PRACTICAL WILDLIFE MANAGEMENT INFORMATION

Wildlife Trends JOURNAL

MAY/JUNE 2015 VOLUME 15, ISSUE 3

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Earl Says...

I recently read an article about a man who was charged for cruelty to animals for shooting and killing a hunting dog here in Alabama. He pled guilty and is currently on probation and was made to pay restitution for the dog and the tracking collar he destroyed. I'm not clear on all the facts in this case but this sure opens up a discussion on a variety of issues such as property rights, animal cruelty and hunters rights, just to name a few.

I am a huge animal lover. I mean, just look at the picture of my boy Earl above this column and tell me you don't want to just love him all over. But a lot of folks, including myself, have felt the anger and frustration of sitting on a deer stand and having dogs running those deer all over creation. Sometimes those are wild dogs which were abandoned by some low-life who didn't want to take care of them, thinking the dogs would be better off in the wild. And sometimes those dogs were put out by dog hunters hunting their own property and the dogs got away from them. This happens way too often and sometimes on purpose by the small minority of dog hunters who give legitimate, law abiding dog hunters a bad name. I've hunted with a few dog hunting clubs in the past who do things the right way and everybody is happy. But I've heard horror stories about that minority of thugs who hunt where they please and threaten and intimidate landowners and hunting clubs.

Every year I hear the pros and cons of dog hunting for deer at our state's annual Advisory Board meetings. The legitimate hunting groups want landowners to let them know about problems so they can be corrected. And landowners tell stories about being over-run by dogs while they are hunting. There's not any simple solution other than getting rid of and punishing the bad apples that spoil everything for the rest of us. We all need to get on the same page because we have enough problems fighting against groups like PETA who I'm sure just love to see us divided amongst ourselves.

Andy Whitaker
Publisher/Editor

Wildlife Trends JOURNAL

P.O. BOX 640596
PIKE ROAD, ALABAMA 36064
www.wildlifetrends.com
800-441-6826

PUBLISHER/EDITOR
Andy Whitaker

DESIGN
Kim Koellsted/Craftmaster Printers, Inc.
Craftmaster Printers, Inc.
687 North Dean Road, Auburn, AL. 36830
(800) 239-3293

CONTRIBUTING AUTHORS
Dave Edwards
Dana Johnson
Brant C. Faircloth
Wes and Leslie Burger
Dr. Wes Wood
Theron Terhune
Marion Barnes
Ted DeVos
Bryan Burhans
Keith Gauldin
Rodney Dyer
Dr. Keith Causey
Gary Springer
Dr. Stephen Ditchkoff
Anna Huckabee Smith
Tes Randle Jolly
Kevin Patterson
Ryan Basinger
G. Ryan Shurette
D. Clay Sisson
Kent Kammermeyer
Allen Deese
Scott Brown
Dr. Larry W. Varner
Jason R. Snavely
Steve Tillman

For Wildlife Trends editorial, advertising, or change of address:
1-800-441-6826
info@wildlifetrends.com

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 Tes Jolly
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Cultural Practices and Weed Control Improve Forage Plot Production

Ecotones and interspersion index (shooting lane). Removing the cool season monocots (winter wheat/Buck Forage oats) with Poast.

By Mark Thomas

Mark Thomas is a Certified Wildlife Biologist/Forester and President of Forestry/Wildlife Integration, LLC. He is also a Past Chairman and current Board Member of the Quality Deer Management Association. Contact him at 205-733-0477 or caribouhunter55@yahoo.com or visit his website, www.forestrywildlifeintegration.com.

Weeds! They can sure be a problem, and can wipe out all of your hard work while planting forage plots for wildlife. There are three main types. Annual weeds germinate from existing seeds. Biennials need at least two years in order to complete their life cycle; the first is mostly vegetative, while the second is mostly reproductive. Perennials reestablish from roots, tubers, or rhizomes and live year after year. There is usually a level of weed infestation that becomes problematic with respect to forage crop loss. I usually recommend some treatment when losses become measurable, say 10% or so. Also, I usually recommend an integrated weed management approach, utilizing first cultural practices, then mechanical methods, and finally chemical control.

Identify Your Competition Problems First

Warm-season grasses (monocots) are by far the worst competitors when trying to establish wildlife forage crops and these should always be eradicated prior to establishment. Then, plant only forbs or legumes or mixtures of legumes to encourage the use of selective herbicides, or utilize cultural practices like bushhogging for competition management. Some of the worst warm-season grasses are fescue, bermudagrass, and johnsongrass. Some of the worst broadleaf weeds include chickweed, cocklebur, deadnettle, groundcherry, henbit, jimsonweed, morning glory, pigweed, ragweed, lambsquarter, nightshade, and leafy spurge. In this article we will learn to maximize agricultural plants established for wildlife by controlling competition.

Tall Fescue

Tall fescue is one of the worst wildlife food sources ever created and I recommend completely eradicating it if wildlife management is your objective. It is fruitless to try and establish high-quality wildlife forage plots without first controlling fescue. I usually recommend burning off the field in the late winter or early spring to remove the thatch (dead material), allow it to grow vigorously until it is around 6-8" in height, and then spray it with any glyphosate-based herbicide (Roundup® or Roundup UltraMax® @ 1.5-2.0 quarts/acre). Do not mow the fescue just prior to spraying, as that reduces the surface area of the plant. If you use a generic glyphosate, be sure and add a non-ionic surfactant. You can spray in the fall, prior to a spring planting, or in the spring in advance of a fall planting. Do not spray if the fescue is drought-stressed, but wait until after a rain event.

Bermudagrass

While fescue is relatively easy to control with one application, bermudagrass is significantly more difficult, and usually requires different chemistry and multiple applications. For bermudagrass control, I usually recommend

Growth Rate, Grazing Preference, Browsing Resistance, Crude Protein, and Total Digestible Nutrients of 25 Selected Forages Planted for Whitetail Deer.

Forage Plant Species	Growth Rate	Grazing Preference	Browsing Resistance	Crude Protein (%)	TDN (%)
*Alceclover	Slow	Moderate	Good	21	64
*American Jointvetch	Slow	Moderate	Good	25	75
*Iron-and-Clay Cowpeas	Moderate	High	Excellent	30	78
*Lablab	Moderate	High	Good	26	67
*Soybeans	Moderate	High	Extremely Poor	29	71
*Quail Haven Soybeans	Moderate	High	Excellent	25	64
^Arrowleaf Clover	Slow	High Excellent	31	83	
^Berseem Clover	Moderate	High	Excellent	25	81
^Crimson Clover	Moderate	High	Excellent	29	83
^Alsike Clover	Slow	High Excellent	27	74	
^Landino Clover	Slow	High	Excellent	32	80
^Red Clover	Slow	High	Excellent	24	70
^Sweet Clover	Slow	Moderate	Good	31	79
^Alfalfa	Slow	Moderate	Excellent	29	77
^Austrian Winter Peas	Fast	High	Fair	28	78
^Birdsfoot Trefoil	Slow	Low	Good	28	77
^Crown Vetch	Very Slow	Low	Good	17	56
^Hairy Vetch	Moderate	Low	Good	19	59
"Barley Fast	Very	Low	Excellent	24 6	9
"Oats	Fast	High	Excellent	27	71
"Wheat	Fast	High	Excellent	25	70
"Rye	Fast	High	Excellent	24	69
-Buckwheat	Fast	Moderate	Excellent	26	71
-Chicory	Moderate	High	Good	25	74
-Rape	Moderate	Moderate	Good	33	88

* Warm-Season Legumes, ^ Cool-Season Legumes, "Cool-Season Grasses, -Other Forage Crops

Weed Wiper is excellent for removing tall weeds, like Johnsongrass, from legumes, like clovers.

the imidazolinone chemistry over glyphosate, as it is more effective. Burn off in late winter or early spring and spray after it is actively growing with 16-24 oz/acre of ARSENAL® or 32-48 oz CHOPPER®. Be mindful of the limited soil residual activity with the imi's, and do not apply over non-target root zones. In these areas, use 1.5-2 quarts of glyphosate plus 12 ounces/acre of SELECT® 2EC. I usually plant an annual mixture the first year and spray again to control any remaining bermudagrass the following year. Iron-and-clay cowpeas @ 85 #'s/acre broadcast will likely shade out any leftover bermudagrass if whitetail deer are your management species. After that, perennials can be established. Be sure and completely eradicate all bermudagrass, as even a little bit will spread and eventually cover the entire field.

Johnsongrass

There are several ways to control this problem weed. If just a few plants are present in established food plots you can use a wick applicator on the back of an ATV set at just above the height of the forage plants. Use a rate of glyphosate at a 50:50 solution mixed in water. Or, use a backpack sprayer applying a 2% V:V solution and judiciously spray the johnsongrass, being careful not to cover desirable vegetation. Don't spray on a windy day. For areas that are infested with johnsongrass, apply 1.5-2 quarts of glyphosate/acre prior to forage crop planting. SELECT® (or ARROW®) is also effective at 8 oz/acre. Be sure and use a surfactant. I usually wait until the plant is actively growing and around 24" tall. You can also apply a pre-emergence herbicide (PURSUIT®, PURSUIT® DG @ 2 oz/acre, or SLAY® all contain imazethapyr), with timing in advance of a rain event. The pre-emergence application should be made with legume forage crops only such as iron-and-clay cowpeas, lablab, alfalfa, or any of the tolerant clovers.

Established Forage Plot Maintenance

Annual Warm-Season Forage Plots

Warm-season crop species typically planted for wildlife include alyceclover, American jointvetch, iron-and-clay cowpeas, Eagle® soybeans and Quail Haven® soybeans. Warm-season wildlife food plot management is more successful if you have first taken care of most of your problem weeds, especially grasses, prior to establishment. Sometimes bushhogging can be used to control late-maturing weeds, like horse-

Eagle Soybeans drilled and looking good. Roundup Ready, so you can spray glyphosate at any time weed competition becomes evident.

weed for example. Mow prior to seed-head formation so you do not scatter the seeds. When planting forbs, any of the grass-selective herbicides can be applied post-emergence. SELECT® and POAST PLUS® are best applied post-emergence while PURSUIT® can be applied pre-emergence. Be sure and read the label and follow the directions with regards to the rate of application, and spray prior to the flowering stage. It is also important to identify the weed species that is present. PURSUIT®, for example, will not control legumes as they are tolerant to this class of chemistry, but works well on non-leguminous warm-season broadleaf weeds like morning glory, ragweed, and pigweed, which are all common weeds in forage plots. Other herbicides can be used in a pre-emergence application, but need to be incorporated into the soil pre-plant, like TREFLAN® and PROWL®, for example. Be sure and read the label with respect to weeds controlled, as there are significant differences in weed susceptibility.

Annual Cool-Season Forage Plots

These plants include Austrian winter peas, crimson clover, and arrowleaf clover (all legumes), and oats, rye, triticale, and wheat (small grains). You can use the same pre-emergence herbicides for cool-season legumes that you use on warm-season crops. TREFLAN® and PROWL® can be used pre-emergence and incorporated into the soil pre-plant, while PURSUIT® can be applied pre- or post-emergence. Typical application rates include 24 oz/acre for TREFLAN® EC, 32-48 oz/acre for PROWL®, and 2 oz/acre for PURSUIT®, but always read and follow all label directions. PROWL® 3.3 EC (or PENDIMAX® 3.3, both contain pendimethalin) is a fairly weak herbicide and should be used in a rotation. The rate is dependent on the weed species that are present. You may also use 2,4-D Amine @16-32 oz/acre, or OVERDRIVE® @ 4-8 oz/acre, to con-

The two most important ingredients in any food plot are the proper amount of lime and fertilizer. Then you can start talking about seeds.

This is my liquid lime dispenser, made from PVC pipe, for liming smaller food plots. Works great.

trol broadleaf weeds in cool-season grain crops when weeds are about 4" in height. Do not apply PURSUIT® DG over cool-season grains if they are newly emerged, and it's best not to spray newly-emerged legumes until they have at least three fully expanded trifoliate leaves.

Cultural Practices Extend Annual Cool-Season Forage Plots

Some reseeding annuals can actually be managed like perennials. Crimson clover, for example, can be initially established in October at a rate of 10 pounds per acre (drilled) or 20 pounds per acre (broadcast) planting at a depth of ¼", adding 200 pounds/acre of 6-24-24 and fine tune your pH. Maturation is usually in May. After the Crimson has gone to seed, usually in June or July, spray the plot with glyphosate at a 2-quart/acre rate with surfactant prior to weed seed-head development and then bushhog the plot to scatter the Crimson seeds. If summer annual weeds germinate, repeat the glyphosate application. In August or September, top-dress with fertilizer and lime, if needed, and lightly disc, which re-sows your crimson seeds without adding any additional seed. Then you can overseed with your cool-season annuals like 40% Buck Forage Oats®, 40% Plot Spike Oats®, plus 20% annual wheat in the fall without discing. Arrowleaf clover can be managed in this way, as well. I've had Crimson Clover plots last up to seven years without using additional seed.

Perennial Cool-Season Forage Plots

Cool-season perennials include Alsike clover, alfalfa, birdsfoot trefoil, ladino white clover, and white-dutch clover. Perennials can be difficult to get started, due to their slow establishment rate, and can really suffer with competition, especially the first year after planting. In established food plots you can apply PURSUIT® DG over-the-top at 2 oz/acre or BUTYRAC® (2,4-DB) at 32 to 64 oz/acre to control the majority of competing weeds. For pre-emergence/pre-plant control, use TREFLAN® at 16-24 oz/acre. TREFLAN® can also be used if you are mixing chicory and rape with perennial legumes. For grass control in these forage plots, use SELECT® (8 oz/acre) or POAST PLUS® (24-32 oz/acre). Be sure and

Beautiful field of giant sunflowers, great for pollinators.

add a non-ionic surfactant. Often these plants will last longer if planted in partial shade, at least for part of the day.

Conclusion

In order to maximize forage production for whitetail deer and other wildlife, an integrated competition control program should be implemented utilizing cultural, mechanical, and chemical methods. A number of herbicides are available for grass and broadleaf weed control in forage plots. If you are unsure what to use, or at what rate, consult with a wildlife biologist prior to your application. And, always read and follow label directions. For grass control, the sethoxydim and clethodim products are best. For broadleaf control,

Broadcasting from trailer. This setup works well, and is very fast.

Whistleback ecotone planted around the perimeter of a ladino clover field. This feature adds edge cover when it matures.

try imazethapyr-based products. In pure legume plantings, use pre-emergence applications of imazethapyr, pendimethalin, or trifluralin. These later two can also be used in legumes that contain sunflowers, which are sometimes added for structural reasons. Imazethapyr and pendimethalin are also effective in eradicating crabgrass, which can sometimes be problematic. One note of caution, if you are adding companion plants to legumes like Brassicas, buckwheat, chicory, grain sorghum, etc, you may not be able to conduct a herbicide application over-the-top without injury. This is also the case when planting many of the complex Spring mixes. With these I have found that drilling in wide-spaced rows and cultivating between the rows when necessary works great. Good luck with your forage plot weed control.

Common herbicides, active ingredient, suggested rate/acre, application, and crop information for successfully managing competing weeds in wildlife forage plots.

HERBICIDE	ACTIVE INGREDIENT	SUGGESTED RATE/ACRE	APPLICATION	CROP
Arsenal AC	imazapyr	6-24 oz	post-emergence	various
Atrazine 4L	atrazine	32 oz	pre/post-emergence	corn/grain sorghum
Butyrac 200	2,4-DB	16-64 oz	post-emergence	legumes
Overdrive	dicamba/diflufenzopyr	4-8 oz	pre/post-emergence	grasses
Roundup	glyphosate	1-5 quarts	post-emergence	non-selective
Prowl 3.3 EC	pendimethalin	32-48 oz	pre/post-emergence	various
Pursuit DG	imazethapyr	2 oz	pre/post-emergence	legumes
Poast Plus	sethoxydim	32-48 oz	post-emergence	forbs
Select 2 EC	clethodim	8-10 oz	post-emergence	forbs
Treflan HFP	trifluralin	16-32 oz	pre/post-emergence	various
2,4-D Amine	2,5-D	16-32 oz	post-emergence	grasses

An Overview of Modern Wildlife Diseases, Part 1 of 2

By G. Ryan Shurette

G. Ryan Shurette is a Certified Wildlife Biologist and Owner/Guide of DragSmoker Fishing Guide Service. Contact him at 256-404-5814.

To combat the spread of rabies in wild raccoons, the Animal and Plant Health Inspection Service aerially deploys baits embedded with an oral vaccine packet seasonally in strategic locations across the East. These baits and vaccines are safe for pets and if you find one of them in the woods, the best thing to do is simply leave it where it is. Photo credit USDA APHIS Wildlife Services.

Wildlife populations can obviously be affected by a variety of influences. Most often as managers, we deal with population manipulation *directly* via harvest management, or *indirectly* through vegetative habitat improvements. It is easy for us to conceive how chronic overharvesting of a species in a concentrated area could bring numbers down significantly. Indirect management activities like prescribed burning or timber thinning, on the other hand, can also obviously have drastic influences on local wildlife populations. In fact, for most wildlife species, habitat condition can be the difference between abundance and complete absence on a particular area of land. These are all concepts that most of us are familiar with. However there is another significant factor that can bring sweeping changes to native wildlife populations; sometimes regardless of the local management we provide. That factor is disease.

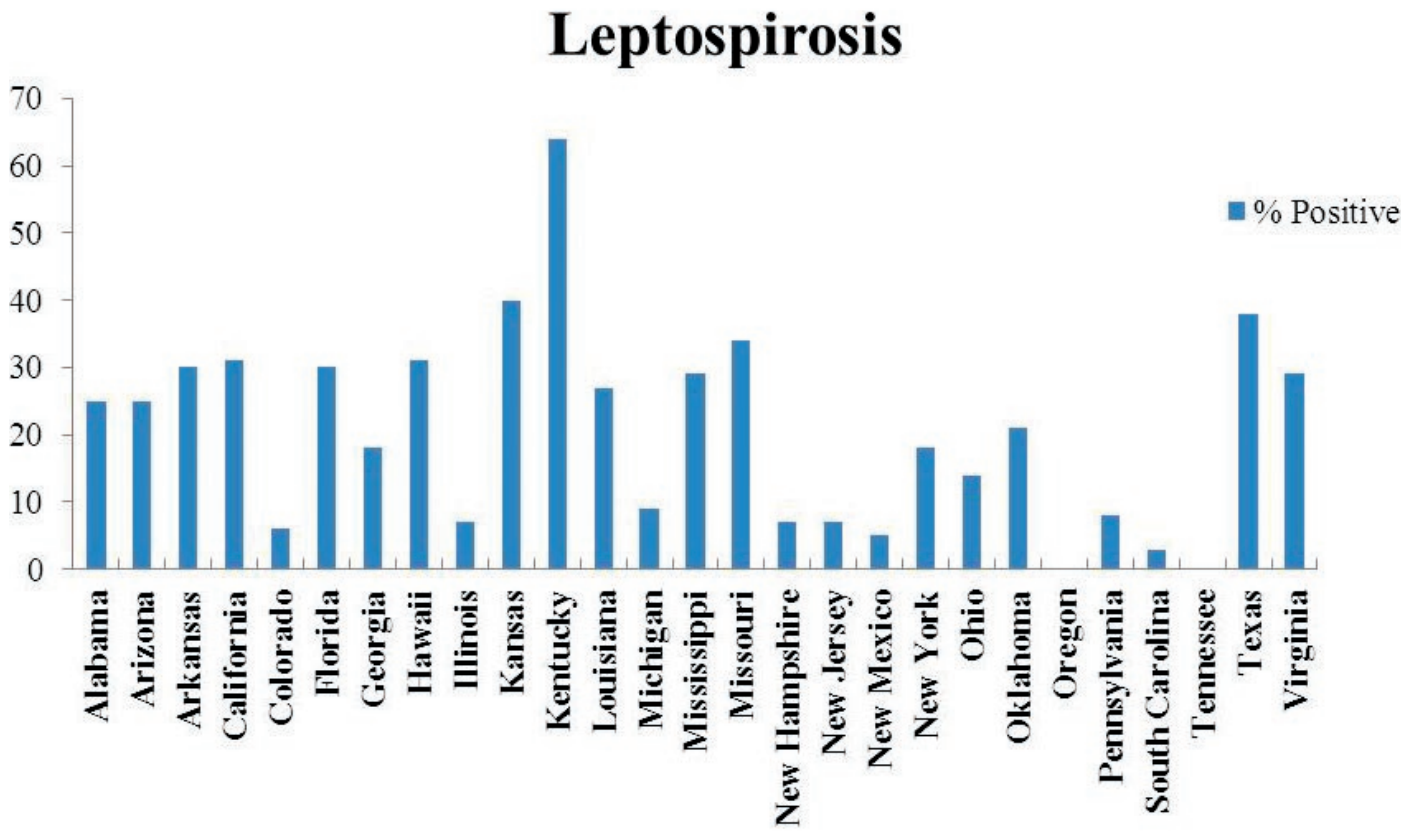
Just as in humans, disease in wild animals can be induced by several categories of

causative agents. These categories include bacterial, viral, fungal, and parasitic agents, but also can include certain chemical toxins. (There are also a few protozoan-caused diseases that are associates with some species but we will not address those here). And just as in humans, some of these diseases have predictable symptoms, cycles, and remedies. Yet with others, there is little we as managers can do but for let natural illness run its course. Another thing to consider is that pathogens, and in turn diseases, are always evolving. In this article we will provide an overview of some of the common and not-so-common modern diseases in major game and select non-game wildlife species. We will especially highlight certain *zoonotic* diseases (those that can be shared by humans and animals) so that precautions can be taken when dealing with wildlife.

Bacterial Diseases

Bacterial diseases are the most likely of the aforementioned categories to be zoonotic. That is because many bacteria are generalists and can infect a multitude of species. One of the most common examples is probably Salmonellosis, caused by one of several species of *Salmonella* bacteria. It is most often found in birds and reptiles but these bacteria can also infect a host of mammal species, including humans. In wild animals, this disease (as is the case with most bacterial diseases) does not generally pose a major threat to population levels. In fact symptoms (often including diarrhea and fever) are not even typically noticeable. In humans however it can be associated with severe gastrointestinal distress and dehydration. A somewhat more serious (in regards to human risk) bacterial disease is Tularemia, or rabbit fever, cause by the *Francisella tularensis* organism. Just as its name implies, this disease is commonly found in rabbits as well as rodents and other mammals. Beavers, flying squirrels, and muskrats are all known carriers, as well as a few species of birds. In the aforementioned mammals, it generally causes fever, loss of appetite, sepsis, and even death in some cases. Vectors in nature are typically deer flies and ticks but humans can also become infected from handling infected animals (through cuts or skin abrasions). It can even be contracted by inhaling the bacteria during the skinning process. Skin lesions are a common symptom in human infections. The *F. tularensis* bacterium also attacks white blood cells in humans and can evade the immune system for some time, leading to high fever and the infection of several organs. Untreated, the disease has a 7% average mortality rate in humans (CIDRAP, 2013) but with antibiotic treatment the fatality rate is well under 1%. Wild rabbits that appear "lazy" or exhibiting no fear of hunters or other odd behavior would be suspect of this disease.

Leptospirosis is another bacterial disease and has recently been a topic of discussion. With the expansion of feral pigs and the public health threats asso-



Preliminary results from studies by LSU, APHIS Wildlife Services, and other researchers have shown alarmingly high rates of leptospirosis in feral swine in recent years. Figure provided by USDA APHIS Wildlife Services, 2012.

ciated with them, this disease is worthy of some concern. Preliminary results from studies by LSU, APHIS Wildlife Services, and other researchers have shown alarmingly high rates of leptospirosis in feral swine in recent years. For the pigs (and the many other mammal carriers such as rats, skunks, raccoons, and opossums) the disease is not typically fatal, however experimental infections in white-tailed deer did induce fever, fetal abortion, and death in some cases. Generally wild animals will build immunity and recover from the disease but will remain carriers of the bacteria. That means they can infect domestic livestock and people where they frequently cross paths. The disease is most often spread to other animals through contaminated drinking water, and to humans by them either swimming in urine-contaminated waters or via direct contact with an infected animal's urine. Either way, the corkscrew shaped spirochete bacteria can be bad news for humans, as it can cause severe headaches, fever, vomiting, meningitis, and even kidney failure.

Leptospirosis is not the only bacterial threat that feral pigs present. In fact, they are carriers of over 40 different diseases that pose a threat to domestic animals, wildlife, and/or humans. Brucellosis and *Escherichia coli* are just two of the other notable infections that are commonly seen in wild pig populations across the country. Both are gram-negative rod-shaped bacteria. Most folks are already aware of the unpleasant consequences of *E. coli*, so we will briefly discuss Brucellosis. This disease is caused by the *Brucella* spp. bacterium and it can infect many other wildlife species including elk, bison, foxes, and raccoons, as well as domestic livestock. Deer can

Leptospirosis is not the only bacterial threat that feral pigs present. In fact, they are carriers of over 40 different diseases that pose a threat to domestic animals, wildlife, and/or humans. Photo credit USDA APHIS Wildlife Services.

also be infected; however they seem to be much less susceptible than elk and other species. In a national study (including white-tailed and mule deer) with a sample of over 17,000 individuals, only 20 (all were white-tails) tested positive for the bacteria. In cattle and other ruminants, abortion is a common result of infection, along with chronic infections in bones and joints. There have been successful vaccination programs in the domestic livestock industry; however vaccination of wild animals is very challenging. In the West elk are the most prevalent carriers, while in the Southeast feral pigs are probably the most common host. Prior to pasteurization, human infection most commonly occurred through consumption of infected milk. In modern times, human risk is greatest from direct exposure from butchering infected animals or from other occupational exposure. Consumption of infected meat can also infect humans as well as predators. In humans, Brucellosis is characterized in the initial phase by undulant fever, profuse sweating, and joint and muscle pain. A long-term, multiple antibiotic regime is usually needed. If untreated, it can cause chronic bone and joint problems. Preventative precautions include using protective gear, especially nitrile gloves while handling potentially infected animals.

The final zoonotic bacterial disease we will briefly mention here is bubonic plague, caused by the *Yersinia pestis* bacterium. In the western US, this disease is transmitted by fleas and cycles naturally through wild rodents like ground squirrels, prairie dogs, chipmunks, wood rats, and mice. Typically low levels of plague exist in wild rodents from year to year with no drastic population effects. Rabbits are also sometimes susceptible. Humans and pets (especially house cats) can be infected by the bacteria-contaminated fleas or through direct contact with infected rodents. In humans bubonic plague symptoms include rapidly swelling lymph glands. If infection of the lungs develops, that infected person can then be contagious (by coughing infectious droplets) to other humans. This version of the disease is referred to as pneumonic plague, and has a higher fatality rate.

Viral Infections in Wildlife

A wide variety of viruses are known to cause disease in wild animals, and some have the potential to cause major population-level declines. However, only a few viral diseases in wildlife are zoonotic. An example of one zoonotic viral threat is rabies, caused by *Lyssavirus* (Rhabdovirus family). Rabies is a mammalian disease, most commonly seen throughout recent decades in wild skunks, foxes, raccoons, and bats. In fact, these animals make up over 95% of all recent reported cases in the US, although the host importance varies by location. The raccoon rabies virus for example is most prevalent along the East Coast and adjacent regions, while rabid bats consistently show up all across the country. Prior to the mid-1900's and consistent vaccination programs, domestic dogs served as the country's main reservoir for the disease for a period of several decades. Rabies causes acute swelling of the brain, and in non-human animals,

Epizootic Hemorrhagic Disease (EHD) is the most important viral disease of white-tails across the country. It is transmitted by small biting flies called midges in the Culicoides genus, especially C. variipennis, shown here. Photo credit Wikipedia Commons.

Individuals that survive EHD often have cracking or sloughing hooves. Past outbreaks have typically involved mortality rates lower than 20% of the population, however local die-offs of more than 50% have occurred. Photo credit Mississippi Department of wildlife, Fisheries, and Parks.

it is characterized by three different stages. During the first stage (1-3 days) of the disease (the prodromal phase) some basic behavioral changes are noticeable. Animals may begin to lose their fear of humans and may be seen out during unusual hours. The second stage (with a duration of 3-4 days) is the excitable phase (also called the furious stage) in which the infected subject becomes hyper-reactive with a tendency to bite anything in sight. Finally, the affected mammal experiences a paralytic stage, where motor neurons of the nervous system are severely damaged. Loss of limb function and drooling (due to facial and throat muscle paralysis) is characteristic of this third and final phase of rabies. Death soon follows, often as a result of suffocation. Without treatment, human infection is also fatal. Precautions include occupational vaccination (for those who handle bats or other potentially infected wildlife) and avoidance of suspicious bats or other animals. To combat the spread of rabies in wild raccoons, the Animal and Plant Health Inspection Service aerially deploys baits embedded with an oral vaccine packet seasonally in strategic locations across the East. These baits and vaccines are safe for pets and if you find one of them in the woods, the best thing to do is simply leave it where it is.

Another very important viral disease with regards to American ungulates is Epizootic Hemorrhagic Disease (EHD). Although it can affect pronghorn, elk, big-horn sheep, and mule deer, it is most commonly seen in white-tailed deer. In fact it is the most important viral disease of white-tails across the country. The disease is caused by an orbivirus in the Reoviridae family. It is transmitted by small biting flies called midges which are in the *Culicoides* genus, especially *C. variipennis*. The seasonality of EHD outbreaks (typically late summer into fall) coincides with the abundance of this insect vector. In the West and Midwest, occurrences of EHD are intermittent while in the Southeast, outbreaks occur annually. Some animals carry only mild infections with no symptoms while others experience a variety of clinical symptoms. Deer with EHD will often lose their fear of humans and may seek out water sources like creeks and ponds (to reduce fever). Some infected animals may experience a swollen neck, tongue, or throat and have breathing issues. Some deer die quickly (within 3 or 4 days) while others usually live longer with other complications, including lameness. Lesions are common in EHD-infected deer, as well as hemorrhages of the heart, pulmonary artery, rumen, or intestines. Individuals that survive the disease often have cracking or sloughing hooves. The severity of past outbreaks have typically involved mortality rates lower than 20% of the population, however local die-offs of more than 50% have occurred. Because of the high mortality rate this disease can have drastic effects on local deer populations. There is no current treatment for the disease in wild animals, since widespread vaccination is not an option. There is no evidence that suggests EHD

poses a threat to humans and venison from infected animals has been declared safe. However use discretion in the consumption of animals with ulcers, abscesses, or other abnormalities. Hunters who observe deer with symptoms of EHD are encouraged to report to their local state conservation agency.

In wild birds, a myriad of viral diseases are known. We covered several of these important avian viral illnesses in detail in a previous *Wildlife Trends* article (including avian influenza, lymphoproliferative disease, avian pox, and Newcastle Disease). However, here we will highlight a couple of the lesser known viral diseases in wild birds. The first is a relatively recently discovered disease that affects American woodcocks. In the winter of 1989-90, approximately 1000 dead woodcocks were found in the coastal regions of New Jersey and Virginia (Docherty et. al., 1994). Another die-off occurred in the winter of 1993-94. From these birds a type of virus (called a reovirus) was isolated. Reoviruses are fairly well known from poultry industry and in domestic chickens they can cause inflammation of the pericardium, enteritis, hepatitis, bone degeneration, and other symptoms. Little is known however about the woodcock reovirus. There were no visible lesions on the dead birds although most were thin and emaciated. Following the outbreaks, samples were collected from across the range of the species, from hunter-harvested and live-trapped birds. No positive results were found from any of those tissue samples (N=481) or cloacal swabs (N=305) (Docherty et. al., 1994) in the Southeastern and Midwestern populations. The implications of woodcock reovirus in regards to population declines are still not well understood. No human threats from this disease are known.

Another viral disease that affects ducks, geese, and swans (Order Anseriformes) is duck plague, also called duck virus enteritis. This disease is caused by a herpes virus and only waterfowl are known to be susceptible. Therefore, when several ducks or geese are found dead and there is no observed mortality in local shorebirds or other species, duck plague is likely responsible. Although duck plague is not zoonotic and poses no direct risk to humans, this disease is important to migratory waterfowl as they can carry the virus long distances during the incubation period. Mortality during outbreaks can reach as high as 90% (Carter, et. al., 2006). The only known control is depopulation and decontamination of affected carcasses and sites.

Chemical Toxins and Wildlife

Chemical toxins associated with the transportation, manufacturing, and agricultural industries have been an important topic regarding wildlife conservation for the past several decades. The following chemicals have been known to cause problems in wildlife, especially in birds: pesticides, polychlorinated biphenyls, oil, lead, selenium, and mercury. Chlorinated hydrocarbon insecticides like DDT (also called organochlorines) were largely banned in the United States in the 1970's because of their persistence in the environment and ecological effects. Since then, organophos-

In addition to waterfowl, raptors (especially eagles) have also recently been found to carry elevated concentrations of lead in a surprisingly high percentage of the population. Eagles and other birds of prey ingest lead bullet fragments from hunter killed carcasses and carrion. Photo Credit USFWS.

phate (OP) and carabamate insecticides have become more common. These pesticides typically last only days or weeks in the environment instead of months, but they can still accumulate and cause die-offs in wild free-ranging birds. While many species can be affected by OP insecticides, passerines, raptors, and waterfowl are among the most commonly reported mortalities. Birds are usually exposed to OP and carabamate insecticides via consumption of seeds or vegetation with residues, eating treated insects, drinking contaminated water (runoff), or through direct contact (inhalation or absorption) in treated areas. OP and carabamates are toxic because they disrupt enzymes in the nervous system, and in wild birds this can cause symptoms including convulsions, drooping wings, respiratory distress, and paralysis.

Polychlorinated biphenyls (PCB's) are used in multiple industrial applications (including the plastic, insulation, printing, asphalt, and paint industries) and are very long-lived in the environment. This has made them one of the most common worldwide contaminants, especially in rivers and industrial-associated water bodies. They are similar in their molecular structure to DDT and can bio-accumulate in the tissues of wildlife as they move up through the food chain. Large long-lived predatory fish are more likely to build high concentrations of PCB's. Mammals, especially mink, are also very susceptible to these compounds. Other commonly affected wildlife species include fish-eating birds like cormorants and pelicans. The Hudson River in New York is one of the best-known case studies for PCB contamination in wildlife.

Oil is obviously another chemical toxin that can affect birds and marine wildlife. Accidental petroleum releases are actually more common than most people realize and on average over 10 million gallons are spilled directly into fresh and saltwater environments in the US. Even more comes from intentional wastewater release and from urban runoff. Oil contamination is probably most well known in birds. In addition to the obvious issues associated with oiled feathers and the resulting hypothermia that usually ensues (due to the inhibition of the waterproofing and insulating properties of the plumage), there are a variety of toxicological problems that are associated from exposure to petroleum products. Chronic exposure to oil can cause reproductive system failure, malformation of embryos, impaired immunity, and a host of other symptoms in many types of birds. Shorebirds, waterfowl, and wading birds like herons and egrets are typically the most affected species. Another contaminant that commonly affects waterfowl is lead. Almost all species of ducks and geese are affected to some extent by lead poisoning in the US. Field symptoms in waterfowl include a crooked, slouching neck and emaciation. Canada geese, mallards, pintails, and scaup are usually the most commonly seen species with symptoms. These ducks are dabblers and are generally exposed by picking up and ingesting lead shot (from shotgun hunting) in shallow waters and marshes. Although waterfowl hunting regulations (using only non-lead shot) were imposed nationally around 1991, a significant level of lead poisoning in ducks can still be seen in many locations mainly due to residual shot from years of hunting, and the occasional ingestion of lead fishing sinkers or mine wastes. In addition to

waterfowl, raptors (especially eagles) have also recently been found to carry elevated concentrations of lead in a surprisingly high percentage of the population. Eagles and other birds of prey ingest lead bullet fragments from hunter killed carcasses and carrion. In 2011 for example, of the 120 bald and golden eagles taken into the Minnesota Raptor Center, 85% of those tested positive for elevated blood lead levels. Similar findings have been occurring in recent years across many other states. Considering these statistics, there is a movement currently to introduce legislation that would prohibit the use of lead bullets used in rifle hunting. This would undoubtedly lead to increased costs in ammunition and so it will continue to be a topic of debate for some time to come.

Other elements like selenium and mercury are also naturally occurring in the environment but can be hazardous to wildlife in certain situations. Selenium for example is actually an essential nutrient but at some point-source locations (such as smelter sites or sewage treatment areas) it can accumulate in plant tissues and then be passed through the food chain and concentrate in birds and mammals at toxic levels. It often causes embryonic abnormalities and missing limbs in wild birds. Humans can also be poisoned by high selenium levels. Mercury is a heavy, non-essential metal that can be introduced into the environment at higher than natural levels. It's presence in fish and shellfish in many locations (and potential risk to humans who eat them), is well documented. Like selenium, mercury is transferred up through the food chain and causes emaciation in birds and a variety of other symptoms in mammals. Mitigation for chemical intoxication among wildlife involves careful disposal of wastes, responsible industrial management, and clean-up of contaminated sites. The latter can be very difficult and virtually impossible in aquatic environments.

In this article, we have discussed a variety of wildlife diseases caused by bacterial, viral, and chemical agents. Some of these typically persist in game and non-game populations without causing too much of a problem. Others, as we indicated, have the ability to cause major die-offs and can significantly affect local population levels. In Part 2, we will continue this discussion by taking a detailed look at some very different diseases caused by fungal and parasitic agents.

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Behavior of Incubating Northern Bobwhites

By Steven Smith

Steven Smith is a Certified Wildlife Biologist® and serves as a Wildlife and Fisheries Consultant for The Samuel Roberts Noble Foundation, Inc. assisting land managers in Oklahoma and Texas. Steven received a B.S. in Wildlife and Fisheries Ecology and a M.S. in Rangeland Ecology and Management from Oklahoma State University.

All photos taken by Steven Smith.

A successful nest.

Since the 1920s, more than 2,000 studies on northern bobwhites have been conducted. These studies have covered topics such as disease, survival, reproduction, predation, movement and habitat requirements. However, few studies have focused on nesting behavior. Due to advances in camera technology, wildlife biologists have been able to study these aspects of quail biology in recent years. Miniature video cameras have become one of the most useful tools available to wildlife biologists.

In this article, I will share with you a study I conducted in graduate school at Oklahoma State University. This study* was conducted in the Texas Panhandle in Roberts County, Texas, during 2001 and 2002. The purpose of the study was to document the behavior of incubating northern bobwhites while on their nest. Since 2001, several studies using miniature video cameras have found similar predation results, but few have reported incubating behavior.

I used radio telemetry to follow bobwhite adults. Once a nest was located, I waited until the nesting adult left the nest before setting up the camera. A 25 meter (82 feet) cable connected the infrared camera to a time-lapse VCR, which was used to record three seconds of real time onto one second of tape. Another way of looking at this is that we were able to record 24 hours of actual time on an eight-hour tape. This system used a waterproof, black-and-white infrared camera, allowing for day and night observations.

Videotapes were viewed using a standard television and a time-lapse VCR. All tapes were watched for the following behaviors of the nesting adult: gular flutter (similar to panting like a dog when hot), turning of eggs, leaving the nest, returning to the nest, predation events and any additional unique behaviors. Daily behaviors were recorded from every third tape at 10-minute intervals. Each behavior received a unique four-letter code (e.g. leaving nest = LEAV). Behavior frequency was compared between day versus night and time of season.

Thermal probes placed in the nests were used to measure the temperature of nest contents. These probes were inserted through the back of the nest wall and placed under the eggs. This allowed me to determine if there was a relationship between nesting behaviors and nest temperatures as well as between behaviors and ambient temperatures. Temperature data was logged every 15 minutes simultaneously with a permanent weather station. All nests were located within 3 miles of the weather station.

Using five miniature video cameras, I monitored 59 different nesting attempts during 2001 and 2002. In 2001, I observed 26 nesting attempts by 15 individuals (11 female, 4 male) and in 2002, 33 nesting attempts by 21 individuals (17 female, 4 male). I obtained 24,677 behavior samples from 35 nesting attempts to estimate the percent of time incubating bobwhites spent in various behaviors. The remaining 24 nests were not included in the behavior study because the nesting adults were not able to incubate the nests due to the adult abandoning the nest, depredation of the nest or death of the adult. Sleeping and sitting were the dominant behaviors during night and day and early and late in the season; these behaviors accounted for more than 61 percent of the samples.

Before this study, very little was known about the behaviors of the nesting bobwhite. The only known report of bobwhite nesting behavior was by Stoddard (1931:33), which noted that if the nesting adult was undisturbed it "may doze by the hour with partly closed eyes, oblivious apparently of the usual noises of the vicinity." Furthermore, Stoddard (1931:34) noted that at night, incubating adults sit motionless, only leaving the nest if disturbed. This is an accurate representation of an incubating adult's nighttime behaviors. In the early season, birds spent the majority of the night sleeping and sitting (approximately 68.9 percent and 26.4 percent respectively). Nighttime behaviors in the late season

An example of the cameras setup in front of the nest.

A hen taking a nap with the camera in the foreground.

were slightly different with birds sleeping approximately 34.1 percent and sitting 38.5 percent of the time. Stoddard (1931:34) suggested that "the quieter the bird remains, the less is the chance of its being detected by any of the multitude of the keen-sensed prowlers that enjoy a meal of quail or quail eggs."

This study showed that birds left the nest at practically all hours of the 24-hour day. A previous study conducted by Lehmann (1984:87) noted that incubating adults left the nest once daily, either in the morning or in the late afternoon. In my study, nesting adults showed two distinct leave time peaks: 6-9 a.m. and 3-7:30 p.m. Return times also showed two peaks. The early trips occurred approximately between 8:30 a.m.-12 p.m. and the late trips around 6-7 p.m. Lehmann (1984:87) reported that birds usually return from the morning trips about 9 a.m. Afternoon trips usually began about 4 p.m. in the afternoon and ended shortly after dark. The average off-nest time that I observed was approximately 4.5 hours. Burnam et al. (2012, 77) showed an average off-nest time of approximately 3 hours in Florida. Incubating adults are commonly known to limit off-nest duration so the egg temperature does not fall below physiological zero temperature, or the point at which the chick stops developing.

Figure 1 shows an adult leaving the nest in the afternoon after the air temperature begins to drop and returning shortly after the air and nest temperature intersect. This figure illustrates that the incubating adult insulated the eggs from the summer heat as well as cooler temperatures. Figure 2 shows the insulating effect the incubating adult has on the temperature of the nest and eggs.

Behaviors of interest included calling from the nest, preening, nest repair, yawning, attacking the camera and threatening the camera. Of the 42 nests with camera setups, seven nests were abandoned after the camera was set up (two by the same female). Several incubating adults exerted a large amount of energy defending their nests from the camera. In three cases the incubating adult pecked, scratched and kicked the camera severely enough that the lens needed to be replaced. One male who was normally peaceful toward the camera began attacking it after a bullsnake consumed half of the eggs in his nest.

Bobwhites also displayed aggression toward other bobwhites, as well. I witnessed one instance in which a hen incubating two eggs was flushed from her nest by an unknown pair of female and male bobwhite. The nesting hen sat motionless as the pair approached the nest. The unknown female advanced

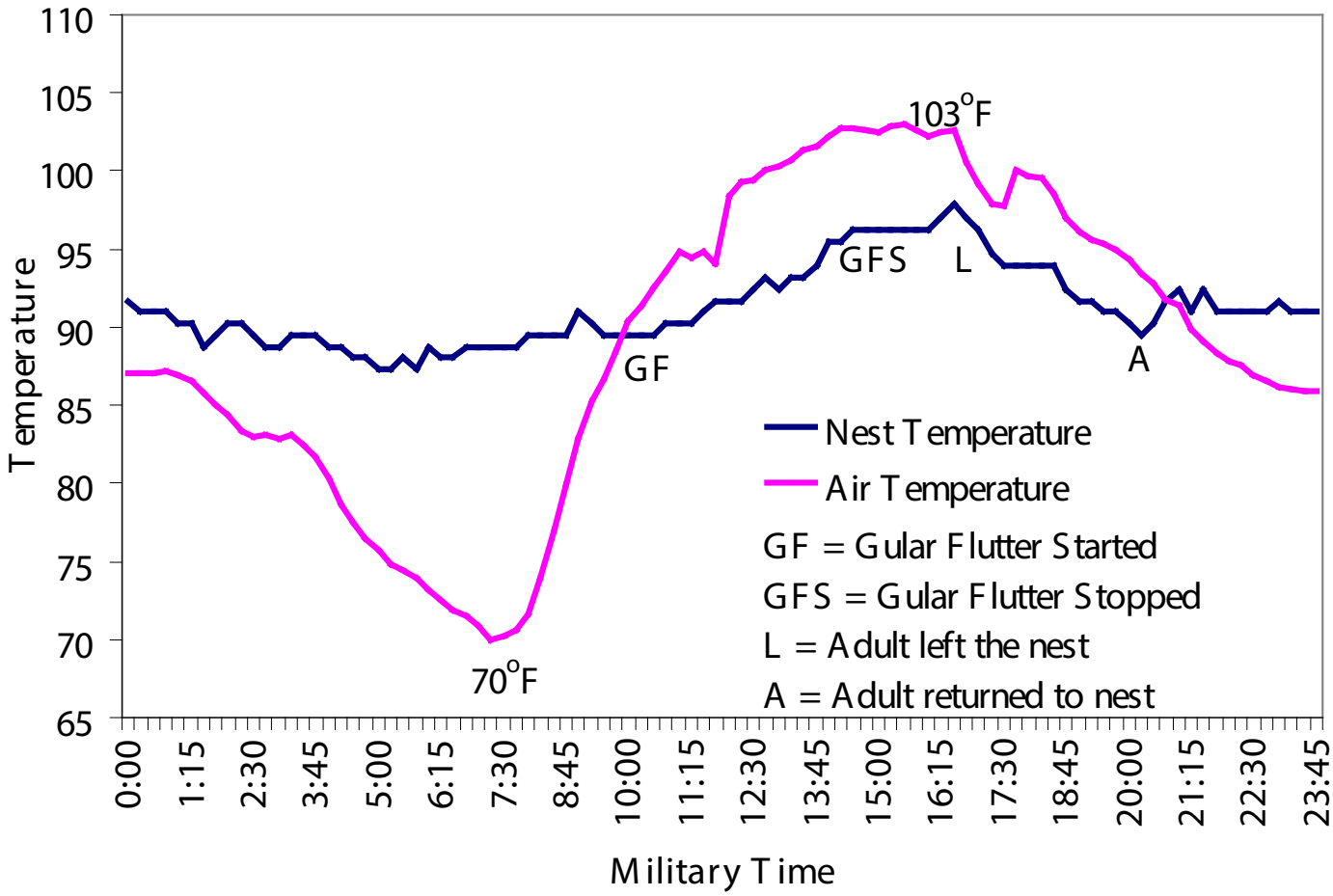

Figure 1. Comparison of air and nest content temperatures of Nest 22 on July 30, 2001 with respect to nesting behavior of the incubating adult. Mesa Vista Ranch, Roberts County, Texas, Summers 2001 and 2002. Courtesy of Smith, S. G. 2003. The effect of ambient temperatures on nesting northern bobwhites. Masters Thesis, Oklahoma State University, Stillwater, USA.

toward the nest with a threatening posture, flushing the nesting adult. After the incubating hen was gone, the unknown pair began investigating the nest. The unknown female entered the nest first pecking about to nest. The accompanying male was standing in front of the camera blocking most of the view of the hen. This lasted several minutes until the female left the nest and the male entered it, causing the female to stand in front of the camera blocking all view of his actions. The two intruders were at the nest for about 10 minutes then suddenly left for unknown causes. The nesting hen returned and continued incubating as if there was never an intrusion. There were three other occasions when an unknown bobwhite visited a nest, but this was the only assault witnessed.

One behavior that required a great deal of movement from the incubating adult was turning the eggs. This behavior is necessary to prevent the developing embryo from sticking to the shell membrane. For artificial incubation, it

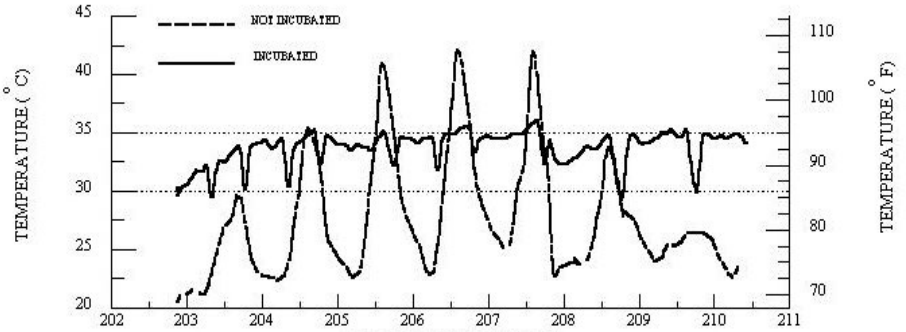

Figure 2. Comparison of nest-content temperature for incubated and control nest of northern bobwhites from July 21, 2001 to July 30, 2001, Mesa Vista Ranch, Roberts County, Texas, Summers 2001 and 2002. Courtesy of Smith, S. G. 2003. The effect of ambient temperatures on nesting northern bobwhites. Masters Thesis, Oklahoma State University, Stillwater, USA.

is suggested to turn bobwhite eggs only twice daily. It is known that bobwhites turn their eggs, but there is little if any knowledge on how often the eggs are turned. Stoddard (1931:34) noted the difficulty in determining how often all the eggs were turned because the incubating adult may only turn a portion of the eggs at any one time. Even with the help of miniature video cameras, this problem still persisted. In this study, if one or more eggs were turned it was considered a turn. The average time between turns was approximately six hours and ranged between a few minutes to 48 hours. This range seems wide but may be explained. The minimal time of a few minutes may be the results of an uncomfortable position of the eggs. Nesting adults frequently readjusted themselves in the nest either for comfort or for better thermal regulation on the eggs (covering more eggs). The high end of the range may be due

to the absence of the adult. I had a small sample of nests incubated by males. These males seem to be less attentive than females. They exhibited longer off-nest times and longer times between turns.

I observed 991 time between-turn events distributed among 26 nests (range = 3–85/ nests). For individual adults with more than 20 turns, the average time between turns ranged from 4 hours to 10.5 hours. This range highlights the variability within and among individuals in egg turning behaviors.

Knowing the primary cause of nest loss is an essential piece of information needed to implement the proper management strategy. When compared to previous studies, I observed a common depredation rate (Rollins and Carroll 2001). In this study, I had the advantage of using miniature video cameras to determine the main cause of nest failure/loss. In attempting to compare my results with previous studies, I began to doubt reported primary nest loss findings. The prevailing methods for determining the cause of nest loss was by the presence of or lack of disturbance (Stoddard 1931:187, Thompson and Nolan 1973, Best 1978, Lehmann 1984:92). Thompson et al. (1999:262) results generally followed this method, but there were enough examples to cause them to "question the reliability of identifying predators based on the level of nest disturbance." One nest was depredated by a raccoon and was undisturbed, while snakes clearly disturbed two nests (Thompson et al. 1999). Pietz and Granfors (2000) noted signs at nests might lead to misinterpretations of nest fates. They give examples of successful nests appearing to have been depredated and depredated nests appearing to be successful. Staller et al. (2005) could not with 100 percent confidence assign the correct animal that depredated the nest. In their study, mammalian predators were only identified correctly 30 percent of the time. To help understand these different situations, I continued to record footage of the nest for three days after the success or loss of the nest.

I observed several events of incubating adults removing broken eggs shell from the nest after the nest was depredated by a mammal. Without the camera being present, one would assume the nest was depredated by a snake. The same results occurred when ground squirrels visited after the nest hatched or was depredated by mammals. Ground squirrels ate the remaining eggs or carried them out of the camera's view. Raccoons, badgers and coyotes were able to depredate nests and leave no trace of disturbance, thus making one think it might have been a snake.

After reviewing these facts, one must be careful when estimating the cause of nest failure. Nests can receive post-fate visitors before the nest fate is able to be determined causing the misidentification of the cause of failure. Previous estimates of predation rates are most likely to be accurate, but studies attempting to estimate the depredating species without the event being observed should be viewed with caution.

So what does all this mean? Bobwhites are amazing and interesting little birds. When you stop and think about all the obstacles that a bobwhite must overcome to survive, one must give them a great deal of respect. Just to be born, the eggs must be incubated for 23 days. This requires constant attention from the nesting adult.

In my opinion, two very interesting points were learned from this study. The first was the way nesting adults monitored the ambient temperature with regards to managing the nest temperature. The second was the new information about nest depredation. Using video cameras, I was able to correctly identify nest predators instead of having to use the current incorrect rule of thumbs of "if egg fragments remained it was a mammal" or "if the eggs were gone it was a snake." Before my study, there was no evidence that nesting adults removed egg fragments after the nest was depredated, and there was no evidence of nesting behavior. I hope this provided some insight into to a very secretive aspect of quailology.

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FAQ's – Ponds

Taking out smaller bass allows the remaining bass to grow at a faster rate and get larger than if in an overpopulated, forage lacking waterbody.

Over the years, working in both state government and in the private sector, I have been asked many questions regarding lake management. There are a core number of questions that lake owners ask most often. Some are related to the early phases of lake development such as how deep or how large does a pond need to be to grow quality fish. Should I lime and fertilize? Why can't I treat large areas of aquatic vegetation with herbicide in the summer? Should I stock shad? And probably the most common question asked – Should I and why do I have to remove largemouth bass? Not all the answers are cut and dried, and every lake is unique and has to be looked at individually. For example, just because one of your waterbodies is benefitting from a fertilization program doesn't mean all lakes on your property should be fertilized.

By Scott Brown

Scott Brown is a biologist and regular contributor to *Wildlife Trends Journal* with over 30 years experience in research and managing natural resources throughout the southeast. Scott founded Southern Sportsman Aquatics & Land Management in 2007 and now has clients from Texas to Florida, and into the Carolinas. Scott can be reached at scott@southernsportsmanaquaticsandland.com or (336) 941-9056.

How big should my pond be to grow nice bass?

After lake construction is complete, this question is irrelevant. Generally, the heart of this question is - how small of a pond can I build and still have a chance to grow some big bass? Bream require at least a one acre pond to grow large individuals with a well maintained supplemental feeding program. For largemouth bass, we like to see three acres or larger. For black crappie, 15 acres or larger, while 25 acres or larger is preferred. However, we have seen a few smaller waterbodies offer great crappie fishing, but more often than not they are not a good fishery. How many fish a waterbody can support is not based on the number of fish but the total weight (biomass) of that particular species. For example, a largemouth bass carrying capacity of 100 pounds can be 100, one pound individuals, 10, ten pound individuals, or a combination of weights and sizes totaling 100 pounds . Most desirable fish species are edge species, so shape can make up for size. A three acre pond with an irregular shoreline and islands can have more quality habitat than a square or round five acre pond.

How deep should my pond be?

This is another question that needs to be answered before the pond is built. In the North, shallow ponds get too cold, dissolved oxygen levels go down and ponds can freeze solid if not deep enough. In the South, water temperatures become elevated in the summer, pushing Dissolved Oxygen (DO) levels down. Both instances can stress or kill fish. A good rule of thumb is to have the pond at least eight feet deep during drought conditions and no more than 12 feet deep, unless you install aeration. Without aeration anything deeper than 15 feet will experience low DO in the deeper holes and fish do not go down there certain times of the year when DO is below acceptable levels (3 parts per million [ppm]). If you install an aeration system, going deeper is acceptable and will ensure fish will use the entire water column. Many landowners dig to eight feet and stop to let it refill, only to find out after refilling that the final product is only seven or six feet deep. Once you stop digging the lake starts filling in with sediment immediately as the water comes in, so dig a little deeper than desired to compensate for silting in during the filling process and to allow for adequate depths during drought.

When digging your lake, make sure its final depth will be between 8 and 12 feet, digging slightly deeper than desired to compensate for some silting in during the filling process is advised.

A wide range of forage species and sizes is best to assure all size predators from the smallest to largest have adequate food.

Should I lime and fertilize?

Liming and fertilizing are great tools to increase fish production. Several things need to be looked at while considering this option and before implementing. Lake size is the first consideration. Lime is approximately $25/ton delivered, and extra for spreading (unless from shore or in lake bottom with delivery trucks in a new lake not yet filled). Two tons per acre in a 30 acre lake is $1,500 and you spread yourself. This usually needs to be performed every three-to-six years depending on natural pH and the rate of inflow/outflow of water. To some, this is not a financial issue; to others it may be a reason not to perform the task. Obviously the less adjusting of the pH required and the size of the waterbody can greatly influence costs. The price of fertilizer has gone up drastically over the years, so again the size of the waterbody, pH levels along with hardness and alkalinity need to be considered before you incorporate this management tool. To raise those parameters, liming may be required in your area. To fertilize, a pH above 6, and hardness and alkalinity above 20 milligrams per liter is desired. With so many variables, the answer to our question is to first look at some of the things previously mentioned. Be aware that fertilizing is something that requires constant monitoring to assure the desired effects occur and undesirable effects are nonexistent or kept to a minimum.

Why can't I treat large areas of vegetation in the summer?

Many do-it-yourself lake owners get behind in the spring trying to tend to the uplands and ponds simultaneously. They see a little vegetation growing in the lake and know that we always preach about leaving some habitat. Then by early to mid-summer the once "looking good" weeds are now out of control, affecting a large part of the lake and need to be treated with herbicide. The majority of herbicides prescribed for aquatic vegetation are not toxic to fish (a couple are toxic in extreme application rates). Most (99.9%) of fish kills that occur from herbicide use is from a drop in DO caused by dead plants. Living plants put oxygen into the atmosphere and water. But dead and decomposing plants in water are removing oxygen. The act of decomposing requires oxygen. If too much aquatic vegetation is treated with herbicides at once, a drop in DO can cause stress or kill fish. To help avoid this, treating partial areas over several weeks needs to be performed when water temperatures are elevated. Warmer water holds less dissolved oxygen than cooler water. Warmer water, decomposing plants, more fish present post spawn and less oxygen available means fish will become stressed or perish. Aquatic herbicide labels instruct you on how far apart treatments need to be in summer to defend against a fish kill. Usually it is 7-14 days between treatments and ¼-1/3 of the area gets treated at one time. For an entire waterbody treatment of contact herbicide, striping the area is better than doing a partial treatment all at one end. Stripe waterbody into six or eight sections, treat an area, then skip two or three sections and treat. Return after label recommended days and treat another untreated area and skip two or

When dealing with large areas of nuisance vegetation during the summer, treat partial areas over a period of time as described on the herbicide label, or spot treat and return in the fall when water temperatures are cooler to treat the majority of vegetation.

three sections, same way as the first treatment. After three or four visits, the entire area has been treated. When dealing with a severe infestation, it may be better to spot treat access points such as boat ramps, docks, feeders, etc. and then return in early fall and treat remaining nuisance vegetation.

Should I stock shad?

Shad have always been associated with a quality bass fishery. Several research papers and articles have been written documenting the benefits from threadfin shad, and some managers feel gizzard shad also benefit big bass. The first question we ask is, do you get a natural or man-made algae bloom (green water) every growing season? If not, these fish have nothing to eat, as they live off the planktonic algae and zooplankton in green water. Stocking them in clear water will result in them dying, not reproducing, and only being beneficial to bass for a short period of time. Another note is they are expensive, so stocking them without doing your homework is unadvisable. In the deep-South it is unadvisable to stock gizzard shad because they grow too fast, and many will get larger than the big bass can consume, eventually overpopulating and causing problems. Where winters are longer, gizzard shad growth is slower and more beneficial to big bass for more years. Threadfins can become stressed and die if water temperatures get below 44° F.

I have lots of minnows, why do I not have big bass?

An abundance of forage a certain size does not make for a perfect forage base. One-to-two inch minnows or bream will not feed bass over a couple pounds. As mentioned earlier with the lake that had a bottle neck at the three-to-four pound range, the pond had plenty of threadfin shad up to 4 inches and plenty of bream over 7 inches. The largest bass had forage but the mid-size fish three-to-six pounds were struggling because there were so many mouths to feed, but not enough forage for bass that size. You must look at forage make-up. If 1,000 pounds of forage is present, all in the form of one inch minnows, it will not support bigger bass. Lots of food for small bass, but once they become larger, food becomes less plentiful and growth slows or stops. Various forage sizes are required to grow bass from juveniles to quality or trophy fish.

What is the one single thing that will improve my fish population the most?

After we develop a management strategy some lake owners want the "silver bullet" to improve their fish population. Some may decide their water chemistry is poor and their lake is too large (costly) to lime. So the question arises "of which recommendations will singly most improve things?" This is very difficult to answer but over the years we have seen starting and upkeeping a supplemental feeding program is more times than not the answer. Keeping feeders full, fully operational and using a quality fish feed are all necessary to get the biggest benefit. All fish benefit from a feeding program, including top predators that feed on fish that eat the feed.

Why do I have to take out bass?

This is the most asked question and most neglected task in bass management in small waterbodies. The more food present, and fewer individuals

This is a common sight we see during a client's first lake evaluation. Lots of small bass, skinny, big eyes and large heads due to too many bass present and not enough forage. One of the management recommendations here will be "take some small bass out!"

feeding, the faster and larger the predators (largemouth bass) remaining grow. A desired combination of increased forage and reduced number of predators creates favorable conditions for bass to reach their full growth potential. The number prescribed to be removed may be from 10 – 30 per acre, depending on how productive your lake is. Generally in plankton rich (green water) lakes, 20-30 bass per acre are prescribed to be removed ANNUALLY. In Clearwater lakes, possibly 10-15 per acre ANNUALLY may be prescribed. This is not a once in awhile task, it needs to be performed every year and every two-to-three years an evaluation (electrofishing) should be conducted to adjust the slot to accommodate the needs of the bass population. The more bass present, the more that needs to be removed. This "bottle neck" usually occurs from 12-16 inches, but it can occur throughout the size range. Fish become stunted when there is not enough appropriate size forage for a particular size predator to keep growing at their full potential. We have seen this around three-to-four pounds, in which case fewer individuals are removed, but they are each larger than the typical one pound fish. Instead of 30 one pound fish per acre to be removed, 10 three pound fish per acre may need to be removed. Additionally, forage for bass in this size group is lacking and it needs to be addressed to provide food for those individuals.

These are a few of the common questions lake owners have for professional lake managers, but there are a wide range of answers to each one. When I get asked one of these questions, I usually ask a lot of questions back before I can give the best answer for their particular situation.

Wildlife Trends Journal Management Calendar

By Dave Edwards

June/July 2015

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 General Manager for Cabin Bluff Lodge and President of Tall Tines Wildlife & Hunting Consultants, Inc. Contact him at Dave.Edwards@CabinBluff.com or 912-464-9328.

Cogon grass is an extremely invasive exotic species that can quickly take over the understory out competing desirable wildlife friendly plants.Initiate control strategies as soon as it is identified on your property.

Identify and control invasive exotic plant species

Many 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 and expensive. 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 be complicated as well.

Complete draining duck ponds and prepare for planting

If you are managing a moist soil area/duck pond (i.e., native vegetation vs. planting agricultural crops), you 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 result in many different types of food sources (seeds and insects). By May or early June, your drawdown should be complete and native moist soil plants are starting to establish. Herbicides can be a useful tool to remove undesirable vegetation if it becomes a problem and is dominating the pond. Button bush and sesbania (wetland shrubs) can be beneficial, but should be kept in check and not allowed to comprise more than 25% of the pond.

If you plan to plant an agricultural crop rather than manage the native vegetation, leave the pond flooded until closer to planting time. That is, drain ponds you plan to "plow and plant" a few weeks before you start plowing and preparing the soil for planting. Leaving the pond flooded until this time will provide weed control and will reduce tractor time later. Drying time will vary depending on your soils. It is better to drain early than to wait and not be able to work the ground because it is too wet and chance running out of growing season.

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 until it will be drained later this summer for planting, now is a great time to make needed repairs to water control structures, catwalks, hunting blinds, and levees. While the pond is relatively dry, I often lubricate and check water control valves to ensure they work properly. This is also a good time to remove muck that builds up in front of drain pipes or along pond edges. In some cases, re-leveling with a tractor may be needed. If you 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 the pond for undesirable vegetation such as sesbania, willows along the dam or levee, etc.. A chainsaw, machete, and/or herbicide applications are the tools of choice for removing these trees.

Initiate management of beaver ponds for creating and attracting waterfowl this winter

Similar to cultivated duck ponds and

Sorghum

green tree reservoirs equipped with water control structures, beaver ponds can be managed to produce duck food to attract waterfowl and provide great hunting opportunities. If quality mast producing trees are still alive in the beaver pond, manage the pond as a green tree reservoir – meaning apply a slow draw down before spring green up. While most oak species can tolerate being flooded over dormant season, few do well and often die if their feet stay wet well into summer. If few quality trees exist or if trees are already dead (from constant flooding), you have a few options on management strategies. First, you could drain the pond early in the growing season (at spring green up or very early summer) to allow natural wetland/moist soil plants to germinate and grow throughout the summer. Many moist soil plants produce seeds which are quality duck foods. A slower draw down over several weeks will result in a more diverse species composition of plants providing a variety of seeds/food. Another option would be to hold water on the pond until mid-summer, drain the pond, then broadcast small grains such as millets. I personally like Japanese millet because it easily germinates on mud flats with little or no site preparation, grows well in wet soils, produces an abundance of seeds, and if water is properly managed it will often re-seed the following year. Planting grain in a beaver pond is relatively easy. Simply broadcast seed at the recommended seeding rate per acre onto exposed mud flats. Although fertilizing is not essential to success, it can help. I have rarely fertilized broadcasted crops in beaver ponds and have had great success without it.

Now to the hard and messy part – water control. To consistently manage a beaver pond successfully for ducks, it is necessary to drain the pond by breaking the dam and installing a drain pipe. Generally speaking, this means a pipe that extends well into the pond with many perforations to prevent beavers from patching the leak. Although it is messy, and certainly watch out for water moccasin/cottonmouth snakes, breaking a beaver dam is often not as difficult as it seems and can normally be done with a fire rake. Break the dam on the downhill side of the existing channel in the form of a narrow, deep "V". The initial flow of water through the dam will help clear excess dam materials. Place the drain pipe deep into the break so that at least 10' of pipe extends into the upstream area. The final level of the pond will be determined by the height of the downstream end of the pipe, or the stand pipe position height. There are many options for beaver pond drain pipes. The key is to install a pipe that is designed to prevent beavers from "patching the hole", yet does not drain the pond completely so that beavers remain in the pond. Always leave at least 1/3 to 1/2 of the pond area un-drained during drawdown, as over-draining may cause the beavers to seek new areas. There are many homemade and fabricated designs that can be found by doing a little internet research. If you do not use a drain pipe that allows you to adjust the water level, you

Establishing mineral licks will provide great locations for capturing late summer bucks on camera

will need to remove the drain pipe approximately 45 days after natural moist soil plants or your planted crop germinates. This will allow beavers to patch the break in the dam resulting in the pond flooding. Using this method often requires re-breaking the dam and re-installing a drain pipe higher in the dam to maintain the desired water level. I like the Clemson Pond Leveler as it is a great and relatively permanent design that allows you to control water levels by adjusting a standpipe on the downstream side of the dam.

Plan now for late summer trail cameras - Create mineral licks

While the nutritional benefits of providing mineral licks for deer have not been well studied, they are cheap to create, deer use them, and they do not appear to have any negative nutritional effects. In fact, most deer biologists think there are nutritional benefits of providing minerals for deer. You can create a mineral lick using commercial blends of dry minerals and/or placing mineral blocks in desired locations around your property. I have had great success getting deer to use commercial mineral rocks, such Bio-rock or Trophy Rock, throughout summer and into early fall. Using a mineral lick or salt rock is also a good way to reduce bear or hog problems commonly experienced when using corn. Deer tend to use mineral licks the heaviest from summer through early fall. The key however, is to establish the mineral licks early in the summer to allow deer time to find them and begin using them. My experience with mineral licks has been that the longer they have been established, the better they are. Rains dissolve the minerals and saturate the stump or area they are placed. Evidently "leftover" minerals or salt that attracts them lingers and deer often come back to the same site the following year. Having said this, corn is still the "go to" attractant if you are conducting a true camera census on a property, but mineral licks offer a cheaper way to get deer in front of cameras for "casual" photographing. Get them established now so that deer are using them during later summer/early fall when you want to photograph them.

Install new food plots or expand existing ones

From a landscape level, actively managing nature habitats should be one of the highest priorities for landowners desiring to enhance wildlife value of a property. Having said this, we all know the wildlife value created by dedicating land to actively managed food plots. Because all properties are unique with various habitat compositions, forest

ages, diversity, timber management strategies, agricultural practices, and management on neighboring lands, it is impossible to provide a "cookie cutter" amount of acreage that should be dedicated to food plots. However, if adding more acreage in food plots is in your plans summer is a good time to create new food plots or enhance existing plots. I personally like to plan and mark/flag areas needing clearing during winter months while leaves are off allowing me to see the area better. Another advantage of doing this during winter is there are no snakes, ticks, and chiggers to worry about! I then come back in summer to do the "dirt" work. Through years of experience, I am a big fan of using mulching machines when creating new food plots, expanding existing ones, expanding roadsides, or creating new trails. A mulching machine, also referred to as a forestry mulcher, uses a rotary drum equipped with steel chipper tools (or teeth) to shred vegetation. Heavy duty forestry mulchers can clear up to fifteen acres of vegetation a day depending on terrain, density, and type of material. However, 5-8 acres per day is more realistic for most applications I've used them. The advantage of using a mulcher is only needing a single machine to cut, grind, and clear vegetation verses needing a dozer, backhoe and farm tractor to do the same job. Mulching is essentially a one-pass and done type process. Because the vegetation is grinded into chips there are no debris or root piles commonly associated with dozer type clearing. Another advantage is mulchers are capable of clearing land of unwanted trees and brush with limited disturbance to soils leaving more nutrient rich top soil and reducing the risk of erosion. From a location and design standpoint, I always consider soil quality, hunting stand placement, preferred wind direction for hunting, hunter access, and obviously what the land, terrain, and habitat will allow. Where possible I try to create linear shaped food plots. Deer, particularly mature bucks, feel more comfortable and secure using linear plots which results in more sightings and harvest opportunities while hunting. Examples of this may include a "turkey foot", "V" shape, or "hub and spoke" – aka "wagon wheel" shape. When expanding existing rectangular food plots I often add linear "ears" or "fingers" that extend from the core food plot area. In this situation, deer often enter the fingers first then work their way to the more open plot. Regardless of the methods used to clear the land or the shape you design, summer is a good time to conduct this work. Doing so allows plenty of time

Summer is a great time to create new food plots or expand existing ones. A forestry mulcher is an efficient machine for land clearing.

Allowing summer wildflowers to mature and dry before mowing will enhance seed production for next year.

for working and amending the soil in preparation for fall plantings.

Control feral hog populations

"Control" may be the wrong word to use here, but you get the point. Although removing hogs could be on your management calendar throughout the year, summer is a good time to put extra effort into this since it often causes a moderate disturbance on your property. Hog populations are rapidly growing in many areas and are causing significant damage to wildlife habitat, food plots, roads, etc. wherever they live. One reason it is difficult to "control" hog populations is that they are reproductive at 6-8 months old and are very prolific having up to 3 litters of young per year! Thus, exponential population growth can and does happen if resources are adequate. The most effective way to remove hogs is through aggressive trapping. Be sure to do some research before you simply throw a few traps out. Specific trapping techniques have proven to be more effective than just baiting a trap and catching a hog or two each time. Another effective strategy, but more costly, is hiring professional hog hunters that use either night vision equipment and/or dogs to harvest hogs. Simply shooting hogs when opportunities present themselves helps, but is not an effective strategy to control them.

Conduct warm season or summer prescribed burns.

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

great sources for obtaining more information regarding burning in your area.

Allow wildflowers to mature and go to seed before mowing

Managing wildflower areas is a great addition to your property management strategies, particularly if one of your goals is improving habitat for turkeys and quail. They not only add aesthetics which adds to your outdoor experience, but the flowers attract an abundance of bugs and insects that are eaten by turkeys and other birds. If you have planted or are managing wildflowers on your property, avoid mowing these areas until seedpods have matured. Allowing the wildflowers to produce seed before mowing will ensure adequate reseeding for a good crop the following year. If you are not currently managing wildflowers on your property, but want to do so, do your homework to determine the best wildflower blend for your particular soil and climate, begin preparing seed beds well before planting time (fall) to create a smooth firm seed bed, and plan to plant them this fall. Due to the small seed size of many wildflowers, a smooth seed bed is critical to success. Rough seed beds often result in seeds getting covered too deep and will result in low germination rates even if broadcast by hand. Once established, and with periodic management such as mowing, wildflower areas can persist for many years.

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), sunflowers, grain sorghum, corn, and wheat. For best results obtain soil samples and apply required lime and fertilizer before planting. Be sure to allow enough time for your crop to produce seed before dove season arrives. 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. It also offers landing areas and access to seed once it matures as well. 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 gravel roads and other roadsides.

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