PRACTICAL WILDLIFE MANAGEMENT INFORMATION

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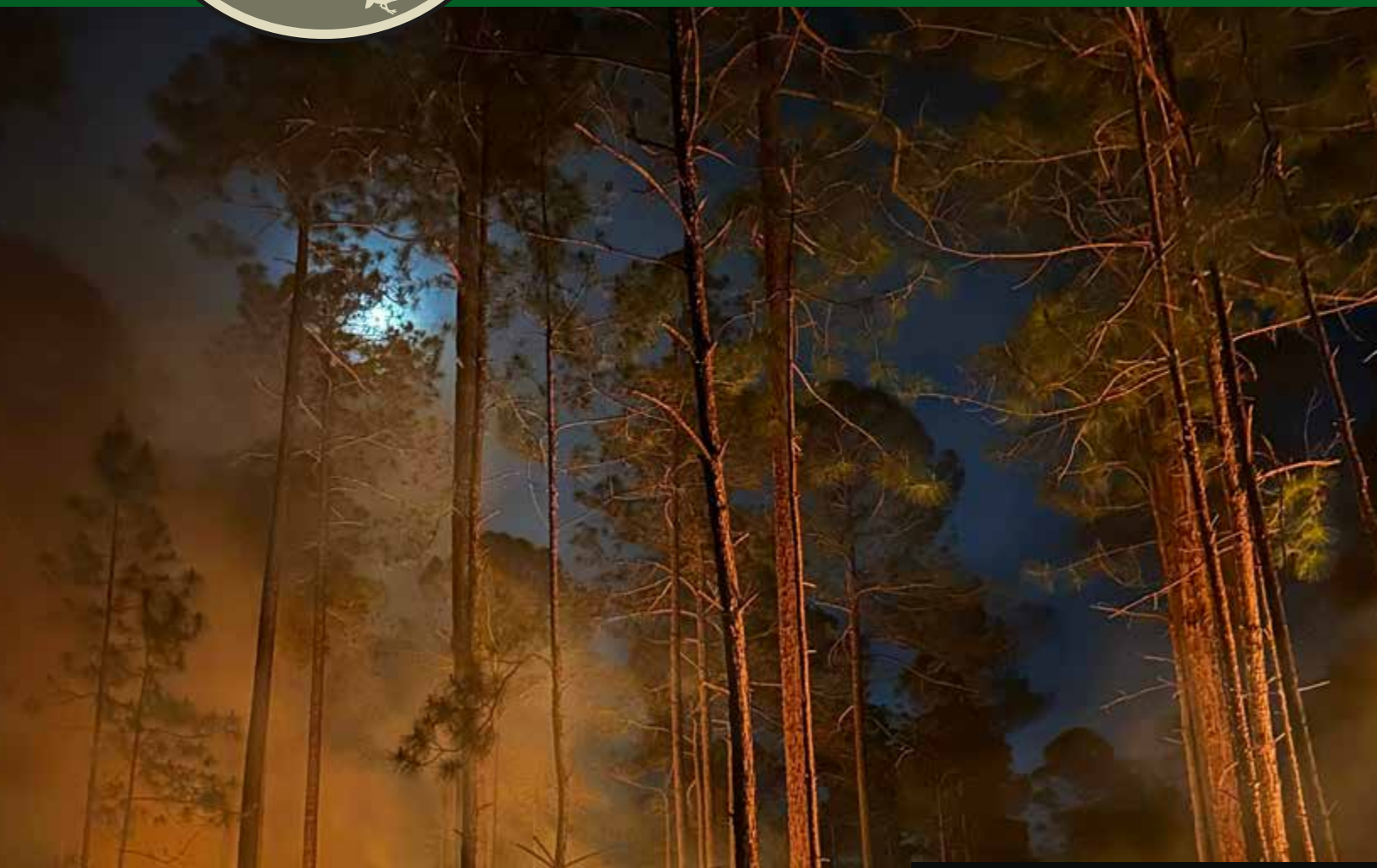

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Earl Says…

Summertime is upon us and for many of us it's summer food plot planting time. The article by Matt Petersen in this issue on Clover planting will be a great help to many of us.

And with Deer Season around the corner, here's a schedule of the Outdoor Hunting Shows where we'll be exhibiting this year. I hope to meet you this summer!

World Deer Expo – Birmingham, AL – July 21-23

Georgia Outdoor News Outdoor Blast – Emerson, GA – July 28-30

Buckmasters Expo – Montgomery, AL – August 18-20

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Cover Photo by Dave Edwards

Clover

By Matt Petersen

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The first food plot I ever planted was a field of perennial white clover. This would have been in the early 90's when I was in elementary school, and I can still remember that giant Whitetail buck on the bag. This plot was being planted by my dad and pawpaw and I was merely a spectator that was likely more in the way than anything. That first clover plot was a blend of perennial clovers that was sold by the Whitetail Institute who, to my knowledge, was the original food plot seed company. In those days in the Mid-South, white clover was synonymous with the word food plot to the point if you said we planted a food plot, it was safe to assume it was white clover being sowed. I can remember my pawpaw cutting ground and spreading seed with an old cloth hand seeder and me thinking that surely the giant buck on the bag would appear shortly after to eat our new clover plot. As we all know now, it doesn't quite work that way, but that fall, and for years after, we got to enjoy watching deer and turkeys feed on that plot and others we had planted together. This set the hook in me to plant food plots and led to many acres of clover being planted in the future.

WHY CLOVER

Clover is a fantastic forage crop that is selected very highly by all sorts of game and non-game species alike. Game species such as deer, turkeys, rabbits, and others relish the highly digestible leaves and seed heads and will seek out fields of clover when they are lush and producing well. Game birds such as turkeys, quail, pheasant, and others also enjoy clover for the rich bugging areas a field provides. If you've ever walked through a field of lush 8"+ high clover, you know exactly what I'm referring to. Grasshoppers, crickets, flies, beetles, worms, and all sorts of insect life can be found enjoying the lush foliage and roots. This bug food source is a very important component in the lives of young turkeys and other game birds, and hens with their poults will constantly be in clover plots searching for bugs. Also, clovers are an important source of pollen and nectar for all sorts of pollinating insects. Often when clover plots are in full bloom you can hear a low buzz from honeybees, bumble bees, and other pollinators flying around the plot and feeding on the clover flowers.

Clover is also quite versatile in its ability to grow and thrive in various conditions. There are many species and varieties of clover that are best suited for various conditions and, if properly paired with the correct site, can thrive where other food plot plantings struggle. Clovers tend to be very browse-tolerant (especially perennial clovers) and often can persist for many years if maintained properly and/or allowed to re-seed. Also, another aspect of clovers that is often overlooked that I think is the most valuable trait, is that clover is often thriving when other crops are dead and/or have had their forage exhausted. For example, in the Mid-South, most of our fall Ag crops, or fall food plots or spring crops, such as soybeans that were left to stand through winter, often have been depleted by mid-March. At the same time, the weather is starting to warm, and clovers are beginning to actively grow again. At this point, most of your high-quality native plants haven't begun to break dormancy and it's too early to plant any spring plots. Clover can fill the void in high-quality forage and give deer and other wildlife a highly nutritious food source when they desperately need it after going through the leanest season of the year – winter. The same can be said of late summer and early fall in certain areas in the country. It's often too early to plant fall plots, and maybe the summer was harsh on your annual spring plots, and they aren't producing well. One good thunderstorm and your clover plots are green, growing, and once again filling the gap in forage.

Clover is also fairly easy to plant and maintain. As mentioned earlier, it can persist for many years if

Annual clovers mixed in with beardless wheat can provide high-quality, year-round forage, and also offer great cover for fawns and poults.

A classic perennial white clover plot that's been planted in a semi-shady site where clover can persist for many years with proper management.

Another perennial white clover plot that was planted in a shady firebreak that only receives filtered sun. It's easy to see that clover can thrive under these conditions.

maintained properly so the initial investment of time, fertilizer, seed, etc. can be stretched out for multiple seasons. Again, it is highly browse-tolerant so it can be planted in small plots. It is the Swiss army knife of food plot plantings and is often the perfect choice for many plots.

CLOVER TYPES – ANNUAL VS. PERENNIAL

The definition of an **annual clover** is a plant that emerges from a seed, grows, makes seed, and dies in a 12-month time frame. Annual clovers do not re-produce from their root system, but only from seed. They are typically planted in the fall, and if growing conditions and fertilizing are favorable, will produce seed in late summer the following year. This seed will often germinate late in the fall of the same year (if conditions allow) and will provide a new crop of annual clover. Annual clovers come in many varieties such as **balansa**, **arrowleaf**, **crimson**, **berseem**, **ball**, and others. Each of these varieties have unique qualities of growth, re-seeding capability, browse tolerance, and site requirements. For a wildlife manager, it gives us the ability to select one of the species or to blend multiple species that will thrive on specific sites and under certain conditions. In my experience, annual clovers can be a great choice for drier sites that often become too dry for perennial clovers, can provide excellent forage and cover in the late spring through summer when fawns and poults are particularly vulnerable, and can be blended together to provide forage throughout the entire year. They also grow well with cereal grains, which can add further diversity in a plot.

The definition of a **perennial clover** is when individual plants can live for multiple years. **White clovers** are your classic perennial clovers that reproduce from stolons, as well as seed. There are many species of white clover (too many to list), but old classics such as **ladino**, **durana**, and **Dutch white clovers** all have their place. Again, all the different varieties of white clover have various qualities and attributes that make them a better choice for certain sites and growing conditions. Use these species like you would tools in a toolbox and they will thrive when paired with the correct site. **Red**

clovers are also considered a perennial crop that last multiple years but typically only two. They are great re-seeders and are very drought tolerant. I tend to mix red clovers in with all my white clover plantings for added diversity and summer production. Just as with the other clovers, there are multiple varieties of red clover that perform best in certain situations. Choose wisely according to your site.

SELECTING A SITE

One of the main reasons I see food plots fail, whether it be clover or any other food plot, is site selection. In the case of clover, and especially perennial clover, this is a critical factor to producing a quality crop, and even more important to allow that crop to persist for multiple years. In general, clover prefers heavier soils that hold moisture well. For perennial clover plantings that we want to thrive and grow for many years, I prefer moist bottomland type soils or upland sites that are smaller shady fields that can hold moisture better than full sun sites. These areas will allow clover to stay thick and lush on most years and allow them to provide lots of forage, as well as to stay thick to shade out most grass and weed competition. Again, select your variety of perennial clover according to your site specifics. A drier, more upland, large, or full sun field, where perennial clover is desired, would be best suited for an intermediate white clover such as durana, mixed with a drought tolerant red clover variety and a touch of chicory, which is a great drought tolerant companion to perennial clover. A large, moist bottomland field would be better suited for a ladino variety that prefers the heavy soil and will often out-produce an intermediate clover such as durana when moisture is not a limiting factor. Also, the various ladino and even Dutch varieties can be a perfect choice for shady or filtered sun environments, such as firebreaks or edges of woods, roads, gas lines, or narrow shooting lanes. These perennial clovers are well-suited to handle these high browse and low sun environments and often will out-compete most other plantings in forage production.

I often use my annual clovers in fields where perennial clovers won't persist due to the fact that these fields often become very dry and droughty during the summer. These fields tend to be full-sun upland sites or are situated on hills that don't soak in the quick rain from summertime thunderstorms. The annual clovers typically have no issue becoming established in those areas due to the abundance of rain they typically receive in the fall and early winter and tend to explode with growth in the spring. Annual clovers such as arrowleaf and balansa provide great cover and forage throughout late spring and into mid-summer and, once established, can be quite drought tolerant. When paired with a cereal grain they make lots of biomass that enriches the soil and clovers provide lots of nitrogen that will be available to the next crop. Simply put, there aren't many situations that an annual or perennial clover won't perform well in, as long as you pair the correct species and varieties to your site. Choose well and your clover will thrive.

SITE PREP

Another factor in your success in establishing a quality clover plot and often another overlooked one is site preparation. At this point, we know what kind of clover we want to plant, and we've selected the proper site for that species and variety. The next step is to pull a soil sample and see what the soil test tells us about the soil's pH and fertility levels. Clover will thrive in a pH of 6.5-7.0 and it's very important that we apply the correct amount of lime to get our soil's pH in that range. Also, adding the correct fertilizer according to your soil test results is important as well to establishing a quality plot. I tell folks all the time that I would rather see them plant half of their food plot acreage the proper way by applying the correct lime and fertilizer according to a soil test and using the appropriate planting methods versus planting double the acreage and trying to save time and money by simply not doing things correctly. Also, another vital component of plot preparation for clover plantings is seeing what's growing in the field now. Weeds, such as curly dock, thistles, wild mustard, nutsedge, sericea lespedeza, rushes, ground ivy, plantains, as well as horsenettle, along with grasses such as tall fescue and ryegrasses, can be hard to control in clover plots and should be eradicated before clover plots are established. I often use a broad-spectrum herbicide, such as **glyphosate** and/or **24D** to kill these weeds months in advance of my clover planting. I like to spray in advance of my clover planting long enough so that another generation of weeds and grass will germinate and grow before I plant, allowing another herbicide application before planting, if needed. I also have used Round-Up ready crops for a season or other species that allow control of specific weeds ahead of a clover planting. These tactics will go a long way to "cleaning up" a plot of problem weeds and grasses before planting your clover.

CLOVER PLANTING

At this point, we've selected our site, clover species and variety, soil tested, and added the required lime as far in advance of our planting as

possible, conducted any needed herbicide applications and are within the recommended planting dates for our region of the country, and it is time to plant. If you're planting your crop via conventional tillage, I would suggest using a disc harrow or a rototiller and cutting the soil down to bare mineral soil and getting the dirt as smooth as possible. Breaking the dirt up and preparing it to make a smooth, even seed bed is very important when planting a small-seeded and shallow planted crop, such as clover. If the plot is not level, it will often pool water in places and drown out your plants. If the plot is made up of large clods of dirt, the clover seed will fall in those cracks and get too deep, and when it germinates, the small seeds won't have enough energy to push out of the deep soil and reach the top of the ground allowing it to grow. Once the soil in the plot is in fairly good condition, I like to spread my fertilizer at this point, then I'll make one last pass with my roto-tiller or disc to incorporate the fertilizer in the root zone of the clover, 2"-4" deep. After this, I'll go over the plot one or two times with a cultipacker or a roller to firm up the plot and be sure that the soft dirt doesn't allow the clover to get too deep. The next step will be to spread your seed on top of the firmed-up ground. This can often be tricky for clover due to its low seeding rate and small seed size, and I typically prefer to spread mine by hand with an over the shoulder bag seeder. I normally will set my seeder low enough so that I can walk over the plot twice – once long ways, and once in the opposite direction (or short ways) – to ensure proper coverage. After my seed is applied, I simply cultipack or roll the plot one more time to be sure we have the proper seed to soil contact, and you're done.

This picture illustrates how well companion plants such as oats and chicory can grow with clover and increase forage quality and diversity.
clover types:

Another great planting method is utilizing a **no-till drill**. Most no-till planters have a small seed box specifically designed to plant very small seeds such as clover. If this tool is available to you, it's best to practice with the drill some and be sure you can plant your clover ¼"- ½" deep with your drill. This can often be tough with heavy drills or ground that's too wet or if the operator is unfamiliar with the equipment. If this shallow planting depth is achievable with the available equipment, no-till planting can be a great method of clover planting due to its ability to plant into undisturbed soil. By not having to disturb the soil, a manager can limit erosion and also limit grass and weed competition by not un-earthing a new generation of seed through tillage. To prepare the plot for no-till planting, it's best to use a non-selective herbicide such as glyphosate to eliminate all the existing vegetation in the plot. Be sure, if you need to use an herbicide such as 24D that has a residual effect, that you allow the appropriate time for the residual effect of the herbicide to dissipate before

The use of grass and broadleaf selective herbicide is often necessary in the maintenance of perennial clover stands to keep competition low and allow clover to thrive for multiple years.

planting your clover. After that, use your no-till planter to push in and cover your clover seed around that ¼" mark in the soil. You can apply fertilizer within a week or two before or after planting as long as your clover is dry.

Also, the most low-tech and low time input form of planting clover is frost seeding. **Frost seeding** is simply seeding clover right on top of the ground during the time of year when you're in the last 2–4-week weather period when you're getting frost in late winter or early spring. Clover seed is a small and hard seed that can lay dormant for a few months before it germi-

A thick, healthy stand of clover is the best defense against weeds and grass

nates. The heave action created by the ground freezing followed by it thawing and flattening back out does a great job or incorporating clover into the top ¼" of the soil. The key to this method being successful is seed to soil contact. If the field you desire to plant has a high layer of thatch or duff from past vegetation or has established plants growing in it, frost seeding will be a poor choice. Regardless of which method you choose to establish your clover, timing your clover planting ahead of incoming rain is always ideal.

It's often a good idea to add in nurse crops or crop companions with clover. A good example of a nurse crop with a perennial clover would be **oats**. Oats can be planted at the same time in the fall as perennial clover and if planted at ⅓ or ½ rate, allow enough room for the clover to grow well with them and establish. The oats will establish quicker than the clover and will take a lot of browse pressure off the clover early and allow it to take hold. A good example of a companion crop for annual clover is beardless wheat. Beardless wheat at ¼ or ½ rate allows plenty of room for annual clovers and will also act as a nurse crop while they become established. Beardless wheat also provides a seed head that deer, turkeys, and other game birds relish and add further diversity and attraction to an annual clover planting.

CLOVER MAINTENANCE

Maintaining clover properly is key to keeping a quality and thriving plot year-round. Luckily, clover does offer some herbicide flexibility as well as mechanical weed control options such as mowing. The key to these methods is knowing when and how to use them. We'll start by assuming you planted your plot this past fall and followed all the steps listed previously in the article to achieve a good stand of clover. The first bit of maintenance I would suggest would be frost seeding the clover during the last 2-4 weeks of frost for your area in late winter. I typically frost seed my established clover plots at a rate of 2-6 lbs. per acre depending on how thick or thin they looked the previous fall. If you had a very poor crop, you can even go up to a full seeding rate of clover. Again, this is best done with an over the shoulder bag spreader or another type of spreader that will allow you to plant a very low seeding rate of small seeds. Frost seeding will help your plot by filling in any dead spots of clover or thickening up the stand and keeping it constantly regenerating. The next window of maintenance will typically take place in spring to early summer and will be an herbicide application to control grass and broadleaf competition in your clover. As with any herbicide or maintenance, practice these as needed. It's important, too, that a manager learns to identify weeds and grass that he's looking to control. For grass control, I typically use **clethodim** but **sethoxydim** also works well. Refer to your product label for rates of use. If I'm just spraying a grass specific herbicide, I mix in crop seed oil to help the product stick and penetrate the plant tissue. If broadleaf control is required my go-to product is **Imazethapyr**, but **24DB** is also a common herbicide used to control broadleafs in clover. Refer to your product label for rate of use. When spraying broadleaf herbicides in clover I use a non-ionic surfactant to help the herbicide stick and penetrate the plant tissue. Grass herbicides and broadleaf herbicides can often be tank mixed together and sprayed in one pass, but again, refer to your product label and conduct a jar test to be sure they are compatible.

After this spring or late season herbicide applications on your clover, you'll typically need to mow your perennial clover once or twice throughout the growing season. Again, it's all on an as-needed basis. If the deer are keeping the clover eaten down well and there aren't any weeds in the clover to be concerned about, I won't mow them. If the clover has gotten really tall (perennial clover) or if weeds are becoming too dense or are about to produce seed then I'll mow the clover around that 4"-6" mark, being sure to leave forage for wildlife and not cutting the clover too short to stress it out. I also want to time this mowing ahead of incoming rain so that the clover can bounce back quickly with new growth for wildlife and will prevent future weed and grass growth by shading out the ground.

At this point, it's late summer or early fall and I'm assessing my clover plot for weeds, grass, and overall performance. I'll make another herbicide application if necessary and apply fertilizer according to a soil test and will have come full circle from last year's initial planting.

CONCLUSION

In conclusion, clover is a fantastic food plot crop for all sorts of wildlife species of both game and non-game alike. It's a very versatile planting that comes in a wide range of species and varieties. When paired with the proper site, planted, and maintained correctly, both perennial and annual clovers can thrive and provide quality and forage throughout the year. Without a doubt, if you're looking to provide year-round quality forage on your property for wildlife, clover needs to be planted on it!

Supplemental Food for Thought

By Dr. Theron Terhune

Dr. Theron Terhune is a Wildlife Biologist and Research Scientist at a private-owned property near Wilmington, NC and a Research Fellow at the Spatial Informatics Group – Natural Assets Laboratory (SIG-NAL). He received a B.S. and M.S degree from Auburn University in Wildlife Science and a Ph.D. in Forestry and Natural Resources at UGA.

Baiting and feeding of wildlife has been around since the early history of human and wildlife interactions. However, supplemental feeding is one of the most controversial management practices applied for wildlife to date. Early pioneers in wildlife management, including the "father of wildlife management," Aldo Leopold, in the early 1930s understood and clearly articulated the inherent need for careful regulation of public baiting and feeding. Today, The Wildlife Society has an official working statement on *Baiting and Supplemental Feeding of Game Wildlife Species*, providing guidance for wildlife professionals on ethical benchmarks for applying such practices in a sound and judicious manner while mitigating negative impacts on ecosystem integrity. Still today, there remains significant controversy within the wildlife profession as well as among the public over the ethics and impacts of baiting and supplemental feeding on wildlife populations. Common concerns centered around these practices range from disease transmission, deleterious effects on non-target species, creation of predator traps, compromising of the fair take (harvest) of wildlife, artificial inflation of wildlife abundance resulting in habitat degradation, and increased stress due to overcrowding.

In this 2-part article, we will discuss the impacts of food supplementation on the Northern Bobwhite (Part I, this issue) and the Eastern Wild Turkey (Part II, next issue) grounded in the findings of recent research. A primary goal is to provide some best management practices and considerations when implementing food supplementation as part of your management program be it for quail, turkey, and-or other game and non-game species.

Part I – Impacts on Northern Bobwhite

A common mindset among many bobwhite practitioners is that ***more food will equate to more birds***. Fundamentally, this sentiment makes sense but much like any management practice too much of

a good thing may result in undesirable results. As such, understanding the pros and cons of supplemental feeding should help dictate management decisions, avoid pitfalls, and protect the resource while mitigating the impacts on non-target species. Like feeding other wildlife, controversy around feeding quail dates back many decades and continues today. Reports of food supplementation for bobwhite date as far as the late 1940's and early 1950's in Georgia, Florida, and Texas. More recently, research in the past 2-3 decades has provided some clarity as well as some additional ambiguity as to the benefit(s) of food supplementation on bobwhite quail. Today, there remains somewhat of a negative undercurrent, most often outside the plantation communities, surrounding supplemental feeding for various reasons. Although the value of supplemental feeding may vary among seasons, between years, and among properties, proper application of supplemental feeding can improve conditions for wild bobwhite in many different scenarios. In this article, we will discuss the benefits of supplemental feeding for bobwhite, traditional methods of feed distribution, and common food types.

Benefits of Feeding for Bobwhite

A common question often asked is if supplemental feeding is necessary for long-term population viability? The short answer is NO, but the value of supplemental feeding depends on various factors. Several research studies over the past 2 decades have demonstrated how distribution of feed can increase carrying capacity and provide opportunity for higher fall densities raising the bar for harvest potential. Supplemental feeding is like a shot of energy into the entire food web and can profit the entire ecosystem from basic consumers like small mammals to birds to predators either directly or indirectly.

Supplemental Feeding May Increase Small Mammal Abundance

In one study, we found that supplemental feeding for bobwhite, increased cotton rat abundance. We found that cotton rat survival was similar on fed and unfed sites, but recruitment was 1.5 times higher on fed sites compared to unfed sites.

For bobwhites, direct benefits of supplemental feeding can impact their survival, home range size and-or reproductive effort. A study in the Southeast indicated that bobwhite home range sizes were 33% smaller (see Figure 1; 33% smaller) on fed sites than unfed sites. In that same study, we found that bobwhite survival varied annually but only during years of poor environmental conditions. During years with poor environmental conditions, bobwhite survival was higher – such that nearly 3 times as many hens started the breeding season – on fed sites compared to unfed sites (see Figure 2a). In contrast, during years with good environmental conditions, bobwhite survival was nearly identical on fed and unfed sites (see Figure 2b). We also found that hens on fed sites, on average, were in better body condition starting the breeding season resulting in slightly larger clutch sizes and nesting 10-14 days earlier than hens on unfed sites. In terms of productivity, bobwhites produced 27% more nests, 38% more broods, and 33% more chicks per capita on fed sites compared to those birds on unfed sites (Figure 3). Taken collectively, the long-term impacts of supplemental feeding on sites in the Southeast resulted in nearly a 2-fold higher fall density and maintained bobwhite densities greater than unfed sites (see Figure 4).

A 2-year study in Texas also revealed similar positive impacts of

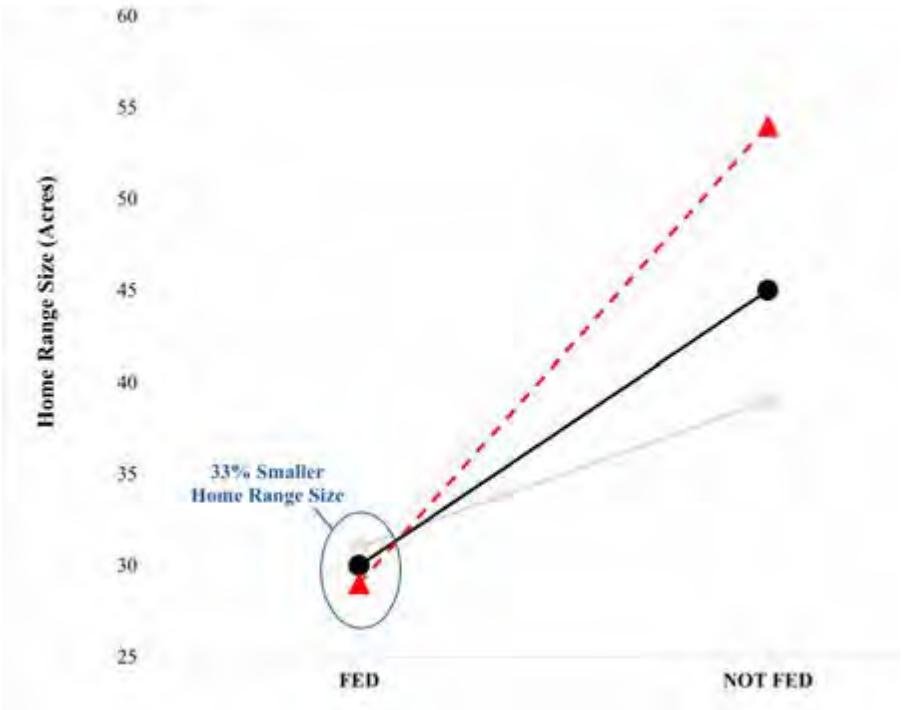

Figure 1. Northern Bobwhite home range size on fed and unfed sites in Georgia and Florida. On average, home ranges on were 33% smaller on fed sites compared to unfed sites.

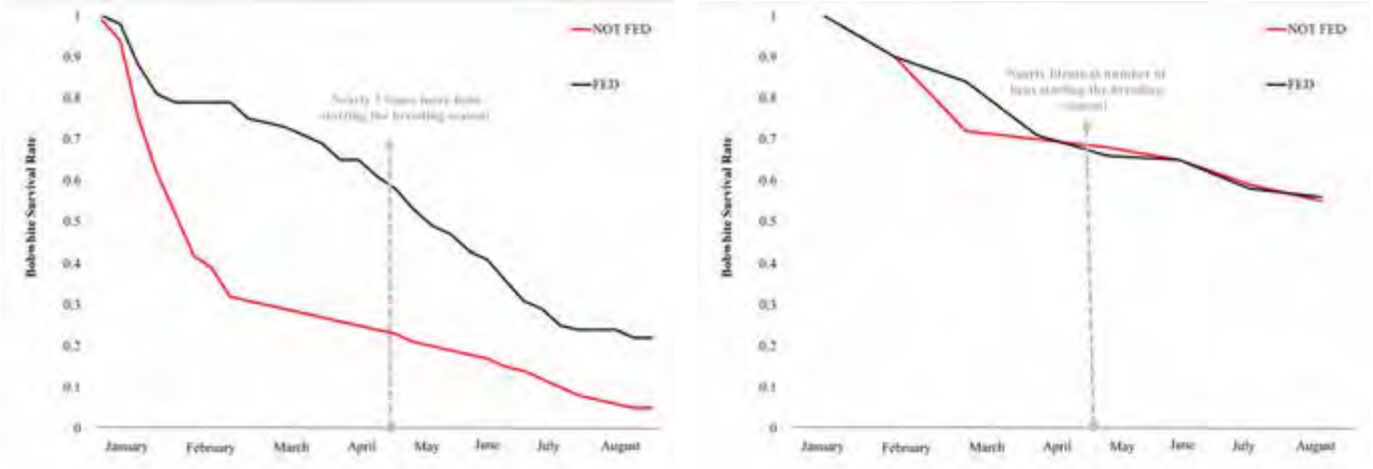

Figure 2 a & b. Cumulative northern bobwhite survival from January – August on fed and unfed sites in Georgia and Florida. (a) Feeding resulted in nearly 3 times more hens surviving to the start of breeding season compared to sites not receiving supplemental feed during years in poor weather conditions. (b) Feeding resulted in nearly identical hens surviving to the start of breeding season compared to sites not receiving supplemental feed during years in good weather conditions.

supplemental feeding on bobwhite demographics (Buckley et al. 2015). Although they did not find that broadcast supplemental feeding impacted home range size, they did observe an average of 31% increase in bobwhite survival on fed sites compared to unfed sites during both breeding and non-breeding seasons. Another study in South Carolina demonstrated a strong selection of feedlines by both bobwhite coveys during non-breeding season and broods during the breeding season (McGrath et al. 2017).

Research has demonstrated that the benefits of supplemental feeding have even greater impacts in areas where harsh winter weather events occur, especially on the northern periphery of the bobwhite range. Another study in Texas demonstrated that provisioning supplemental feed during winter events increased survival by >40% (see Figure 5a&b; McLaughlin et al. 2018). Studies in Ohio and Maryland demonstrated that the magnitude of the snow event and duration of snow cover may result in severe population declines (Janke et al. 2017). During winter events with extended (>5 days) snow cover, bobwhites' access to food declines substantially. Thus, the inability to forage becomes of critical concern for bobwhites who, during periods of low ambient temperatures, have high energy requirements and metabolic demands for thermoregulation – it is not uncommon for birds to lose 40-50% of their body mass during cold weather winter events. Supplemental feeding during these times is critically important to aid bobwhites in maintaining body condition, accessing feed for thermoregulation, and to miti-

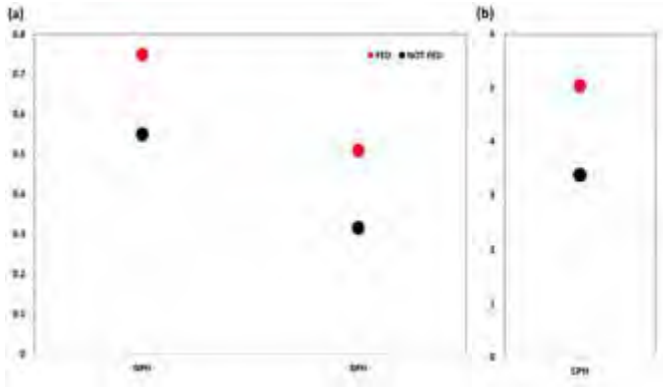

Figure 3. Northern bobwhite reproductive effort on fed (red points) and unfed (black points) sites in Georgia and Florida. The number of nests produced per hen (NPH), broods produced per hen (BPH), and chicks produced per hen (CPH) was 27%, 38%, and 33%, respectively, higher on fed sites compared to unfed sites.

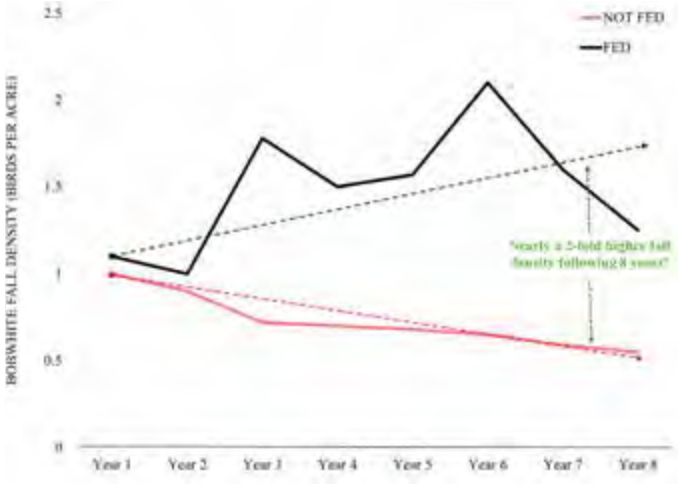

Figure 4. Northern bobwhite fall density, estimated from covey counts during October and November, on fed and unfed sites in Georgia and Florida. Supplemental feeding resulted in nearly a 2-fold increase in bobwhite density over an 8-year period with an average of 1.5 birds per acre on fed sites compared to less than 0.75 birds per acre on unfed sites.

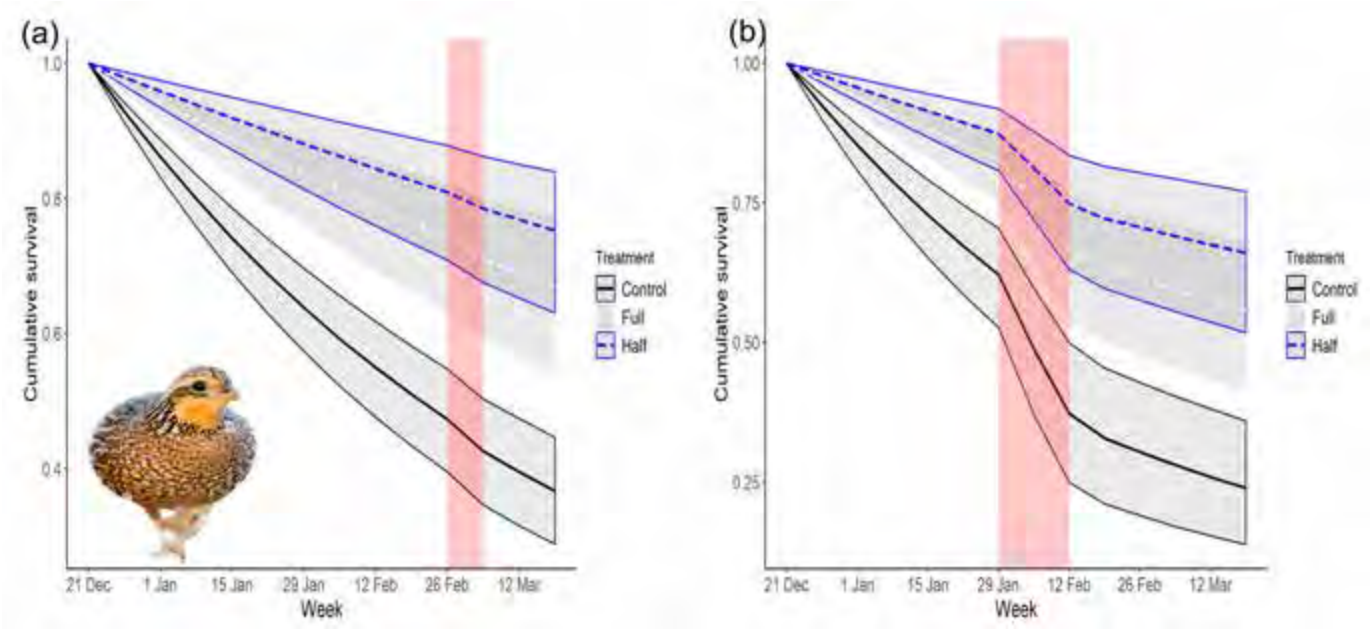

Figure 5. Northern bobwhite survival on fed (half and full feed rates) and unfed (control) sites in Texas – red-shaded areas represent winter (snow) event and gray-shaded areas represent 95% confidence intervals. (a) Year 1 of study and (b) Year 2 of study.

gate large-scale population declines. The results from these studies unequivocally showcase that supplemental feeding is a value-added management practice to bobwhite population stability and potential carrying capacity.

Methods of Feeding

Like choosing where to take the family out for dinner, nowadays there are several options available for how and what to feed quail. Notably, not all feed programs are created equal and not all feed programs should necessarily be the same; that is, there is not a one-size fits all approach to feeding and differing supplemental feed programs can provide benefit wild bobwhite. Numerous factors such as edaphic conditions, cover quality, and bobwhite density may impact what to feed, how to feed and when to feed. When it comes to how to feed, there have been 3 common approaches to provisioning supplemental feed: (1) feed patches or food plots; (2) feeders; and (3) broadcast distribution.

Feed Method #1 – Feed Patches. The use of traditional "feed patches" or food plots for quail has undergone a major paradigm shift over the past couple decades. Once a cornerstone of wild bobwhite management in the Deep South, feed patches are now much like rotary phones – largely a thing of the past! Why is this the case? Well, smart phones simply work better and do more … and so it goes with supplemental feeding such that timely and consistent distribution of food throughout the year far exceeds inconsistent and ephemeral food availability associated with traditional food patches. Although feed patches do "hold quail" during hunting season, they are often too small and spatially insufficient (average one-tenth of an acre, comprising <1% of the landscape), and they provide limited temporal food value for bobwhite, especially during poor weather years, to warrant widespread application. It has been my experience that when native food is scarce (i.e., during drought conditions), productive and beneficial food patches also prove challenging, and when they do grow well, they often aren't needed because the native food is abundant during those years due to good environmental conditions. Further, the availability of food from feed patches is often limited to 2-3 months during late summer and early fall, which is when native food availability is typically highest.

As the mirage of traditional food patches dissipated, the advent of differing agricultural plantings cropped up providing added and differential value to bobwhite such as the development of "cover patches" and "brood patches." Cover patches are like feed patches but larger in size (>0.25 ac) and are intentionally and surgically planted behind burn piles following a hardwood cleanup or timber thinning with quality cover, rather than food, being the objective. These cover patches integrate a mixture of cover and food plants, that especially on sandy sites where cover is at a premium, can provide cover for birds and mitigate bobwhite mortality during years following a cleanup event. Rotationally planting agricultural mixtures in the woods at a high enough percentage, and of the right mix, can provide brood habitat and added food value during late summer and

Bobwhites are 1 of many species consuming supplemental feed. Typically, bobwhite are third or fourth on the list of primary consumers of supplemental feed behind insects, small mammals (e.g., cotton rats), and songbirds.

early fall, stimulating bobwhite populations, but this practice is expensive and labor intensive if done on a big enough scale to do any good. Beyond bobwhite, these cover plantings can be good for other game species such as deer, turkeys, and doves. If fallow rotations are incorporated, the benefit for quail may increase as well.

A second, broader-scale improvement to the traditional feed patches, is the cultivation of "brood patches," aka brood fields or ragweed fields. A plethora of research over the past several years has demonstrated that creation of fallow fields, especially in poorer quality soils, can provide a resource highly preferred by bobwhite hens raising broods. These brood fields are managed with timely periodic, rotational disking and-or mowing to provide lush weedy growth which harbors a diverse and ample insect population for foraging bobwhite chicks (aka bobwhite chick "feed patches," see Image). However, in areas with high-quality soils, burned piney woods typically provides good forb and weed response reducing the need for high amounts of brood fields. On sites with soils sensitive to heavy disturbance, one should be cautious on the extent of brood and cover patch establishment.

Feed Method #2 – Feeders. Initial research on the effects of supplemental feeding on wildlife and bobwhite focused largely on food plots and feeders. The results from many of these studies yielded equivocal results and indicated that feeding had little-to-no effect on bobwhite demographics and abundance. However, many of these early feeder studies often were conducted on sites with low management intensity resulting in less than favorable habitat conditions and-or incurred low feeder density (≥1 feeder per 50 acres). The combination of low feeder density and poor habitat conditions may create a predator trap scenario such that feeders concentrate birds to specific locations rendering easy feeding grounds for predators, especially avian predators. Thus, the value of supplemental feeding was likely washed out by high predation risk and increased mortality associated with feeders. Despite these

A brood patch, aka brood fields or ragweed fields, provide excellent brooding habitat such that they provide good protective cover from avian predators, good insect habitat, and excellent open and bare ground at a birds-eye level for easy mobility and efficient foraging for bobwhite chicks.

A cover patch with a mixture of sorghum alum, pearl millet and browntop millet provides good late summer cover for broods and good over-winter cover for bobwhite coveys, especially following hardwood cleanup and burn piles.

Bobwhites have an amazing ability to locate and consume large amounts of food items (seed, insects, plant material etc.). They can store hundreds of seeds in a sac-like pouch called the crop (see left picture) for digestion later. The most seeds I have found in a single crop is just shy of 300 seeds! Bobwhites select seeds based on metabolizable energy and availability and consume a wide diversity of seeds (top-right picture) from pine seeds to ragweed to beggarweeds to gall berry to partridge peas, and when available consume supplemental feed like milo or wheat (see picture on bottom-right), but ideally ,we want them to have a good mixture of native and supplemental seeds.

shortfalls no effect on survival and reproductive effort during many of these studies, researchers reported that supplemental feed did improve bobwhite body condition which is a mechanism for increased demographic performance. Much of the stigma that is associated with supplemental feeding is most often linked to feeders whereby concentration of wildlife can create predator traps, concentrate birds to specific locations for hunting, and increase disease transmission risk.

Bobwhite practitioners that focus first on habitat management, and provide high feeder to acre ratios (e.g., 1 feeder per 20 acres or better), can experience success using feeders. However, the implementation of feeders at high enough densities is both time and labor intensive as well as very expensive. I have witnessed first-hand successful quail programs on public and private lands implementing feeders to provision supplemental feed for quail, but given the downsides of using feeders (namely, time and cost) most intensively managed properties no longer use feeders as part of their feeding program.

Feed Method #3 – Broadcast Distribution.

Hands down the most popular method employed today on intensively managed quail properties is broadcast distribution of supplemental feed. In fact, feeding in this manner has become a staple in bobwhite management on many properties such that managers deem it as important as other management practices like timber management, understory vegetation management, and prescribed burning. Broadcast distribution of supplemental food typically involves a tractor and spinner feeder – often a fertilizer feeder (see Image) – which slings feed into vegetative

cover along a continuous feed route on access roads or meandering feed lines through the pine woods. Although there is not a one-size-fits-all recommendation for feedline density, feeding rate, and feeding frequency, there are some general guidelines coalesced from various research projects and pragmatic experience-based knowledge implemented on thousands of acres in the Southeast of over the past several years. A good starting point is feeding ~2 bu/acre/year with a feedline density of 1.5 to 2.5 miles of feedline per 100 acres (see Figure 6) and a feeding frequency of once every 2 weeks. This method distributes feed across a property which does not heavily concentrate quail and other wildlife to a specific location (like feeders), reducing predation risk such that quail can forage naturally in quality protective cover. I have found that the preferred metric for evaluating feedline density is buffering feedlines by 125 meters – the average distance coveys, broods and mating individuals will travel, on average, to access feed without dramatic consequences to survival – and visually inspecting a map for gaps in feedline coverage (see Figure 7). This buffer distance results in feedlines approximately 250 m apart or less and helps to ensure that supplemental feed is highly available and easily accessible to most bobwhites in the uplands being managed. In evaluating thousands of home ranges, this distance and spatial feedline coverage results in nearly all (>97%) home ranges being intersected by a feedline. In terms of feed amount, the starting point is ~2 bu/ac/yr, but on lower-quality sites higher amounts (3.5 bu/ac/yr) can be more advantageous to compensate for the lower production of native seeds, especially during years with poor environmental conditions.

A monitored covey found frozen (bottom) during a snow event in Maryland. It is common for bobwhites to lose 40-50% of their body weight during harsh winter weather and extended periods of snowfall. Severe muscle atrophy can occur (top left and right images) and result in the inability of birds to thermoregulate, especially without access to native or supplemental food sources. Supplemental feeding increases body condition in front of harsh winter events, extending their ability to thermoregulate during these times. Spreading feed following snowfall will also provide access to feed enabling them to thermoregulate – in most cases, if bobwhite have access to feed cold weather rarely results in mortality due to cold and inability to thermoregulate.

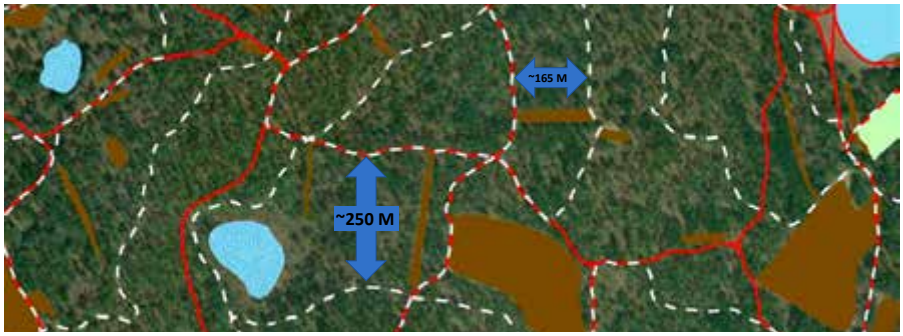

Figure 6. Snapshot of a section of 1 hunting course on a property in South Georgia displaying the feedlines (white-dashed lines), roads (red lines), drains (blue dotted blocks), and fields (brown blocks). This is an example of excellent feedline coverage with a maximum of 250 m between feedlines – some feedlines are closer than 250 m but the idea is to not have many areas greater than 250 m to ensure adequate feedline coverage and reduce areas whereby bobwhites are not within 125 m of a feedline from any given place in the uplands.

Figure 7. Geospatial analysis (buffering) of feedlines (white lines) on a hunting course with a 125 m buffer (blue-shaded area). All the non-shaded areas indicate places where bobwhites would have to move >125m to access feedlines – these are areas that can create dead zones in resource use, impact survival of birds, or reduce effective usable space which may impact hunt success and-or bobwhite abundance.

The most common implement used to broadcast supplemental feed is the traditional spinner-type feeder. However, an alternative broadcast distribution method less commonly used is the blower feeder (see Figure 8). The blower feeder is equipped with a hydraulic turbine which creates high-pressure air to blow seed 45-60 ft. from the road. There are 2 primary benefits to using a blower feeder compared to the traditional spinner feeder: (1) less feed in the open road and more feed in quality protective cover and (2), increase in foraging efficiency for growing chicks and adults.

The blower feeder launches feed into the cover and reduces the amount of feed in the road which can be very important on sites with low-quality soils and-or low-quality cover on or nearby the roads. On average, 75-80% of feed distributed using a spinner-type feeder lands directly on the road whereas <5% of the feed lands on the road using a blower feeder. This means that most of the feed using the blower feeder is located in better protective cover compared to the traditional spinner feeder. Preliminary research in North Carolina has resulted in increases in survival from 10 – 20% during the over-winter season and 5 – 12% during breeding season. In addition, we have observed where pen-reared release hunting operations the blower feeder increases the quality of the hunt such that birds are not sitting on and running down the roads/feedlines nearly as frequently because the feed is not directly located on the roads or feedlines.

Related to "grassy roads," sod-forming grasses are known to decrease foraging efficiency, mobility, and thermal conditions for bobwhite chicks (Martin et al. 2012). Martin et al. 2012 indicated that dense Bermuda grass reduced movement times for young (5-day-old) chicks and increased body temperatures which may have negative thermal consequences when foraging. Using seed count transects, we found that dense cover and especially sod-forming grass reduced seed accessibility and seed detection by human observers. Forage trials using imprinted pen-reared adults also revealed that seed consumption was highest directly on roads without cover (bare ground) or sod-forming grasses followed by recently burned areas then unburned areas whereas roads and or woods containing sod-forming grass (e.g., Bahiagrass) there was, on average, 43% lower seed consumption rate. Thus, using a blower feeder to allocate feed into protective cover compared to directly on roads with sod-forming grass should ostensibly increase foraging efficiency for adults and chicks and portend survival benefits.

What to Feed

Bobwhite quail are naturally master foragers, capable of locating and consuming seeds and other food items quickly and efficiently. When establishing bait sites for trapping quail for research purposes, I have witnessed firsthand quail finding bait sites in as few as 1-2 days. They can consume hundreds of seeds in just a couple to a few hours of foraging, depending on food availability and localization or concentration of seed availability. Simply stated: if food is out there and accessible, quail will typically have no trouble locating it. That said, the diet of bobwhites is highly diverse, and they opportunistically consume food items based on energy content, adjusting their consumption rate and amount based on nutritional needs and

metabolizable energy of food consumed.

Although research indicates that bobwhites can detect and select foods based on energy content, they are ostensibly incapable of ascertaining and moderating protein content. Natural seeds vary in nutritional value such that some have high amounts of metabolizable energy or usable energy whereas others have low amounts of usable energy but high amounts of metabolizable protein. Bobwhite life-stage dictates the quantity versus quality of food items in terms metabolizable energy and protein content required; for example, laying hens require more protein and certain minerals like calcium and phosphorous, among others, and bobwhite chicks require high amounts of protein containing specific amino acids for growth and development. In fact, bobwhites require 23-28% crude protein for optimal growth and reproduction (Guthery 2000).

Fortunately, the list of food items consumed by bobwhite is extremely long. Scores of studies on bobwhite food habitats show seeds of native or natural foods are the most frequently consumed; however, the seeds of legumes (e.g., peas and beans) are eaten in the largest amounts and greatest variety. In general, bobwhites select foods that are high in metabolizable energy and avoid foods low in metabolizable energy. Interestingly, the diet of wild bobwhite is quite diverse, yet most supplemental feeding programs often lack diversity, and are relatively low in protein, which is likely linked to the readily available grains on the agricultural market. Thus, the selection and timely provision of supplemental foods can be important to maximizing the benefits of food supplementation for bobwhites.

A fertilizer spreader equipped gravity-fed bin, a chain to pull grain, and spinners to sling feed is the most common method of broadcast distribution of supplemental feed.

Most intensively managed quail properties feed grain sorghum (aka milo) and a lower percentage of plantations mix in corn with only a handful, to my knowledge, feeding wheat. The protein content for corn (~7.5%; range 4 – 10%), milo (~9.5%; range 5 – 13%), and wheat (~12%; range 9 – 15%) is much lower than that required by laying hens and growing chicks – thus quail cannot and should not live on supplemental food alone. Ideally, the majority of the bobwhite's diet should be natural food items and supplemental feed can help to offset deficiencies on the landscape. Given the high demand for protein during the breeding season, insects provide excellent food value for laying hens and growing chicks. Thus, focusing management efforts on managing quality habitat and integrating a proper prescribed burning program is the most important step toward promoting bobwhite and producing a wide variety of native foods. Frequency fire is important to ensure native seed-producing and insect-laden plants are productive and seed produced is accessible to foraging quail which also facilitates the consumption of supplemental feed by increasing bare ground and open cover at the ground level. That said, much of the research evaluating supplemental feeding impacts on bobwhites revealed the greatest impact occurs during the non-breeding (overwinter) season compared to breeding which is likely linked to winter effects and a major demographic pinch point often occurring in late winter (see Buckley et al. 2015, McLaughlin et

al. 2018, and Janke et al. 2017).

When it comes to wildlife management, be it managing native vegetation or planting food plots for deer, my philosophical and pragmatic approach is to increase diversity where possible. In a similar vein, a supplemental feeding program should also be diversified to meet the changing needs of bobwhite throughout the year. It is also important to remember that supplemental feeding is meant to be a "supplement" and not meant to be a holistic diet. In other words, we want bobwhites to consume native foods for a more balanced diet and use the grains we broadcast as supplemental. Many of the native foods provide higher amounts of protein whereas the supplemental foods provided often yield higher amounts of usable energy (see Figure 8 & 9).

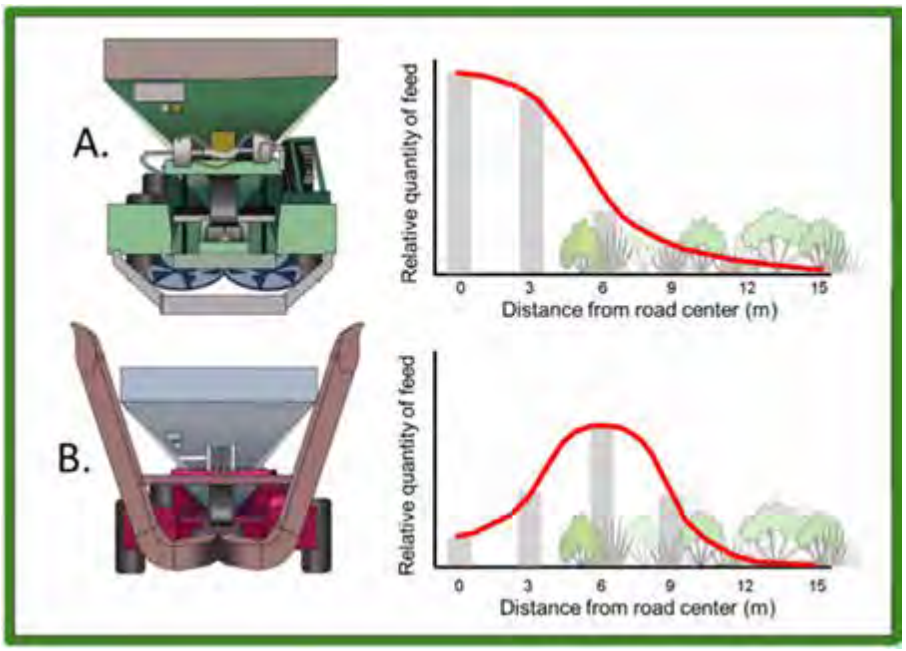

Figure 8. Alternative feed broadcast distribution methods. The traditional method of distributing quail feed, the spinner feeder, distributes most feed on/near the road (A). In contrast, a novel blower feeder launches most feed off the road and into vegetative cover (B).

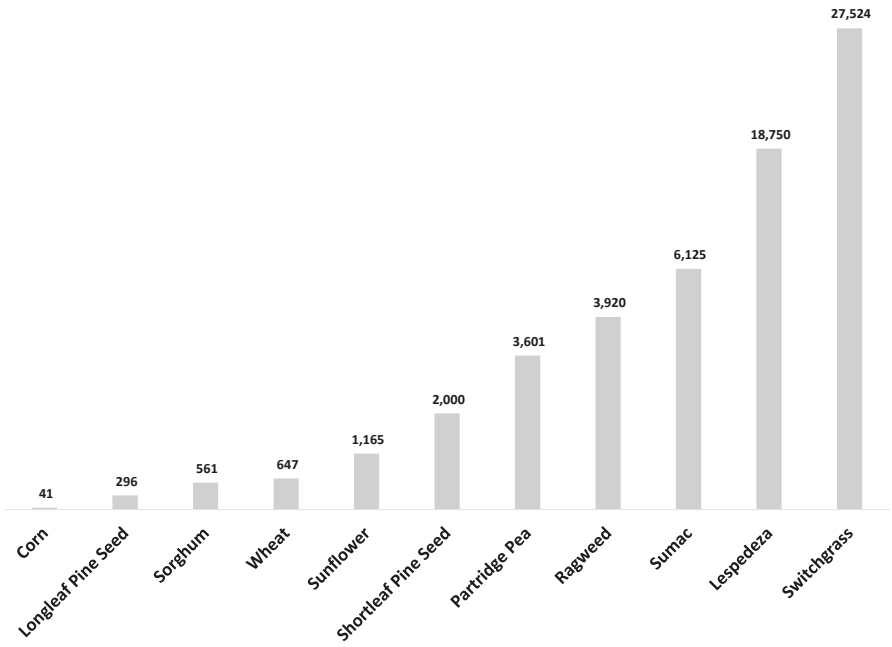

Figure 9. The number of seeds required to meet the daily caloric intake for bobwhite for a few common native and supplemental food types; both the size and nutritional value of the seeds impact the amount of metabolizable energy.

Given the bobwhite's keen ability to regulate food consumption in terms of metabolizable energy providing a buffet of supplemental food choices throughout the year by using a variety of grains is ideal. As such, I recommend feeding a mixture of corn, milo/sorghum, and wheat with varying ratios throughout the year depending on the season and life-stage of bobwhites. I prefer to mix 70:30 wheat and milo during the breeding season (1 April – 30 September), a more balanced 50:50 mix during fall (October – December), and an even split (~one-third) during the winter of corn, milo, and wheat. The higher proportion of wheat during the breeding season provides a slightly higher amount of protein and reduces the tannin consumption from milo which may impede amino acid digestibility, especially important for growing chicks and laying adults. During the cold months, I like to integrate corn to provide quick energy in the form of carbohydrates compared to wheat (~20% less metabolizable energy). Although milo and corn have similar amounts of metabolizable energy, it takes fewer seeds of corn to meet the daily caloric requirements of bobwhite (see Figure 9), which can be especially important during cold nights and during nasty winter weather events.

Take Home Message

The use of food supplementation is a common practice on many intensively managed quail properties and is deemed as important as most other management practices. However, supplemental feeding is not a panacea for quail population

restoration, and it is not a replacement for quality habitat management! As it is written: "Man shall not live on bread alone" Dt 8:3. Like us needing more than bread to sustain a fulfilled life, so too northern bobwhites require more than supplemental (i.e., corn and milo) food to sustain life.

Food supplementation for bobwhite is meant to supplement native food resources, and NOT meant to be a holistic diet. Although more birds do require more food, more food does not always equate to more birds. During years where conditions are good, cover is good and food production is good, supplemental feeding typically adds relatively little value on the well-managed quail preserve, BUT when/where conditions are poor, cover is poor and natural food production is poor, supplemental feeding can help to tie over birds and may increase carrying capacity. Put another way, when times are good, supplemental feeding is unnecessary on most well-managed properties, but when times are bad supplemental feeding can keep coveys rising through the thin times while bolstering them during thick times. In many ways, supplemental feeding is akin to an insurance policy affording bobwhite population stability and increasing the opportunity for population growth where quality habitat exists by being better poised to take advantage of good times while mitigating hardships during poor times.

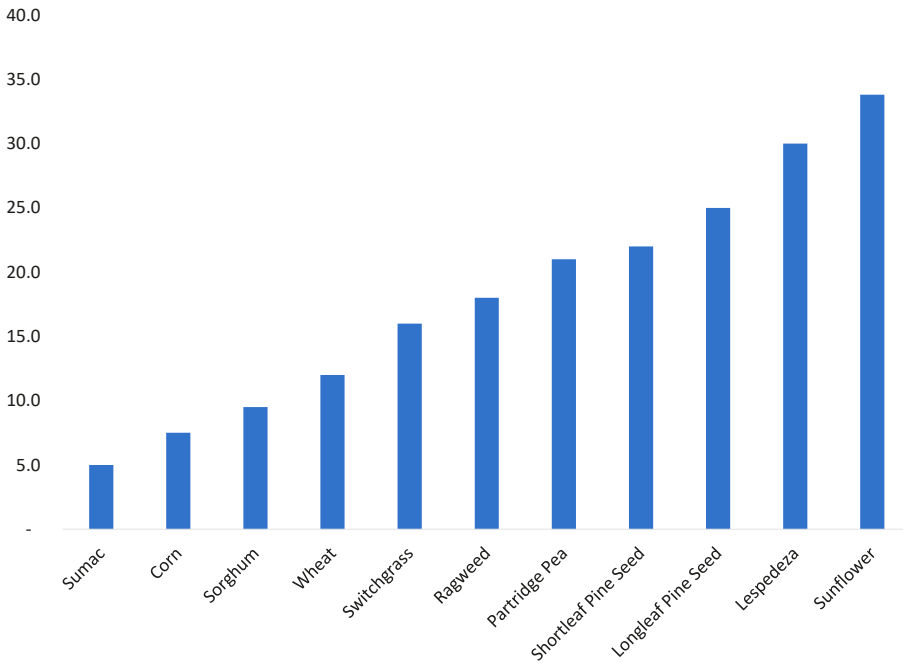

Figure 10. Protein content (average from Guthery 2000 and several other peer-reviewed sources) of some relatively common native and supplemental food types. Note where the common supplemental foods (corn, milo, and wheat) are typically lower in protein content than other native seeds.

One thing is for certain: Quail got to eat! While feeding is not a panacea for quail restoration and management, it is one of the few things you can control 100% and ensure food is adequately available throughout the year, especially during critical demographic pinch points like late-winter and early spring and during harsh weather events such as winter snow-events. The priority should always be establishing and maintaining quality habitat first and only then can one expect supplemental feeding to profit bobwhite. In doing so, broadcast distribution of supplemental feed into quality cover using a spinner or blower type feeder will produce the best results.

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Drought and Flood Effects on Lakes

By Scott Brown

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Drought is usually a longer duration than flooding. Here the shoreline vegetation is re-establishing itself with some upland plants growing behind them. This lake was down long enough to scrape the shoreline and regrade it to a steeper slope.

Most lake and pond owners now are experiencing extreme droughts and/or floods on their waterbodies at some point. Hopefully these events are rare and consider yourself lucky if not too frequent and when they do occur use them to your management advantage, as they can improve water chemistry, soil, vegetation and the fish population.

Effects of Drought

Not sure anymore what happens more frequently these days, flooding or drought. Whether the result of a natural fall and rise or man-made event (drawdown), a drought can facilitate many positive benefits when spaced 8-12 years apart. Like anything, when droughts occur too often, or not for long periods of time, it can be detrimental to a waterbody.

Generally, water chemistry will remain stable until too many fish become overcrowded for too long a of time. As water levels decrease, the waterbody becomes smaller the surface acres reduce and become shallower. The slope, bottom contour, bottom sediment composition and how many fish are present all dictate if any water chemistry issues will occur. The more fish confined, the more Dissolved Oxygen (DO) required. Other parameters can be elevated like ammonia and nitrogen levels from concentrated fish waste or sediment. Ponds with abnormally high salt content along the coast can experience higher salinity levels as water evaporates and salt is left behind. Some freshwater plants and fish species may become stressed or die depending on the salinity levels during drought.

As the waterbody gets shallower, both shoreline and submerged vegetation can increase. As water recedes, aquatic plants high on the bank will start to die and terrestrial plants will begin to grow. If the drought occurs in the fall, this growth will be much slower or nonexistent depending on the air temperature over winter.

The fish population will definitely change during extreme drought. Bigger fish (predators like largemouth bass, catfish and big panfish) experience a growth spurt as forage is pulled out of shoreline habitat, exposed and concentrated. As a result, prey numbers decline faster during a drought. If the drought

last too long, predators can deplete forage numbers to a level where they cannot repopulate and eventually the predator's growth rates slow to even slower than prior drought conditions, due to lack of food. Another issue with drought is fish disease becomes more common and an issue as individuals become crowded and readily pass bacteria or viruses to one another more frequently. These fish population dynamic changes can affect species diversity in your waterbody.

What Can Be Done During and After a Drought to Improve or Restore Your Lake?

One of the first things recommended is to inspect the dam, outflow structure and emergency overflow while water is down. If during a drought you notice a green area of vegetation anywhere on the back side of the dam amongst lots of pale or brown vegetation, this may indicate there is a leak. If repairs to any of these are needed, make arrangements to do the work, to alleviate having to drawdown again later in the near future. Remember that if a repair is decided on, a procedure to keep the water down must be readily handy or put in place in case rain comes and it begins filling up. During extreme drought, cracks may form and not swell back closed when it refills allowing erosion into the dam's interior.

Low water is a great time to improve slope, deepen or remove organic material (muck) that has built up along the shore from decomposing vegetation. A good slope (4:1 or even better 3:1) deters excess vegetation growth after refilling. It allows some plants to grow, but doesn't allow them to grow too far out into the lake. If Hydrilla or other nuisance submerged vegetation is present, lightly scraping the lake bottom where present, removes tubers and seeds to prevent it from coming back when refilling occurs.

Repair or install a dock or pier. It is much easier to conduct this work yourself if you can stand on the bottom and work as opposed to working from a boat, especially when installing pylons. Remember, the water is down, so place the dock height above average water height. Place in an area where a boat can be pulled up to it, a feeder placed on it, and people can jump off into deep water to swim if you wish.

Depending on the time of year, treating excess aquatic vegetation may be necessary or beneficial. Again, some plants are good, but the more shallow areas there are, the more submerged vegetation may grow. As water recedes, the upland plants (weeds) will make their way down the old dry lake bank and possibly into the lakebed in shallower areas. These can be left to grow, as they will become a big part of the re-flooded waterbodies food chain. If a treatment with Floridone (Sonar)

Water chemistry will change in a flood and drought. How long that change is before it goes back to acceptable, determines if you have a stressed fish population or it experiences a fish kill.

An occasional flood or drought are good for the fish population, and promotes faster growth in all predator species.

was being considered, treating during a drought reduces herbicide required and can greatly reduce treatment cost.

If you were considering killing the pond out and starting over, a drought is a good time to also perform this task. It takes much less Rotenone (fish toxicant) when the waterbody has less surface acres and shallower. This saves you money and helps keep the toxicant from flowing out, downstream while active, eliminating all risks of an accidental kill off site.

If the drought lasts an extended period of time, removing more bass and bream/panfish prescribed or stocking forage to keep the populations going will be necessary to alleviate predation stress or death. The time refilling begins is the time to consider evaluating and restocking forage, predators or both. If the event was extensive, whether you observed a fish kill or not, get an electrofishing survey conducted as it refills, not just to see numbers present, how robust or skinny your largemouth bass are, but also to identify forage species, sizes present and estimate their numbers. This will help you determine if restocking any species is necessary. Ideally, if the fish start spawning and it gradually refills to where large post spawn areas of high-quality habitat of flooded shoreline vegetation rich in forage for fry and fingerling fish is present, restocking most species may not be necessary. This decision needs to be made with a professional fishery biologist who has experience in these situations. Just stocking to be stocking doesn't improve the fishery and it uses funds from your budget that can be used elsewhere. As stated earlier, you may need to stock a species as a temporary improvement until the desired species and numbers can be acquired from a hatchery or naturally repopulates.

This lakebed is drying up due to drought. The organics will harden if exposed long enough and be very beneficial to the aquatic ecosystem. Plants, invertebrates and fish once reflooded, will flourish for many years from the New Lake Syndrome.

Not allowing back-to-back extreme low water levels is feasible by landowners that can utilize wells to maintain lake levels, however, every 10 years or so, refrain from keeping it full and allow nature to do its work and improve your lake. If a lake is being used for irrigation and filled with well water and pumped onto agricultural crops, be sure to gradually add and remove water. If water transfer is too great, a fish kill can occur from too much well water.

Effects of Flood

Occasional floods are also good for lakes, as long as most fish are not lost or new species of fish or plants are not introduced from nearby waterbodies. An occasional flood can reduce submerged and shoreline vegetation. It can increase acreage and quality habitat which increases all fish numbers, particularly forage species.

Water chemistry initially will decline during a flood. Either organics are washed in, or as the water rises and floods nearby uplands, the dead or dying vegetation will lower DO levels. When flooding occurs quickly, stress or a fish kill can occur. If it happens slowly, things will remain stable. Water washing in from nearby swamps or pine forests may begin to drop pH (become more acidic), and needs to be checked some time after the event. Turbidity (muddy water) can also increase during flooding depending on bare ground surrounding and upstream of the waterbody, and from water washing in dirt from shoreline erosion. Temporary muddy water does not negatively impact fish. Once the event is over, if muddy water persists, things can be done to reduce turbidity and increase visibility.

Soil may be added to your lake and reduce water depth in certain areas if erosion is extreme. At the emergency outflow, soil can be eroded and washed downstream. Organics from nearby agriculture practices can both reduce pond depth and increase poor water quality after a high-water event. An extreme

event can damage the dam or cause it to fail, in which water and soil can be transferred downstream, along with organics if the lake had any.

As water rises, upland plants may begin to die off and aquatic plants in the original lake bed die from water too deep, but begin growing in the new shallows of flooded areas. Floods generally last shorter periods of time than droughts, so aquatic and/or shoreline vegetation may not be affected at all.

As stated earlier, fish are exposed to new high-quality habitat for hiding and feeding if shorelines are not manicured. If the water stays up for an extended period, fry and fingerlings will benefit from the added feeding and loafing areas. However, during excessive flooding, fish can be lost down stream as they swim or wash over the dam. Also, fish from surrounding rivers, lakes and creeks can wash into and get trapped in your waterbody. Some may not be welcomed (undesirable species) and cause issues in the future.

What Can Be Done During and After a Flood to Improve or Restore Your Lake?

The most important thing to monitor during a flood event is the dam, if your lake has one. Inspect periodically looking for leaks on the backside near top and bottom. Make sure the outflow doesn't get clogged with debris and clean as necessary. Do not cover outflow with a screen or fencing, as it will clog even faster. Watch the emergency overflow and look for erosion. Should the dam look like it may fail opening any valves, adding a pump run by a tractor, a trash pump or siphon to get additional water out may alleviate pressure on the dam. Consider any landowners downstream that may need to be notified prior to a dam breaking. Feeders, aeration or fountain pumps should be monitored and moved to higher ground to prevent water damage if necessary.

During periods of excessively high-water, watch for escaping fish through outflow or over the dam. If an excessive number of fish are observed washing downstream, restocking certain species or all species may be necessary. Fish entering the lake from nearby waterbodies will be observed in an electrofishing survey after the event is over.

If during a flood you witness fish at the surface and/or dying, the only thing that can be done is add aeration. Aeration can be done with large surface aerators run by tractor or electricity. These agitate the water vigorously and raise dissolved oxygen levels to create areas where fish can congregate until the DO throughout the lake rises naturally. These are common at fish hatcheries, but do work for temporary low DO fixes in a time of emergency. We have heard of commercial hatcheries loaning or leasing them out to landowners in an emergency. If the lake is too large, it probably will not help, and you must let nature run its course and deal with the population change after the event.

Once the water recedes to normal levels, check water chemistry. Then recheck water chemistry in a month or two to document any changes and see if the parameters stabilize and return to previous readings. Things should return to previous levels, but if pH does not, applying lime may be necessary. Usually, only pH is affected long term from flooding, especially in the Southeast, or where a liming program has been initiated prior to a flood event. Turbidity should subside after the event and water should return to the clarity it was prior once surrounding shoreline vegetation fills in where erosion occurred.

Long term flooding may affect surrounding upland trees. They may become stressed and even lose leaves during or after the event. However, do not cut down any trees that lost their leaves until they have had a chance to go through the following year green-up period. If after the following spring they do not get leaves, they can be considered dead and removed.

Continue to survey the vegetation after a severe flood. It is not uncommon besides fish to be introduced to your lake, for undesirable plant species to be fragmented (broken up) or uprooted from a nearby waterbody or upstream, and transplanted in your lake after the water recedes. Particularly plants like Hydrilla and other submerged aquatic vegetation that can transplant from pieces breaking off and re-rooting elsewhere. As soon as any exotic or undesirable species are identified, treat with herbicide or mechanically remove.

Have an electrofishing survey conducted once water levels return to normal. The electrofishing survey will help determine what new species are present, and numbers and sizes of remaining fish. Stocking may be required. Grass carp are particularly susceptible to swimming/flowing out of a waterbody during a flood.

If mostly undesirable fish species remain, starting the fish population over may be a necessity. A professional should be consulted to assess the fish population and possibly apply Rotenone and create a stocking strategy. This is a rarity, but is required on occasions.

This old quarry lake was flooded by the creek on the west side about five years ago. It completely changed the watercolor and water chemistry for the better.

A rare flood or drought event is good for a waterbody. Waterbodies that never fluctuate develop water chemistry, sediment and vegetation issues more often than ones that experience occasional fluctuation. Drought and flooding that occurs too often is detrimental to waterbodies and never allows them to reach their full potential, since they are always trying to recover.

None of these species are typically found in a manmade pond, but they showed up after a flood event where a nearby river flooded the property and lake. Three of the species are undesirable, but the minnows now support a quality black crappie fishery.

During flooding, keep an eye on fish feeders and aeration/ fountain pumps. If concerned, pull them and move to higher ground to prevent them from being damaged by flood water requiring costly repairs.

Triploid grass carp are attracted to flow and usually are in the upper part of the water column, which makes them susceptible to leaving your waterbody during a flood event.

These threadfin shad were stocked, but the gizzard shad entered the lake during a flood event. Some events are give and take and you just have to manage with what you are given.

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Wildlife Trends Journal Management Calendar

Dave Edwards

Dave Edwards is a certified wildlife biologist and regular contributor to *Wildlife Trends Journal* and other hunting/wildlife publications. Dave was honored as QDMA's 2007 Deer Manager of the Year and nominated in 2011 as Alabama Wildlife Federation's Wildlife Conservationist of the Year. Dave is President of Tall Tines Wildlife & Hunting Consultants, Inc. Contact him at TallTinesConsulting@gmail.com or 912-464-9328.

Drain flooded hardwoods managed for waterfowl before spring green up.

Build Wood Duck nesting boxes.

Wood ducks are cavity nesters, meaning they construct their nests in hollow trees near water. Since nesting trees can be limited, providing artificial nest boxes can help increase local populations and attract more woods ducks to your property. Building, erecting, and annually maintaining wood duck boxes can be a relatively easy way for the entire family to be involved in wildlife management that is both fun and rewarding. One of the best designs I have used is built from a single 10'x12" cypress board. With a couple hinges, a small piece of hardware cloth, and some screws it is easy to turn a single board into an effective duck management tool. See instructions for building a duck nesting box. Wood ducks will begin searching for a suitable nest site as early as February. Therefore, install new boxes during winter so they can be used during the upcoming spring nesting season. The reason for building duck boxes in the summer is to allow them time to dry. "Green" wood (freshly cut or purchased) is often wet and very heavy making them more difficult to erect. Build them now then deploy them in the winter. Wood duck boxes should be cleaned out each year before nesting begins to remove old nesting material, squirrel nests, and egg shells and filled with 4-6 inches of fresh wood shavings or chips (preferably cypress or cedar) which are available from many pet stores, chip mills, cabinet shops, lumber mills, etc. Avoid using sawdust as it absorbs moisture which results in a wet mess and rotting of the duck box.

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 seen chufas, you may need to lightly disk a strip through the patch in late winter 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. Hogs can be so bad that I do not recommend

Avoid the fall rush and send in cameras needing repair this spring.

In addition to planting summer crops for deer, now is the time to plant "screen" to help manage hunting pressure next fall.

planting chufa if you have hogs. They often demolish the area once they find a tuber. 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. Be sure to rotate your chufa patches every 2-3 years to avoid nematode problems.

Take advantage of dry duck ponds – maintenance, repairs, and build hunting blinds.

Unless you are keeping water on a duck pond to act as a weed screen use flash board riser type water control structures, pull and clean all the boards – make repairs where needed. This is also a great time to inspect duck blinds and perform routine maintenance or repairs as needed, or build new ones. From a habitat management standpoint, this is also a good time to inspect and treat the pond area for undesirable vegetation such as sesbania, willows or other non-desirable species.

Evaluate and repair existing roads & build new ones.

Unless all 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 ing on roads, consider increasing the roadsides where possible to enhance wildlife habitat. 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.

Complete draining duck ponds and prepare for planting.

Those managing moist soil areas/ duck ponds (i.e., native vegetation vs. planting agricultural crops), should have started the 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 provide many different types of

food sources (seeds and insects). By May or early June, drawdowns should be complete allowing native moist soil plants to establish and actively grow. Herbicides can be a useful tool to remove undesirable vegetation if it becomes a problem and is dominating 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 plan to start 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 seeds that will germinate the following year.

Service sporting clays, skeet, and trap machines.

Whether you have a full 12 station sporting clays course, a 5-stand shooting range or just a trap machine on the camp porch, regular maintenance of this equipment is needed to keep everything working. Let's face it, maintenance of trap machines is not fun or gratifying. As such, performing this maintenance seems to be low on the priority list for most owners until it's time to shoot. It is quite frustrating inviting friends or family out to shoot and a machine(s) malfunctions or simply doesn't work. Through experience in managing several sporting clays courses and 5-stand shooting ranges, I've learned that regular maintenance significantly reduces "down time" and helps machines last longer. If your machines are actively used throughout the year, it's a good idea to check and service them each month to ensure proper operation. Each machine should be cleaned, lubricated, tested, adjusted, and if necessary, replace any worn parts. Two of the most common problems encountered are battery and controller wire issues. Batteries are similar to a boat in that you "use it or lose it". The longer they sit idle the more problems you can expect to experience. If you don't have solar trickle chargers for your trap machine batteries consider adding these. Solar chargers are relatively inexpensive and keep batteries charged and active through trickle charging. They also eliminate the need to remove and transport batteries to a power source for charging. My life changed when I discovered wireless remote controllers for trap machines. I have no idea why squirrels and other rodents are so attracted to controller wires. But they regularly find and chew them which shorts the connection. Installing wireless remotes eliminates the need for a wire to run through the woods from the machine to the shooting station – and removes potential problems. Wireless remotes also allow you to easily move trap machines for different shots/angles without having to deal with a long wire to controllers at the shooting station. Like any equipment, preventative maintenance on trap machines will result in fewer problems and longer machine life.

Road maintenance – "limb" roads through herbicide applications.

Summer is a great time to "knock back" vegetation along interior roads of your property. There are essentially two methods commonly used – physically removing limbs & brush mechanically or applying an herbicide to kill vegetation along roadsides. If aesthetics are important to you, using loppers, saws, and other tools to physically remove overgrown limbs and brush from roads is the way to go. However, this method is labor intensive. When manually "limbing" roadsides I often use a tractor with a bucket and a gas-powered pole saw. An efficient set up requires 3-4 people. One person drives the tractor, one is in the bucket cutting limbs with the pole saw, and the others are behind dragging limbs/brush into the woods and cutting smaller brush that the tractor misses. Applying herbicide along roadsides is a great way to accomplish the same results, but as vegetation dies it will be visible along the roads for a period of time. That is, once the vegetation (e.g., brush and limbs of larger trees) are sprayed they will die turning brown. Though it is unsightly for a couple months, the herbicide method produces better long-term 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 one that it is not "soil active", meaning that it gets transported through the soil and will kill entire trees or

Harvesting timber in late winter or early summer allows more growing season for the area to recover and produce wildlife friendly vegetation.

shrubs (unless of course this is your goal). I often us RoundUp (glysophate) 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. 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.

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 often during the growing season. Strategies to control these plants vary depending on the species at hand. However, herbicide (and fire in some cases) 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 be extremely challenging. Some of the common invasive exotics in the Southeast include Cogongrass, Chinese tallow tree, Kudzu, Chinese Privet, Chinese Lesedeza, and many others. 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 sometimes be complicated as well. However, properly applying herbicides is nothing to be afraid of. You simply need to understand how herbicides work, which plant species they control (or not control), and the techniques to apply safely and effectively.

Start preparing and planting dove fields.

Dove field preparations should begin by June or 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 a variety of millets (e.g., dove proso, browntop, Japanese, pearl, etc.), sunflowers, grain sorghum, corn, and wheat. For best results obtain soil samples and apply required lime and fertilizer before planting. A mistake commonly made is planting too late. Most dove field crops generally take between 50 and 90 days for seed to mature. Know the maturity period for the crop you are planting and plant accordingly. Keep in mind that soil conditions and rainfall should play a role in when crops need to be planted. That is, don't hesitate to plant when conditions are right even if it's a little earlier than you planned. While seed 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. These strips also offer landing areas and access to seed once crops matures. Another trick that I have used many times with great success is to include/spread pea gravel (very small gravel) along roads that are within the dove field area. Dove "eat" the smallest particles of gravel to assist in digestion (used in their gizzard to break down seeds and other food parts). This is the reason dove are often seen "feeding" along roadsides.

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