf when mature (in the sawtimber market). Planting shortleaf is not nearly as popular as planting longleaf or loblolly, however. This trend is partly due to forest health concerns, particularly concerns from "littleleaf disease". Littleleaf disease is prevalent on the erodible clay soils of the Piedmont ecoregion and is often cause by stresses due to these soils and their nutrient deficiency, poor drainage, and variable moisture content (Campbell and Copeland, 1954). These stresses often lead to fungal (primarily Phytophthora cinnamomi) as well as nematode infections and ultimately cause death in the tree after a few years in most cases. While other pines in the Southeast are also susceptible to littleleaf disease, shortleaf pine is the most commonly affected species. Open fire-maintained shortleaf pine stands can provide the same high quality wildlife habitat as longleaf stands. Again, this has to do with the herbaceous understory associated with these systems. Bobwhite quail as well as many of the longleaf pine associates are often just as content in these systems as in longleaf.

The most common tree in many parts of the Southeast today is the Loblolly pine *(P. taeda)*. The native range of loblolly pine extends through the eastern United States from southern New Jersey south to central Florida and west to eastern Texas. This range includes the Gulf and Atlantic Coastal Plains, the Piedmont, the Cumberland Plateau, and the Ridge and Valley ecoregions. Loblolly has bundles of 3 needles (5-8 inches long) per fascicle and female cones of about 4 inches long. It commonly reaches heights of 80 feet. This pine can be very fast growing on high quality sites and typically prefers more mesic sites than the former two species of Southeastern pines. However, it can grow on a variety of acidic soil types. Loblolly has been used extensively throughout its native range for paper pulp production and currently exists in densely stocked plantations on millions of acres. Typically these plantations have lesser relative value when it comes to wildlife (both game and non-game species) habitat quality. This is due to the tight, closed canopy conditions and little to no herbaceous understory on the forest floor. While dense plantations do offer good cover for deer and some other species, a common management prescription is to thin these plantations if wildlife is a priority. Loblolly is not as fire tolerant at an early age as longleaf or shortleaf but in areas that are not burned on a short rotation it is an excellent pioneer tree species. Loblolly is generally a more efficient seeder than longleaf as evidenced by the rapid colonization seen in old fields, when mature seed source loblolly trees are present. After it persists to a few years old however, a loblolly pine can tolerate periodic fire and it can be managed with most of the same understory benefits of shortleaf and longleaf systems. In these cases, loblolly is sometimes referred to as a surrogate pine, taking the place of historically occurring pine forests (longleaf and shortleaf) that have been lost due to fire suppression and other land use changes.

Loblolly has similar wood quality traits as longleaf and shortleaf and is still the most commonly planted pine in the southeastern region. One forest health concern that managers sometimes face with loblolly is that it reaches its peak rather quickly (when compared to longleaf and shortleaf) on some dry nutrient-poor upland sites, sometimes as early as 30-40 years old. Loblolly decline can occur when it occurs on these soils for which it is not well-suited, and as a result the stands become stressed. In a weakened state they are attacked by bark beetles and root weevils, and are commonly infected in the process by one or more species of fungus (most commonly Leptographium sp.). On richer, more mesic sites this disease is not too much of a concern and the tree can live to be well over 130 years. Poor soils and overstocking (and other stressors such as injury) can also lead to infestation by Southern pine beetles, especially in Loblolly pine. These tiny beetles can wipe out thousands of acres of pine forests in a single season. Thinning in overstocked loblolly stands is often prescribed as a preventative treatment to defend against Southern pine beetle epidemics. Thinning improves the vigor of the remaining individual trees and helps to break the reproduction cycle of the beetle by exceeding their flight distance from tree to tree. Fusiform rust (caused by the fungus Cronartium quercuum) is another very important disease in Loblolly pine and it is recommended that mangers use "improved", rust-resistant, seedlings when purchasing from nurseries for replanting stands.

Loblolly has been used extensively throughout its native range for paper pulp production and currently exists in densely stocked plantations on millions of acres. Typically these shaded plantations have relatively low value when it comes to wildlife habitat quality. Photo: R. Shurette

With a range that extends from southern South Carolina to eastern Texas and south throughout Florida, in many wetter areas of the coastal plain, Slash pine *(P. elliottii)* becomes the dominant native forest type. Slash is similar to longleaf but it is more suited to semi-saturated and deeper sandy soils and often occupies wetter sites. It is still fairly tolerant of fire and has basically the same high quality wood and timber characteristic as the other southern yellow pines. Due to its high resin content it is often used for railroad ties, pilings, and poles (Lohrey and Kossuth, 1990). It was (and to a lesser extent) is still used as a resin source for the turpentine industry. Slash pines are sometimes difficult to discern from longleaf pines. They have fairly long needles (8-9 inches) and medium sized cones (3-6 inches in length) and express a similar growth habit and look as longleaf. They are also known to hybridize with both Longleaf and loblolly pines as well as Sand pine *(P. clausa)*, which also occupies similar habits in the southern coastal plain. There are two varieties of slash pine, the typical elliottii variety and the Florida variety, with the latter occurring throughout the entirety of Florida, and even into the Florida Keys. Slash is fast growing and is often planted for soil stabilization as well as for wood products in the Southeast. Slash is most commonly regenerated using even-aged silvicultural methods. These

consist of either artificial regeneration (clear-cut and replant with seedlings), or through natural regeneration using on-site parent trees (using a seed-tree or shelterwood method). The two most common diseases of Slash pine are Annosus root rot (caused by the fungus Heterobasidion annosum) and fusiform rust. Slash, like loblolly is often planted off-site on soils that it is not well suited for. This can sometimes cause problems with stand longevity. Regarding wildlife, slash pine seeds are consumed by many birds and small mammals and thick stands offer good cover for deer and other species. Red-cockaded woodpeckers will sometimes use this species, as well as bald eagles, for nesting (like the aforementioned southern yellow pines). This pine is often one of the most common overstory species in the wet flatwood ecosystem. This ecosystem is maintained by fire, but at probably a slightly less frequent rate (perhaps 5-7 years) as compared to upland longleaf ecosystems (Landers, 1991). Wet flatwoods can be very diverse in their herbaceous/shrub understories. They typically contain wiregrass (Aristida), blue maidencane, toothache grass, Carolina redroot, beaksedges, and various species of pitcherplants.

Changing the scenery completely, as we move up into the north half of Alabama and Georgia, through Tennessee, Kentucky and into Pennsylvania, New York, and Virginia we run into another common pine species, Virginia pine (P. virginiana). Virgina pine has short (1/2 to 3 inches long) twisted needles, with 2 per fascicle, and small cones of about the same length. Virginia pine prefers well-drained loam or clay in hilly terrain, but it also persists on very poor, sandy soil, or even rocky bluffs. Here in these harsh environments it often appears stunted and twisted. Virginia pine is short lived for a pine, usually only persisting 90 years or less. Unlike the other pines we've discussed, this species is poorly adapted to fire and is often found mixed in stands with hardwood species. It was historically used to produce mine timbers, railroad ties, and tar. Today it is used extensively for reclamation and rehabilitation purposes associated with coal mining operations, as it is fast growing. Virginia pine can sometimes produce good lumber but it is typically less desirable than the southern yellow pines. This species is also currently grown on tree farms for Christmas trees. Outside of this industry, Virginia pine is not commonly planted for timber production, although it has gained some popularity in recent years in the pulp industry. The Cherokee Indians used this species historically as a medicine for colds, fevers, and stomach ailments, as well as for a soap (from the needles). Other than providing thermal and tough cover, it has limited wildlife benefits.

Moving even farther north into Nova Scotia and across to the Northwest Territories of Canada down into the Great lakes area, the Jack pine (P. banksiana) is somewhat similar in its appearance to Virginia pine. It can form dense scrubby stands on poor sites and is ecologically important because it is the key habitat feature for breeding Kirtland's warblers, one of the rarest birds in the United States. This bird breeds only in large (100+ acres) stands of young jack pine in a very small area of Michigan. These young stands are often a result of periodic fire that causes mature jack pines to completely release their seeds. Kirkland's warblers winter in the Bahamas but depend on these specific young Jack pine habitats to breed. As they mature Jack pine stands generally become more open and host understory shrubs like blueberry.

The Eastern white pine (P. strobus) is a large, long-lived species found on well drained and rocky soils of the Appalachian Mountains and north into Maine, Canada, and the Great Lakes states. It is easily recognized by its blueish-green needles (2-5 inches) arranged in bundles of 5 per fascicle. It has loose slender cones and its branches are arranged in whorls on the trunk. Eastern white pine forests historically covered much of northeastern North America although only about one percent remains. The tallest eastern white pines are 180 feet. It has moderate to high wildlife value and its seeds are important for a variety of animals including red squirrels, crossbills, pine siskins, and others. White-tailed deer, rabbits, and other mammals browse it for forage, especially in winter. White pine produces high quality lumber and this species played a key role in the expansion of settlers and industry into the West. Historical reports from around the Chicago area in the 19th century tell of hundreds of thousands of big white pines per year being sent to the lumber yards. Prior to that time this species was also interestingly used regularly for building large square rigged sailing ship masts. Large white pines in the original Thirteen Colonies area were even known as "mast pines" and were marked with symbols of the crown, reserving their use by the British Royal navy. Today it is commonly grown in plantations for lumber, furniture-making, and sheared Christmas trees. White pine blister rust is an important disease for the species, caused by a non-native invasive fungus from Europe. Since its arrival about a hundred years ago, this fungus has taken a significant toll on many large populations of Eastern white

Jack pine is ecologically important because it is the key habitat feature for breeding Kirtland's warblers, one of the rarest birds in the United States. This bird breeds only in large stands of young Jack pine in a very small area of Michigan. Photo: USFWS

Healthy longleaf systems are generally those that are regularly exposed to, or maintained with, consistent fire. The Red-cockaded woodpecker (shown here) is an associate of healthy longleaf pine forest systems. Photo: R. Shurette

pines, and as it continues to spread it now threatens all nine species of native white pines in the US, including the Western white pine (P. monticola), and even the ancient bristlescone pine groves of the Southwest.

One of the most common and charismatic pines found in the mountains of the Southwest and north through the foothills of the Rockies, is the Ponderosa pine (P. ponderosa). Mature ponderosas are large trees and have yellowish-red bark with large bark plates divided by contrasting black furrows. The tallest was recorded in the Rogue River–Siskiyou National Forest in Oregon and measured 268 feet. Several subspecies and varieties exist but on average this species has needles in bundles of 2-3 and ranging from 4-8 inches long. They have long large taproots that help them withstand drought conditions for extended periods. Much like longleaf, this species is fire adapted and mature individuals are able to withstand periodic fire events due to their thick protective bark. They often grow in open savannahs or in scattered open woodlands with grass understories. At higher elevations ponderosa pine is commonly found in dense forest stands mixed with Douglas fir. Here it provides habitat for the endangered spotted owl. In the higher elevations the natural fire return interval is longer than on the drier ponderosa savannahs. Over time with fire suppression and land use changes these open systems, just like longleaf ecosystems, have declined sharply on the western landscape.

Farther to the north and northwest, the Lodgepole pine (P. contorta), or twisted pine, is another common pine of the West. It grows as far north as the Yukon in Canada and south through the Rockies, down the Cascades all the way into California. Its needles are short (1-2 inches) and occur in pairs. The species can occur as a shrub or a tree that reaches 150 feet tall, depending on site and subspecies. Lodgepole pines are common in Yosemite, Yellowstone, and several other western National Parks. In 1988 when the large Yellowstone wildfires burned, thousands of acres of these trees were killed, but now some 31 years later, dense stands of young lodgepole pine trees have established themselves from seeds of the former generation. This species is an effective recolonizer following fires or drought. It has excellent wood properties for lumber, plywood, and paneling, and is also used for furniture, windows, and fence posts. Lodgepole is used in modern horticulture industry as an ornamental tree and for large containerized bonsai specimens. The lodgepole pine gets its name from its historic (and modern day) use in structural poles for Native American teepees. Ecologically speaking, lodgepole forests are typically low in structural and species diversity and provide habitat for relatively few wildlife species. The Northern goshawk is one exception and can often be found nesting in western lodgepole pine forests. Interestingly, lodgepole pine is a serious invasive species in New Zealand.

In summary, pines are a fascinating part of the cultural and natural history of the country. While there are certainly several more species of pines that occur across the United States, these are some of the most common. Many are important from an ecological and wildlife habitat perspective, as well as com-

Eastern white pine (P. strobus) is a large, long-lived species found on well drained and rocky soils of the Appalachian Mountains and north into Maine, Canada, and the Great lakes states. It is easily recognized by its blueish-green needles (2-5 inches) arranged in bundles of 5 per fascicle and loose slender cones. Photo: Wikipedia commons

Mature Ponderosa pines are large trees and have yellowish-red bark with large bark plates divided by contrasting black furrows. The tallest was recorded in the Rogue River–Siskiyou National Forest in Oregon and measured 268 feet. Photo: Wikipedia commons

mercially. Soils, topography, climate, and periodic disturbances such as fire, can dictate where and to what extent pines occur on the landscape. Some systems host extremely rare plant and animal communities and some species live to become giants. Others, like the ancient bristlecones, seem to have the ability to make time stand still. Hopefully now as you travel across the country you will see the various species of pines along the way in a slightly different light.

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Wildlife Trends Journal Management Calendar

By Dave Edwards

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Fire is an exceptional tool for creating quality wildlife habitat. Take advantage of good fire weather days when they exist to complete dormant season burn plans.

Ensure doe harvest goals are met.

Doe harvest goals should always be based on data and the population management needs of a deer herd. When deer density is already within the desired range and the objective is to maintain that population level, a harvest is still necessary to remove the deer that were recruited into the population that year (i.e., fawns that survived and entered the adult herd). If the objective is to reduce deer density, harvest must exceed annual recruitment. As every Wildlife Population Dynamics student learns early on, population growth is simply births minus deaths.

Ideally, does should be harvested early in the season and preferably before the rut. Early harvest reduces pressure on food resources for the remaining deer and immediately improves the sex ratio heading into breeding season, conserving energy across the herd. A skewed sex ratio heavily favoring does can extend the breeding season, causing bucks to expend excessive energy—often losing up to 30% of their body weight. As a result, those bucks enter spring in a nutritional deficit, and the high-quality forage of spring goes toward basic recovery rather than body and antler development. An extended rut caused by an unbalanced sex ratio also results in poor hunting quality, particularly for mature bucks. When there are excessive numbers of does, bucks have little competition and spend less time seeking does during daylight. These conditions also result in less rutting activity in general - less chases, rubs, or scrapes. We commonly refer to this as a diluted rut.

By the time you receive this issue of Wildlife Trends, the hunting season will be winding down in most states. If you're short of your doe harvest goals, now is the time to act. If needed, recruit friends or club members to help. Hosting a "doe harvest weekend" can be an excellent way to build participation.

If you are short on achieving doe harvest goals for this year, now is the time to act!

Make it an event—hold a camp cookout and offer fun awards for the largest doe, the oldest doe, or the highest combined harvest weight. With the camaraderie that comes with it, these weekends often become some of the most memorable hunts of the entire year.

Strip disk areas to promote natural, desirable habitat for wildlife.

Strip disking is simply one of the easiest, cheapest, and most effective management practices to implement to create high quality food and cover for wildlife. Strip disking is as simple as it sounds. To strip disk, you merely drop the disk far enough into the soil to lightly break the surface of the ground. Lightly disking the ground will provide enough disturbance to stimulate the natural seed bank of wildlife friendly "weeds" the following spring and summer. Heavy disking like you were preparing a clean seedbed for planting a food plot is not needed. One pass is generally enough to stir the ground up and expose bare soils that will promote germination of desirable weeds. While not necessary, I often mow areas I plan to strip disk ahead of time. This makes disking more effective if vegetation is relatively thick or tall. It also knocks back/reduces competition of the undesirable or overgrown plants I am trying to replace. Strip disking can be done in thinned pine plantations, relatively open mature pine stands, roadsides, along the edges of food plots, or in open fields. Basically, anywhere sunlight can reach the ground will work. To optimize the benefit of strip disking, avoid disking straight lines. A serpentine pattern that winds through the habitat will provide the most edge and diversity. However, consider following the contour of the land to avoid creating potential erosion issues. Make the strips 8 - 25 feet wide, and separate them by undisked strips 60 to 100 feet wide. Make the strips as long as possible. These strips can be thought of as a rest-rotation system. After a year, disk another swath next to the previously disked strip. This develops a mosaic of vegetation that is one to three years old. Strip disking at different times of the year will result in different plant communities. While disking can be conducted any time of year, it is normally done in spring or fall. Fall/winter disking normally results in a broadleaf plant response, while spring/summer disking promotes native grasses. Altering the season in which you strip disk will add diversity to your property that will benefit various wildlife species.

Prepare dormant season prescribed burn plans and initiate burns as weather permits.

Fire is an effective management strategy that is relatively cheap to implement and results in better habitat for wildlife. If you have pines on your property, fire is an essential tool to improve wildlife habitat and should be on your annual task list. However, burn plans need to be well thought out and completed well ahead of time. With the exception of longleaf pine/coastal plain areas, most understory burning in the

Providing deer with high quality supplemental feed during late winter can provide a boost of energy and nutrition ahead of spring green up.

Southeast is conducted during the winter dormant season. Acceptable relative humidity, temperature, fuel moisture, and steady, persistent winds often occur during this period. Cool season burns are generally conducted between December and spring green up. In the deep south, try to conduct burns before March 15 to avoid destroying turkey nests. Cool season or winter burning is not only a good way to reduce fuel loads and control undesirable hardwoods in a pine stand (which reduces the chances of a wildfire that can be detrimental) but is also a great way to stimulate new understory plant growth which will result in quality food sources for wildlife. Fire rotations (interval of time between burning the same area again) vary depending on your goals and habitat types but are generally every 2-4 years to promote quality wildlife habitat. It is also a good idea to strategically plan your burns so that you always leave some areas unburned. How much area to burn will depend on your specific property and habitats. However, do not feel that you must burn large areas, say 50+ acres, to make a difference and create quality wildlife habitat. Relatively small burn areas in the 5-to-20-acre range are easily done in a couple hours and will make a difference. 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. Check with the US Forest Service for information regarding prescribed burning as well as examples of a burn plan. It is also a good idea to coordinate your burns with a professional land manager that has experience burning.

Provide supplemental feed for deer.

Even in the South, late winter can be a nutritionally stressful period for deer. They have endured the rigors of breeding season and natural food sources can be limited. Providing supplemental feed during this time can boost energy and nutrition. This recommendation/activity is directed towards landowners or managers that have done a good job managing the natural habitat, food plots, and deer herd conditions. That is, before thinking about starting a supplemental feeding program for deer on your property, you need to take care of foundational things first. In other words, you cannot hang shutters if you do not have a house – and you will not grow big bucks and a healthy herd with supplemental feed alone. It is a supplement to other management strategies and activities. However, when done in combination with other core management practices, supplemental feeding can be valuable for deer. Be sure to check your local game laws before providing feed on your property. Many states do not allow the use of feed during hunting season. Ideally, providing supplemental feed throughout the year is best, but supplemental feed will be most used and most valuable for deer in late winter and summer. These are periods when natural food availability is at its lowest. So, if you have a limited budget and cannot or do not want to feed throughout the year, provide it during the periods deer need it most.

Assess the progress of your management program and create a plan for improvements.

With hunting season winding down, it's time to revisit the wildlife management program on your property to assess whether or not your management strategies are working to help you achieve desired goals. Doing so may reveal limiting factors that may be preventing you from reaching your management goals or maximizing your efforts. In some cases, addressing a couple limiting factors that may not seem so impactful can be a game changer for the overall success of the program. Unfortunately, many landowners and hunting clubs keep

doing the same thing and expect different results. Depending on the wildlife species you are managing for, late winter or early spring is generally a great time to assess habitat needs, review current management strategies and how wildlife or habitat has responded to these strategies, and devise a plan for addressing any needs that are identified. While a general property assessment is easily done by a landowner, I recommend getting the assistance of a professional experienced wildlife biologist to help identify less obvious and often times overlooked strengths and weaknesses of your property or wildlife management program. I can't tell you how many times I have been helping a client where I made what I thought was an obvious recommendation that turned out that they had never thought about or recognized as a limiting factor. My point is that it is always good to get another set of eyes when assessing your property, particularly from someone that does not see the property often and/or someone that is an experienced wildlife/land manager. With the property wildlife management goals in mind, and from this assessment, you and/or your wildlife consultant can develop a list of several to many management activities that will address limiting factors identified. Depending on the property, this can be a relatively short list or a very long list of activities that need to be addressed. Many of you have heard me say this before, but consistent good hunting doesn't happen by accident. It takes planning, hard work, patience and an understanding that Mother Nature is dynamic and things are constantly changing requiring adjustments in management strategies to reach desired results.

Identify roads on your property that need attention.

Winter is often very wet in the mid-south which makes this a great time to identify and assess problem areas along roads where work will be needed next summer. Make notes or identify areas on maps that you can refer back to when you start to repair roads next spring or summer. You will be glad you did. Once your property dries out, it can be difficult to remember and/or find the areas that were bad during the hunting season. Although many landowners/hunters access properties during hunting season on 4-wheelers, electric carts, or other gas-powered ATV's that will certainly get through wet and slippery roads, roads are an important part of managing a property. If you are actively managing your property, you will need to be able to drive or transport large equipment such as spreader trucks, tractors, and agriculture buggies throughout the property. Thus, having good roads is essential.

Winter is a good time to identify and assess problem areas along roads where work will be needed next summer.

Trap and remove nest predators.

If managing for wild turkeys and quail are goals on the property you hunt, don't overlook the value of removing nest predators such as raccoons and opossums. Having said this, attempting to control predators should not be a priority if you are not actively managing the land to promote quality turkey and quail habitat. Creating and maintaining quality habitat should be the highest strategy on the list for managing game birds. Wild turkey is a species that responds quickly to good habitat management such as thinning timber, burning, understory control, food plots, roadside management, etc. However, research has clearly demonstrated that nest predators, particularly raccoons, can significantly impact nesting success rates and thus turkey population growth. Not only will they eat the eggs, but they may even kill the vulnerable hen turkey while incubating the nest. Winter is a great time to trap and remove nest predators. This is also when hunters spend the most time at a property. Trapping offers a great mid-day management activity during a weekend at the camp. The key in being successful and efficient is to pick good trap locations. Water sources, feeders, and food plots can be good places to start. There are many effective traps available. The most common are live traps (cage traps) and steel traps (leg hold traps). If you use leg hold traps, I recommend "soft-catch" or offset jaw traps. These traps do not damage the foot of the trapped animal in the event that

Because late winter is typically a slow time for equipment use, it is a great time to conduct preventive maintenance or repairs.

you catch a dog or other non-target critter. If you have never trapped before, you will learn a lot by trial and error. I recommend doing a little homework by surfing the web and YouTube to learn effective techniques. One more thing to know is that nest predators are prolific and have relatively high reproductive rates. This means that populations can rebound quickly. To be effective in controlling nest predators and helping turkeys and quail, you must significantly reduce nest predator populations and continue to aggressively remove them each year.

Conduct maintenance to equipment.

As a land manager, quality/working equipment is essential to success. While the list of equipment used to manage hunting/recreational properties is wide ranging, most managers have, use, and need the basics such as farm tractors, tractor implements (such as harrows, mowers, grain drills, spreaders, sprayers, etc.), UTVs, chainsaws, and other mechanical "hand tools." To remain in good working order, this equipment will require proper maintenance. Without maintenance, these tools will begin to wear down until they eventually break. This can result in costly repairs and added downtime in which projects fall behind until the machinery or equipment is fixed. Nothing is more frustrating than planning a food plot planting project, getting everything ready, finally getting the right weather and soil moisture, then having a tractor or implement breakdown. There are two forms of maintenance. The first being repair maintenance, which is conducted once the equipment has started to malfunction or has completely broken down. Preventative maintenance is a program designed to prevent equipment from failure – resulting in less repair maintenance. Preventative maintenance varies depending on the equipment but generally consists of checking/replacing fluids, seals, filters, hoses, blades, batteries and/or electrical parts, screws/bolts, etc. In a nutshell, it is giving equipment some love before neglect results in breakdowns. Winter is a great time to conduct preventative maintenance on equipment. Doing so can be a relatively easy project between hunts. Of course, there's absolutely no way to avoid breakdowns and damage in the long term. No matter how much care you give your equipment, it will ultimately breakdown. However, preventative maintenance certainly slows down functional decline but also helps keep equipment in reasonably good shape in the event that you decide to trade it in or sell for new. On larger more complicated equipment like farm tractors, skid steer machines, back hoes, etc., keep in mind that maintenance must be done properly to be effective. For this equipment, consider an annual "checkup" by a professional. Although hiring a professional mechanic to perform preventative maintenance and checkups will be an expense, it is money well spent. Part of your preventative maintenance program may include hiring a mechanic each winter to visit your "equipment shed" to perform checkups. One of my philosophies is that if you take care of your equipment, it will take care of you.

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