Fayette County 4-H Wildlife Judging Information

The Georgia 4-H Wildlife Judging Contest has five activities. Activities 1, 3, 4, and 5 are individual activities and activity 2 is a team activity. The activities are:

1. Activity 1 – On-site recommendation of wildlife management practices.
2. Activity 2 – Written wildlife management plan.
3. Activity 3 – General wildlife knowledge.
4. Activity 4 – Wildlife identification.
5. Activity 5 – Aerial Photographs

For Senior 4-H'ers, all species associated with the Southeast Mixed and Outer Coastal Plain Forest region apply. For Junior 4-H'ers only the ones below:

- barred owl
- northern bobwhite
- mourning dove
- eastern cottontail
- eastern fox squirrel
- white-tailed deer
- bluegill
- largemouth bass

CONTEST ACTIVITIES

- **Activity 1 – On-site recommendation of wildlife management practices**

  In Activity 1, you will recommend Wildlife Management Practices necessary to manage wildlife and habitat on a given site. You will give recommendations for several species, but consider each species listed **separately** as if it was the only species considered on the site.
  You will be given information about the site (a scenario), either verbally or written. Based on this information, an "X" should be marked in the box for each WMP recommended. Contestants will have one hour to complete Activity I. This is an individual activity, thus no talking is allowed.
  Do Not Guess! You lose points for each box incorrectly checked

- **Activity 2 – Written wildlife management plan**
  Complete a written management plan with team members with sections below. For Juniors, the plan will address only the Eastern cottontail. For Seniors, the plan will address two species.

Part 1: Plan Background (20 Points)

What are the species to be managed? (10 points)

The species to be managed are Eastern bluebirds, coyote and American kestrel.

State the management objectives (10 points)

The management objectives are to increase numbers of Eastern bluebirds, decrease the coyote population, and maintain the number of American kestrels on the property.

Part 2: Plan Development (20 Points)

Species Habitat requirements (10 Points)

State the basic habitat needs for each species. For example:

Eastern bluebirds are found in early successional areas interspersed with trees and shrubs where they forage on insects. Water is obtained from their diet. Bluebirds nest in cavities when available, but will readily use nesting boxes.

Habitat Assessment (10 points)

Evaluate the area and state what is present and lacking with respect to the needs of each species. For example:

The area is primarily Stages 5 and 6. Stages 2 and 3 is lacking for Eastern bluebird.

Part 3: Plan Implementation (70 Points)

This section should indicate the team has an understanding of the appropriate WMPs that should be implemented and the effects of those practices on the habitat and other species managed. For example:

Forest regeneration and chainsawing will open the Stage 6 forest and provide more usable space for bluebirds. Native grasses and forbs should be established to provide suitable foraging areas. Although a few cavity trees are available and should be retained when implementing forest regeneration and chainsaw work, additional nesting cover is desirable and nest boxes should be put in place.

Part 4: Plan Evaluation (10 Points)

State what you will do to determine if your plan worked. For example:

Spring counts and nest box checks will be conducted to determine presence of bluebirds. Vegetation surveys will evaluate if establishment techniques for native grasses and forbs were successful.

Sketch:

Participants will be required to draw a sketch and locate where recommended practices will be implemented. An aerial photo of the area may be provided.

- **Activity 3 – General wildlife knowledge**

  This is a multiple choice knowledge test. It may include information from the region(s) involved, wildlife management concepts, wildlife management terminology, wildlife management practices and the biology and ecology of the wildlife species found within a region(s). Questions for Activity III may be from information within *Concepts and Terms*, *Regions*, *Wildlife Species*, *Wildlife Management Practices*, and the *Glossary*.

- **Activity 4 – Wildlife identification**

  Activity IV will be provided as a PowerPoint presentation, hard copy pictures and/or physical specimens (such as skulls, hides, feathers, etc.). There will be 20 pictures/specimens shown to identify by filling in the blank. The photograph/specimen provided may be of an adult, juvenile, male or female. Participants will write the name of the species in the space provided on the answer sheet. **Answers must be legible, spelled correctly, with correct capitalization and the full common name of the species must be provided.**

- **Activity 5 – Aerial photographs.**

  You will use aerial photographs to judge the quality of an area for different wildlife species. You will be given a list of wildlife species, and asked to rank each photograph in relation to habitat needs of these species. Consider only the area that is outlined. Do not consider the surrounding area outside the outlined area. Rank the photographs one species at a time, then mark an “X” in the box that corresponds to your ranking. All possible combinations are listed, and only one box in each column should be marked under each species.

Wildlife Management Concepts and Terms

Wildlife management is both art and science that deals with complex interactions in the environment. However, it is critical to understand basic concepts about wildlife ecology and wildlife habitat requirements before management practices can be recommended to enhance habitat and manage populations for a particular wildlife species. Some of the basic concepts are described in this section. WHEP is based on these concepts, so it is important to understand them.

Definitions of various words or terms may be found in the **Glossary** at the back of this manual. Extension Wildlife Specialists, Extension educators, and local state agency wildlife biologists can provide clarification if needed. Additionally, wildlife management textbooks offer more in-depth reading and explanation.

Concepts and terms

From species and communities to ecosystems and landscapes
Plant succession and its influence on wildlife
Habitat and habitat requirements
Species richness and diversity
Invasive species
Focal species and ecosystem management
Edge
Arrangement and interspersion
Area sensitive species
Vertical structure
Carrying capacity
Compensatory and additive mortality
Home range, movements, and migration
Food webs

From species and communities to ecosystems and landscapes

A *species* is a group of individuals that can interbreed and produce viable offspring. A *population* is a group of individuals of the same species interacting and living in a given area. Populations of various species interact to form communities. Therefore, a biotic (living) *community* includes all the plant and animal populations living in a defined area. Communities interact with the abiotic (nonliving) resources (soil, air, water, and sunlight) to form what is known as an *ecosystem*. The size of the area involved when defining communities or ecosystems can vary. For example, the interacting communities of organisms associated with a decaying log or within an ephemeral pond may form an ecosystem. Likewise, this can be expanded to include all the communities associated with a forest ecosystem. The *landscape* is a larger area that composes interacting ecosystems.

Plant succession and its influence on wildlife

Plant succession represents the orderly and fairly predictable change in the species of plants that occur in a particular area over time. Various plant species that typically occur together represent plant

communities, or vegetation types. The sequence of vegetation types that replace one another in an orderly progression during plant succession is called a *sere*. Thus, each vegetation type represents a seral stage, which is also commonly called a successional stage.

Climate, soils, and disturbance events determine which plant species (and therefore vegetation types) are found on a particular site. Climate, soils, and disturbance events (such as fire, wind storms, ice storms, flooding) are highly variable; thus, there are many vegetation types that can occur within any of the ecoregions represented in this manual. Examples of vegetation types include an oak-hickory forest; an emergent wetland with cattails, sedges, and smartweeds; a stand of loblolly pines; a grassland dominated by blue grama and buffalograss; a thicket of regenerating aspen; or a fallow field of annual forbs, such as common ragweed, horseweed, and fleabane.

Depending on climate in a particular ecoregion, there may be several or only a few successional stages that compose a sere. For example, in the Eastern Deciduous Forest ecoregion where annual precipitation may average 40+ inches, annual grasses and forbs represent the initial successional stage following soil disturbance. Perennial grasses, forbs, and brambles dominate by year 2 or 3 after the disturbance. Woody species, such as winged sumac, Virginia pine, winged elm, eastern redcedar, and persimmon might become prevalent within 7 or 8 years after disturbance. Various oaks, hickories, yellow-poplar, and other tree species may slowly pioneer into the site and dominate the area within 20 years. Without additional disturbance, such as fire, American beech and maples may eventually dominate the forest within 100 – 150 years. Thus, approximately 5 seral stages (or successional stages) can be expected to compose a sere on many sites within the Eastern Deciduous Forest ecoregion.

One forest type replacing another is also observed in other ecoregions that receive considerable precipitation. For example, Douglas fir forests may be replaced over time by western hemlock in the Pacific Coastal Forest ecoregion. In portions of the Northeast Mixed Forest ecoregion, stands of aspen are eventually replaced by spruce-fir. Development of the later successional stages in a sere is continual, but slow, as one successional stage gradually develops into the next. As a result, the process can be imperceptible to many people. Full development of some seres takes longer than the average lifespan of a human.

Descriptions of the successional process in different ecoregions of the U.S. can be found in the ***Ecoregions*** section of this manual. Successional stages can be difficult to identify or distinguish. Plant identification skills and some knowledge of plant community ecology are helpful.

The final seral stage that a site will transition to in the absence of disturbance is often called the climax seral stage and is dominated by species that can reproduce and replace themselves without additional disturbance. In ecoregions with sufficient rainfall (such as Eastern Deciduous Forest, Southeast and Northeast Mixed Forest, and Pacific Coastal Forest), early successional plant communities ultimately succeed to forests. In drier ecoregions (such as Great Plains Grasslands, Prairie Brushland, and Hot Desert), fewer seral stages compose the sere and vegetation communities of perennial grasses, forbs, shrubs, and cacti may represent the ultimate, or climax, successional stage. Disturbance events, such as fire, grazing, ice and wind storms, lightning, and flooding, continually set-back succession and the process starts over.

Although succession is set-back through natural disturbances, many natural disturbance events have been disrupted by man. For example, levees have been built to prevent natural flooding, and great effort is expended to suppress and control fire. Also, extensive plantings of nonnative sod-forming grasses have unnaturally altered or interrupted succession in nearly every ecoregion of the country. Because of their dense nature at ground level, the seedbank is suppressed and response (thus succession) is suppressed. Suppressing succession is often called *arrested succession*.

Plant succession is an important concept for wildlife managers because as succession takes place and vegetation composition changes, the structure (density and height of vegetation, or cover) of the vegetation and the type of food available for wildlife change. **As vegetation structure and food**

availability change, the species of wildlife that use the area change because different wildlife species have different habitat requirements. All wildlife species are associated with various plant communities or successional stages. Some species, such as wild turkey, white-tailed deer, and coyote, may use several successional stages to meet various life requirements. Others, such as grasshopper sparrow and ovenbird, may only be found in one or two successional stages. The fact that different wildlife species require different vegetation types highlights the importance of having a diversity of successional stages *if* a diversity of wildlife species is a goal or consideration.

The compositional and structural changes of plant communities following disturbance events are fairly predictable within a given ecoregion. Thus, wildlife managers intentionally manage disturbance to provide the appropriate successional stage(s) for various wildlife species or groups of species. Wildlife management practices, such as prescribed burning, timber harvest, selective herbicide applications, grazing, and disking, can be used in the absence or interruption of natural disturbance events. Alternatively, planting various plants (especially trees and shrubs) and lack of disturbance will advance succession.

Differentiating successional stages can be difficult where grasslands, savannas, woodlands, and forests all occur. Grasslands are areas dominated by herbaceous plants (grasses, forbs, sedges, and brambles) and very few if any trees. Savannas and woodlands are areas with sparse to moderate tree cover and a well-developed understory of herbaceous plants. Forests are dominated by tree cover. In areas with abundant precipitation, grasslands, savannas, and woodlands will succeed into forests if not continually disturbed (usually with fire). When evaluating a savanna or woodland in these areas, it is not important to define the successional stage. Instead, evaluation of the structure and composition of the plant community and whether it provides habitat for the wildlife species under consideration is most important.


Craig Harper

Plant succession involves a change in plant species composition over time. This field represents an early successional stage with blackberry, persimmon, and scattered oak trees pioneering into perennial grasses (switchgrass and broomsedge).

Craig Harper

Oak or pine savannas and woodlands represent early successional vegetation with scattered trees. However, without continued fire, savannas and woodlands will succeed into forests.

Habitat and habitat requirements

Habitat represents the physical and biological resources (food, cover, water, space) required by a particular wildlife species for survival and reproduction. Habitat requirements are species specific. That is, not all species require the same resources in the same amount or distribution. If those resource requirements are provided in a particular area for a particular wildlife species, then that area represents habitat for that species. Thus, there is no such thing as "suitable habitat"—the area either is, or isn't habitat for a particular species. Habitat *quality* may range from excellent to poor, depending on resource availability, but if the minimum habitat requirements for a given species are not provided, then the area is not considered habitat for that species.

Habitat should not be confused with vegetation or vegetation types, such as a mature hardwood forest or a grassland. Some wildlife species may find all of their habitat requirements within one vegetation type. For example, an eastern gray squirrel may live its entire life within one mature oak-hickory stand. However, other species, such as white-tailed deer and mule deer, thrive in areas with considerable interspersion of vegetation types. Thus, habitat for these species usually includes several vegetation types or successional stages. Although the term "habitat type" is often used interchangeably with "vegetation type," it is confusing, technically inaccurate, and should be avoided.

Differences in habitat requirements among some species are subtle, whereas differences in habitat requirements among other species are dramatic. For example, habitat requirements for northern bobwhite and American kestrel are somewhat similar. They both require cover dominated by shrubs, forbs, and grasses, but whereas bobwhites primarily eat various plants, seed, mast, and insects, kestrels prey on other animals, including small mammals, lizards, and insects. Thus, even though bobwhites and kestrels may use the same vegetation type or successional stage, their habitat requirements are different. Habitat requirements for eastern gray squirrel and mourning dove are not similar at all. Although they may be found in the same ecoregion, they use different vegetation types and foods and have different space requirements.

Habitat requirements for various wildlife species often change through the year or life stage. Food and cover resources needed during one season or for one age of animal may be much different than what is required or available during another. For example, wild turkey hens and their broods spend the night on the ground where there is adequate groundcover until the poults are able to fly. During summer, wild turkey broods use early successional areas with abundant forbs where they feed upon insects and are hidden from overhead predators. As young wild turkeys reach 2 to 3 weeks of age,

they roost in trees and shrubs, and as mast becomes available in the fall, wild turkeys are frequently found in mature hardwood forests when available.

Species richness and diversity

Species richness refers to the total number of different species present in an area. Species richness differs from diversity in that diversity not only accounts for the number of species present in an area, but also how those species are distributed and how abundant each species is on that area. One goal in wildlife management may be to provide habitat for as many different species as possible, as contrasted to managing for a maximum number of individuals within a species or limited number of species. Generally, habitat requirements are provided for more wildlife species when a variety of vegetation types and successional stages are present in an area.

Nonnative and invasive species

Many plants and animals have been introduced, either accidentally or intentionally, into the United States from around the world. These species are commonly referred to as nonnative. Some nonnative species are most useful and have filled a need in our society. For example, wheat (native to southwest Asia) and soybeans (native to northeast China) are two nonnative plants that have provided high-quality foods for both humans and wildlife in the U.S. The domestic cow (ancestors native to Europe and Asia) and chicken (ancestors native to Asia) are examples of nonnative animal species that provide benefit for our society.

Some nonnative species have become naturalized. That is, they are able to maintain populations in the wild. Many of these species have not only become naturalized, but they have become competitive with native plants and animals, sometimes displacing native species. Some naturalized nonnative species are actively managed, such as ring-necked pheasants (native to China), brown trout (native to Europe), wild goats (western Asia), and white clover (native to Europe).

Often, nonnative species are successful because the climate is similar to that from which they originated and they do not have many natural pests or competitors that may have limited them in their native range. Some nonnative species are so favored by the conditions where they were introduced that they spread at incredible rates and controlling them can be very difficult. These species are both nonnative and invasive. Kudzu (native to Asia), cogongrass (native to southeast Asia), and Japanese stiltgrass (native to eastern Asia) are examples of nonnative invasive plants. Norway rats (native to Asia) and silver carp (native to Asia) are examples of nonnative invasive wildlife and fish.

Nonnative invasive plants contribute to loss of habitat for native wildlife and fish species and can lead to population declines of both native plants and wildlife species. Nonnative invasive wildlife and fish often outcompete native wildlife and fish and cause population declines of native species. Nonnative invasive species (both plants and animals) pose a considerable challenge for natural resource managers. Many nonnative invasive species are extremely difficult to control or eradicate. Herbicide applications, prescribed fire, mechanical removal, and biological control are commonly used to limit the impact of nonnative invasive plants on native plants and animals. Not only do nonnative invasive species impact native wildlife and plants, they also impact agriculture production, water resources, municipal capacity, and even human health and safety. Every effort should be made to prevent the introduction of nonnative species that may become invasive.

Focal species management and ecosystem management

Wildlife management is generally practiced with a focal species approach or an ecosystem management approach. The focal species approach involves managing specifically for one or a select few wildlife species. The ecosystem management approach involves managing for a healthy and functioning ecosystem, such as the longleaf pine or shortgrass prairie ecosystems, and allowing the associated wildlife species to respond. Most landowners have specific objectives or concerns about a particular species. Once the species is determined, resources that may be limiting (such as cover, food, or water) for that species on that property can be identified and the appropriate wildlife management practices can be prescribed. Occasionally, the focal species may be totally incompatible with the area under consideration and management goals and objectives must be changed.

It is best to select wildlife management practices that provide or improve the habitat requirements most lacking and, thus, are limiting the population (limiting factors). For example, if a species requires trees for cover with water nearby, and the area being evaluated has plenty of trees but no water, a management practice that will supply water will improve the area more effectively than planting trees.

Wildlife management practices that improve habitat for some wildlife species may be detrimental to other wildlife species. It is impossible to manage an area for any one species or group of species without influencing other species in some way. For example, if a mixed hardwood stand is clearcut to benefit ruffed grouse, then wild turkey, white-tailed deer, and eastern cottontail may also benefit. However, species, such as ovenbird, wood thrush, and eastern gray squirrel, which prefer mature deciduous forest, will be forced to use another area.

Craig Harper

The ecosystem management approach involves managing for a healthy, functioning ecosystem without focusing specifically on one or more wildlife species. This approach is most often used in an effort to restore imperiled ecosystems on large tracts of land.

Craig Harper

Most landowners identify focal species when managing their property for wildlife because not all species benefit from the same wildlife management practices.

Edge

An edge is formed where two or more vegetation types or successional stages meet. An obvious example is where a field meets a forest. A less obvious example is where a mature stand of aspen meets a spruce-fur forest. An even less obvious example is where a 40-year-old mixed hardwood stand meets an 80-year-old mixed hardwood stand.

The transition in vegetation types or successional stages can be abrupt or gradual. An example of an abrupt change would be where a hayfield meets mature woods. This type of edge has high contrast and is called a *hard edge*. A more gradual change would be where a 40-year-old forest meets an 80-year-old forest. A much more gradual change is where an overgrown field with native grasses, forbs, and scattered shrubs blends into a brushy thicket or a 3-year-old regenerating hardwood stand. This type of edge has low contrast and is called a *soft edge*. Sometimes the edge or transition between two vegetation types is so gradual, characteristics of both are evident in a relatively wide zone, called an *ecotone*. A common example of an ecotone is where an upland hardwood stand meets a bottomland hardwood stand. Species transition occurs gradually with the elevation as the upland blends into the bottomland.

The concept of edge is important in wildlife management. If there is increased edge, then there is increased interspersion of vegetation types or successional stages. This may be beneficial for a particular wildlife species *if*:

- both vegetation types are usable by the species and provide some habitat requirement;
- the arrangement of the vegetation types is suitable for the focal species (see ***Arrangement and interspersion*** on page 21).

Increased interspersion can also lead to increased species diversity, as more vegetation types are available, and can potentially provide habitat requirements for a larger number of species.

It is important to realize the presence of edge is not always beneficial for any wildlife species.

If the vegetation types or successional stages present do not provide any habitat requirement for the species in question, the interspersion and resulting edge is not beneficial. Thus, looking at an aerial photo and counting the number of times different vegetation types or successional stages meet is not necessarily a good measure of habitat quality for any particular species. Also, some species may actually avoid edges and seek areas that are more similar.

Further, some species often found along an edge have been relegated to use the edge because the interior of the adjacent vegetation type is unattractive or does not provide any habitat requirement. For example, wild turkey and northern bobwhite broods might be found along the edge of a field dominated by tall fescue or bermudagrass. The reason the birds are not in the field is not because they necessarily like the edge, but because there is not suitable cover or food resources in the field, or the structure of the vegetation in the field is so thick at ground level the birds cannot walk through it. Thus, if the composition and structure of the vegetation in the field was improved to provide mobility and adequate cover for quail and turkeys, there would be as many birds in the opening as along the edge. As a result, there would be additional habitat for the birds and the carrying capacity of the property would be increased (see ***Carrying capacity*** on page 23). In summary, the edge is not what is necessarily important, but rather the composition and structure of the vegetation.

John Weir

Craig Harper

The abrupt change in species composition and structure (left) is typical of a hard edge. Allowing native grasses, forbs, and brambles to grow into the field from a woods edge is typical of a soft edge and increases the amount of "usable space" for many wildlife species by providing suitable cover and food resources.

John Gruchy

For those wildlife species considered "edge" species, the physical edge presented where two vegetation types or successional stages meet is not as important as the actual structure presented within a vegetation type or successional stage.

Craig Harper

Some species do not require much space to live. An eastern gray squirrel or eastern box turtle might spend their entire lives on only a few acres. Other species, however, require considerable area. Grasshopper sparrows, for example, are rarely found in grasslands smaller than 100 acres.

Arrangement and interspersion

How different successional stages or vegetation types are situated in relation to each other is often referred to as horizontal arrangement or juxtaposition. Some wildlife species may obtain all of their habitat requirements from only one vegetation type or successional stage (such as crissal thrasher, eastern gray squirrel, gopher tortoise, sharp-tailed grouse, ovenbird). Other species require (or greatly benefit from) more than one successional stage to provide all their habitat requirements (bobcat, northern bobwhite, white-tailed deer, wild turkey, American woodcock). For example, ruffed grouse may forage on acorns in mature mixed-hardwood stands during fall and winter, but use young forest stands with high tree stem densities for escape cover. Required successional stages should be close to each other to allow for safe travel to and from those areas. Proximity is especially important for species with limited movements and relatively small home ranges.

Interspersion is the frequency of occurrence of different vegetation types. Increased interspersion generally leads to increased “mixing” of vegetation types and often supports a greater diversity of wildlife. However, the vegetation types present and the quality of cover and food resources present in those vegetation types are more important than whether or not there is much interspersion. As interspersion increases, so does the amount of edge. However, as discussed in ***Edge***, increased interspersion is not necessarily beneficial to all species. Interspersion is easily viewed on aerial photos or satellite images. However, habitat quality cannot necessarily be assessed by viewing aerial photos or satellite images. It is true that where there is increased forest cover, the amount of habitat for eastern gray squirrel is likely increased, and where there is increased grassland cover, the amount of habitat for grasshopper sparrow is likely increased. However, the composition and structure of the vegetation in fields, shrubland, and woods greatly influence habitat quality for many species, and that fine-level analysis is not possible by viewing photos. Thus, walking over the property and taking a closer look is necessary when evaluating habitat for most species.

Craig Harper

The arrangement of vegetation types and successional stages directly influences animal movements and home range size. Here, nesting cover, brooding cover, and escape cover are all arranged in close proximity (juxtaposed) to favor habitat requirements for northern bobwhite.

Area-sensitive species

Fragmentation is the disruption of vegetation types either by man or by natural processes. All wildlife species do not respond to fragmentation the same way. For some, the edge between a young forest and an older forest may fragment their habitat, whereas others may not respond to fragmentation except under extreme circumstances such as an interstate highway bisecting a forest or prairie. Some species need large, unfragmented areas in a certain successional stage to provide some or all of their habitat requirements. Such species are referred to as area-sensitive. For these species, large areas in one successional stage are desirable. Unfragmented habitat of at least 100 acres is considered the minimum requirement for many area-sensitive species. Some species, such as the grasshopper sparrow, may require a minimum of 1,000 acres of relatively unfragmented habitat to sustain a viable population. Others, such as the greater prairie-chicken, may require 30,000 acres of relatively unfragmented habitat.

Vertical structure

In most vegetation types, there are distinct layers of vegetation. In a grassland, there is often a litter layer with one or two layers of grasses and forbs. In a forest or woodland, there may be three distinct layers of vegetation. The understory is composed of those plants growing near the ground, up to 4.5 feet tall. The understory may be very diverse and include grasses, forbs, ferns, sedges, brambles, vines, shrubs, and young trees. The midstory is represented primarily by shrubs and trees more than 4.5 feet tall yet below the overstory canopy. The overstory is made up of those trees in the canopy.

How the different layers of vegetation are arranged in relation to each other is important to many wildlife species. For example, some birds require more leaf litter in a grassland than others and some like taller grasses whereas others prefer shorter grasses. Some birds may require a herbaceous understory for foraging in the forest, but nest in the overstory. Vertical structure may vary dramatically from site to site, even within a given field or forest type. For example, one mature oak-hickory forest might have a well-developed understory and midstory with visibility of no more than 30 feet, whereas another has very little understory vegetation and no midstory at all. Although they are the same forest type, these two forests would not necessarily provide habitat for the same wildlife species. The structure could be manipulated on these sites depending on the objectives. Thinning and prescribed fire are two management practices that are commonly used to influence understory and midstory structure in forests and woodlands.

Craig Harper

The vertical structure in this mature oak/hickory forest provides cover and food resources for a suite of forest songbird species that otherwise would not be found here.

Carrying capacity

There are only so many animals that can live in an area. The concept of carrying capacity is related to the number of animals that can exist in an area. Biological carrying capacity refers to the maximum number of animals, within a given species, an area can support before that species or another species is negatively affected. The quantity and quality of food, cover, water, and space determines the carrying capacity. The requirement that is in shortest supply, called the limiting factor, determines carrying capacity. Increasing the requirement in shortest supply can increase the area's biological carrying capacity.

Biological carrying capacity varies from season to season and often from year to year. For most species, it is usually greatest from late spring through fall when food and cover are most abundant. This time of year is when most young are born, which helps ensure adequate nutrition and cover are available for growth and survival. With the coming of winter or summer drought, food and cover gradually diminish.

More animals are produced each year than will survive. Surplus animals are lost to predation, starvation, competition, or disease. Young wildlife and animals in poor health experience the highest mortality rates. Hunting and fishing remove some animals and may help prevent over-population for some species (see ***Compensatory and additive mortality***).

In suburban areas, humans often demand the density of certain wildlife species be lower than the biological carrying capacity because of wildlife damage issues. For example, white-tailed deer populations can thrive in suburban areas where the biological carrying capacity is relatively high because deer have adapted to feed opportunistically on ornamental plants. However, homeowners generally have low tolerance for deer feeding on expensive landscape plants. Thus, the deer population must be reduced to limit damage. In this case, the cultural carrying capacity (determined by human tolerance) is lower than the biological carrying capacity.

Craig Harper

Any area is only able to support a certain number of animals before available food and cover resources are depleted. Here, overabundant white-tailed deer have exceeded the carrying capacity of the area. Chronic overbrowsing has eliminated the forest understory and thus negatively affected many other wildlife species that require understory vegetation for nesting, feeding, roosting, or escape cover.

Compensatory and additive mortality

Annual mortality is the rate at which animals die per year. The mortality rate for a species is often estimated by biologists to help determine management efforts for that species. Animals die from many causes, including predation, diseases, malnutrition, weather, hunting, accidents, fighting, and others. All of these factors may contribute to the annual mortality rate for a particular species. For example, each of those factors contributes to the annual mortality rate of white-tailed deer in Minnesota each year. However, the number of deer that die from each of these causes of mortality is not the same, and the number of deer that die from each of these causes fluctuates somewhat from year to year.

The number of animals that die from one cause of mortality often influences the number that may die from another cause. For example, increased harvest of deer by hunters in October and November leaves fewer animals in the population that winter. Thus, more food is available per animal and the likelihood of deer dying from starvation decreases. Thus, mortality from hunting and mortality from malnutrition can act in a *compensatory* manner. As the mortality from one cause is increased, the mortality rate of another is decreased. To relate this to WHEP contests, ***Increase Harvest*** may be recommended to lower white-tailed deer populations so that food availability is increased per animal and fewer animals are susceptible to winter starvation.

Mortality can be additive. For example, rainfall commonly influences northern bobwhite populations in portions of Texas and Oklahoma. In years with little rainfall, there is less groundcover to provide cover and food and, as a result, fewer quail survive through summer and fall. Thus, the bobwhite population going into winter may be quite low because of malnutrition, predation, and heat stress through the summer. If the population is at a critically low level, additional mortality from hunting through winter may be *additive*, especially if hunting pressure is equal to that in normal years. As related to WHEP contests, if the population of a game species has declined for some reason and is considered too low to sustain the level of mortality experienced recently by regulated hunting or trapping, ***Decrease Harvest*** may be warranted.

Hunting is not the only mortality factor that could be additive. Using the scenario above with relatively few bobwhites surviving through summer and fall, there still may be sufficient numbers of quail to replenish the population when the breeding season begins. However, a late winter storm that dumps unusually deep snow and persists for a while can limit food availability even further. Thus, more quail die. In this situation, mortality is *additive* from the snowfall. Regardless of whether the population was high or low, a significantly high percentage of the population would have been affected by the weather event.

Thus, it is important for biologists to monitor mortality rates for various species, especially those that are hunted, and be prepared to adjust regulations and management practices to better manage for a particular species. Adjusting regulations and management practices as conditions change and additional information becomes available is termed *adaptive management*.

Home range, movements, migration, and corridors

A home range encompasses the area in which an animal lives. Home range size is related to habitat quality. Daily movements include those for normal day-to-day activities. In higher-quality habitat, home ranges tend to be smaller than in poor habitat because movements necessary to meet life requirements are reduced. A seasonal home range is the area an animal uses in a particular season of the year. A seasonal movement, or migration, is made when an animal moves from one seasonal home range to another. Migration may represent movements to and from wintering and nesting areas (such as waterfowl and songbirds) or wintering and calving areas (for caribou and some elk populations). Migration also can involve movements from higher elevations to lower elevations each spring and fall as food availability varies with the seasons (seen with elk and some species of grouse).

Migration distances may be short or very long, depending on the species. Long migrations for some species require habitat along the route (to stop and rest and eat). Thus, wildlife managers must consider this in landscape planning for various species, which means habitat conditions might have to be considered among countries, or even continents.

Corridors are areas that do not restrict movement and allow various wildlife species to move from areas within their home range or during migration. The type of vegetation within the corridor and the size (both width and length) of the corridor varies depending on the species. An example of a corridor might include a stream or river with trees and shrubs along both sides (the riparian zone) cutting through a large grassland. The wooded, riparian corridor facilitates movement for squirrels, deer, wild turkey, and other species that require or otherwise seek the security of wooded cover to cross a broad open area. A smaller version of such a corridor would be a hedgerow traversing a large field. Other examples of corridors might include valleys between mountain ranges for migrating mule deer, or underpasses facilitating black bear movement under interstates and major highways.

Food webs

Food chains are the step-by-step passage of material and energy (food) through an ecosystem. A network of interconnected food chains is called a food web. In terrestrial ecosystems, plants are primary producers in a food chain because they supply food at the lowest level of the food chain. In aquatic ecosystems, phytoplankton (microscopic algae) is the base of the pond food chain. It takes an enormous number of individual plants (or amount of phytoplankton) to support the other parts of a food web. At the next level of a food chain are primary consumers, plant-eating animals or herbivores. Primary consumers include rabbits, mice, deer, and certain other mammals; some insects and fish; and dabbling ducks, geese, and certain other birds. In aquatic ecosystems, zooplankton and aquatic insects feed on phytoplankton.

Primary consumers are eaten by secondary consumers, or carnivores (meat-eaters). This group includes predators, such as birds of prey, snakes, foxes, cats, and people. In aquatic ecosystems, zooplankton and aquatic insects are eaten by small fish. Small fish are eaten by larger fish. Secondary consumers are eaten by tertiary consumers, which may be predators or scavengers, such as turkey vultures, crabs, and sometimes people. Note these categories are very broad and general. Many animals fit into more than one group, and there are more complex levels of a food web. An example is an omnivore, which is an animal that eats both plant and animal matter.

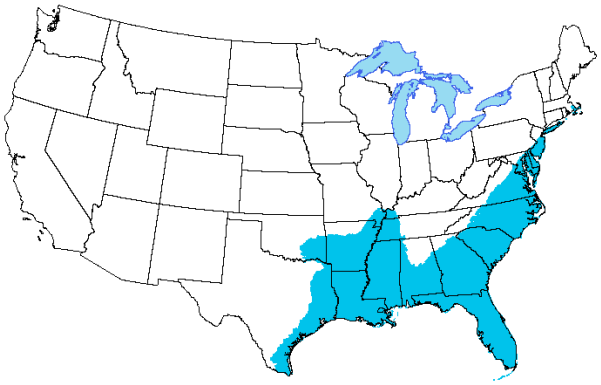
Any of the food web components mentioned above can be broken down by decomposers—organisms such as bacteria and fungi that reduce dead plant or animal matter into smaller particles. A decaying plant, for example, will be broken down into nutrients that enrich the soil. This process supports the growth of more plants and thus, more animals.


Alan Windham

Predators, such as this red-tailed hawk, are necessary to buffer populations of various prey species. For most predators, when one prey species begins to decline, other prey species become more prevalent in the diet.

Southeast Mixed and Outer Coastal Plain Forest

Physical description



The terrain is rolling hills to mostly flat. Marshes, lakes, and swamps are numerous along the Coastal Plain. The average annual precipitation ranges from 40 to 60 inches. Precipitation is received throughout the year. Summers are hot and winters are mild.

Dominant vegetation

The final stage of succession usually consists of deciduous trees, such as oaks, hickories, American beech, blackgum, red maple, redbay, Southern magnolia, laurel oak, American holly, and winged elm. However, on many upland sites, especially where prescribed fire is used, longleaf or loblolly pine are often the principal overstory species. Fire suppression has decimated the longleaf pine ecosystem to a fraction of its former range throughout the ecoregion. Planted loblolly pine is widespread over much of the ecoregion, but without fire and judicious thinning, the value of loblolly plantings for wildlife is relatively low. Gum and cypress are dominant on moist areas along the Atlantic and Gulf coasts and along major river drainages. Midstory trees throughout much of the ecoregion include dogwoods, American hornbeam, redbud, sweetbay, titi, and shadbush. Native forbs and grasses commonly found include lespedezas, partridge pea, ragweed, pokeweed, bluestems, paspalums, wiregrass, povertygrass, and many others. Vines, such as Virginia creeper, trumpet creeper, grapes, yellow jessamine, and greenbriar, are common. Shrubs include sumacs, viburnums, elderberry, wild plum, blueberry, blackberry, hawthorns, and wax myrtle.

Typical nonnative invasive plants in the Southeast Mixed Forest include bermudagrass, bahiagrass, cogongrass, kudzu, Japanese honeysuckle, privets, Japanese climbing fern, chinaberry, tree-of-heaven, mimosa, and popcorntree.

Dwayne Elmore

Planted pines, especially loblolly, are common across the Southeast. Early successional vegetation is provided for a few years until the canopy of the pines closes.

Dwayne Elmore

Mature pine stands, especially longleaf, are best managed by thinning to a predetermined basal area, which allows better tree growth and a diverse understory. Prescribed fire is used to manage the composition and structure of the understory.

Farming and ranching

Many wetlands along major rivers have been drained and forests cleared to grow crops such as cotton, tobacco, soybeans, corn, and other grain crops. Large areas of forests have also been cleared and planted to nonnative grasses, especially bermudagrass and bahiagrass, for livestock. Unfortunately, most of these are not beneficial for wildlife.

Plant succession

John Gruchy

Annual forbs and grasses represent the initial successional stage. Here, a strip was disked in a field dominated by perennial native warm-season grasses to enhance brooding cover for northern bobwhite. Note the common ragweed and bare ground in the disked strip (center) as compared to the relatively dense native grass on the right.

Craig Harper

Perennial forbs and grasses represent the **second successional stage**.

Mike Hansbrough

The second successional stage slowly gives way to the third. Here, broomsedge bluestem, blackberry, and various forbs are succeeding to sweetgum, red maple, and eastern redcedar. This transition provides excellent habitat for northern bobwhite, loggerhead shrike, and eastern cottontail.

Various shrubs (such as wild plum) and trees (such as eastern redcedar, sweetgum, and winged elm) represent the **third successional stage**. Planted loblolly pine stands often represent a third successional stage. Longleaf pine also represents a third successional stage. Longleaf pine is maintained with frequent prescribed fire, which prohibits succession from advancing further.

Craig Harper

Craig Harper

These pictures show the same loblolly pine stand 4 years after planting and 8 years after planting. Although it is the same loblolly pine stand, the wildlife species found in this stand 4 years apart are quite different because the structure of the stand has changed dramatically.

Craig Harper

Mixed hardwood forest dominated by various oaks, hickories, maples, and sweetgum represent the **fourth successional stage**. Loblolly, shortleaf, and Virginia pine are often a component in these forests. More shade-tolerant species, especially American beech and American holly, become more prevalent in stands that are not disturbed with prescribed fire. Unmanaged forests often lack a developed understory, such as seen in this picture.

Wildlife associated with Southeast Mixed and Outer Coastal Plain Forest

barred owl
loggerhead shrike
mourning dove
northern bobwhite
red-cockaded woodpecker
prothonotary warbler
red-eyed vireo
wild turkey
wood duck
coyote
eastern cottontail
eastern fox squirrel
raccoon
white-tailed deer
wild pig
eastern indigo snake
gopher tortoise
bluegill
largemouth bass

Southeast Mixed and Outer Coastal Plain Forest	barred owl	loggerhead shrike	mourning dove	northern bobwhite	prothonotary warbler	red-cockaded woodpecker	red-eyed vireo	wild turkey	wood duck	coyote	eastern cottontail	eastern fox squirrel	raccoon	white-tailed deer	wild pig	eastern indigo snake	gopher tortoise	bluegill	largemouth bass
Habitat Management Practices																			
Conservation Easement		X		X		X										X	X		
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X		
Create Snags	X				X				X				X						
Delay Crop Harvest																			
Edge Feathering		X		X				X		X	X	X	X	X					
Field Borders		X		X				X		X	X		X	X					
Forest Management	X			X	X	X	X	X	X	X	X	X	X	X		X	X		
Leave Crop Unharvested			X	X				X	X		X	X	X	X					
Livestock Management	X	X	X	X	X			X	X	X	X	X	X	X				X	X
Nesting Structures					X	X			X					X					
Plant Food Plots			X	X				X			X	X	X	X					
Plant Native Grasses and Forbs		X	X	X				X	X	X	X			X		X	X		
Plant Shrubs		X	X	X				X	X	X	X		X	X					
Plant Trees	X	X	X		X	X	X	X	X			X	X	X		X	X		
Repair Spillway/Levee			X		X				X				X					X	X
Set-back Succession	X	X	X	X		X		X	X	X	X	X	X	X		X	X		
Tillage Management			X	X				X	X		X	X	X	X					
Water Control Structures			X		X				X				X					X	X
Water Developments for Wildlife			X					X	X			X	X	X		X			
Population Management Practices																			
Decrease Harvest				X				X		X	X	X	X	X				X	X
Increase Harvest								X		X	X	X	X	X	X			X	X
Wildlife Damage Management	X							X		X	X	X	X	X	X				
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices																			
Construct Fish Pond																		X	X
Control Aquatic Vegetation																		X	X
Fertilize/Lime Fish Pond																		X	X
Reduce Turbidity in Fish Pond																		X	X
Restock Fish Pond																		X	X
Streams: Create Pools																			
Streams: Remove Fish Barriers																			

Wildlife Species

This chapter contains information on species featured in each of the ecoregions. Species are grouped by Birds, Mammals, Reptiles, Amphibians, and Fish. Species are listed alphabetically within each group. A general description, habitat requirements, and possible wildlife management practices are provided for each species. Wildlife management practices for a particular species may vary among ecoregions, so not all of the wildlife management practices listed for a species may be applicable for that species in all ecoregions. Refer to the WMP charts within a particular ecoregion to determine which practices are appropriate for species included in that ecoregion.

The species descriptions contain all the information needed about a particular species for the WHEP contest. However, additional reading should be encouraged for participants that want more detailed information. Field guides to North American wildlife and fish are good sources for information and pictures of the species listed. There also are many Web sites available for wildlife species identification by sight and sound.

Information from this section will be used in the ***Wildlife Challenge*** at the National Invitational. Participants should be very familiar with the information presented within the species accounts for those species included within the ecoregion used at the Invitational.

It is important to understand that when assessing habitat for a particular wildlife species and considering various WMPs for recommendation, current conditions should be evaluated. That is, WMPs should be recommended based on the **current habitat conditions within the year**. Also, it is important to realize the benefit of a WMP may not be realized soon. For example, trees or shrubs planted for mast may not provide cover or bear fruit for several years.

Index to Wildlife Species

Note: ***Refer to this list for the correct spelling and capitalization of species for Activity III (Wildlife Challenge).***

Birds (86)

Range map key for birds:

American bittern
American black duck
American kestrel
American robin
American wigeon
American woodcock
barred owl
black-backed woodpecker
black-bellied whistling duck
black-capped chickadee
black-throated sparrow
blue-winged teal
Brewer's sparrow
broad-winged hawk
brown thrasher
California quail
California thrasher
Canada goose
common nighthawk
crested caracara
crissal thrasher
dickcissel
dusky grouse
eastern bluebird
eastern meadowlark
European starling
ferruginous hawk

Barred owl

General information

Mark Musselman

Barred owls are found in mature forests, often near water, throughout eastern North America and the Pacific Northwest. They nest in cavities of large trees and snags, and will readily use man-made nesting structures. They hunt primarily at night, scanning for prey with keen vision and hearing and flying silently from tall perches. Their hooting call of "*Who cooks for you? Who cooks for you all?"* can be heard all year and is a common night sound where they occur.

Habitat requirements

Diet: primarily small mammals, birds, amphibians, reptiles, fish, and invertebrates.
Water: requirements largely unknown. They likely obtain their water needs from the foods they consume.
Cover: mature forests with an abundance of relatively large trees and cavities, often near water

Wildlife Management Practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and reducing habitat quality
Create Snags: where cavities are lacking for adequate reproduction
Forest Management: shelterwood harvests can result in a more open, park-like forest resulting in a more open understory to favor prey habitat.
Livestock Management: livestock should be excluded from forests to maintain understory for prey
Nesting Structures: can be added to forests lacking trees with large cavities.
Plant Trees: in large open areas to create future habitat
Set-back Succession: low-intensity prescribed fire can be used in forests and woodlands to enhance cover for prey.
Wildlife Damage Management: barred owls can prey upon small pets and domestic poultry. Exclusion practices should be used to discourage damage.
Wildlife or Fish Survey: call counts are used to index populations

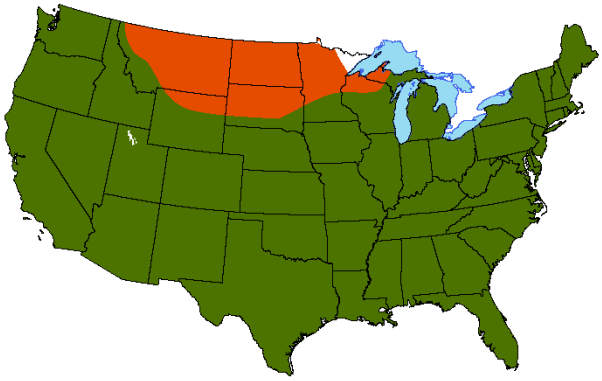
Mourning dove

General information

Dave Menke

Mourning doves may be found throughout much of the lower 48 states. They prefer areas of annual and perennial grasses and forbs for feeding with some shrubs and trees nearby for perching, nesting and roosting. Interspersed bare ground is an important component of foraging sites because mourning doves do not scratch in the litter to find seed. Bare ground is also beneficial for doves to obtain grit (small gravel) to help in digesting food. Nests are made of twigs and placed on branches of shrubs or trees. Nests are also placed on the ground. Mourning doves often use agricultural areas for feeding on a variety of grass and forb seeds. They also forage on waste grain from cropland and livestock feedlots. Mourning doves prefer shallowly sloping or flat shorelines without vegetation for drinking.

Habitat requirements



Diet: a variety of grass and forb seeds, as well as several agricultural grains; small areas of bare ground are beneficial for obtaining grit (small gravel) to help digest food
Water: free-standing water required daily
Cover: shrubs and trees are used for nesting and loafing

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for mourning dove; sod grasses, such as tall fescue and bermudagrass, are particularly problematic because they have no food value and their structure at ground level limits mobility of ground-feeding doves and their ability to search for seed
Delay Crop Harvest: (in some ecoregions) in spring to avoid nest destruction
Leave Crop Unharvested: for a variety of small grain crops, such as wheat, millets, grain sorghum, corn, and oats, to provide additional food resource
Livestock Management: should prevent overgrazing, which can eliminate preferred forbs that produce seed for mourning dove; in some cases, livestock can be used to reduce vegetation height and increase bare ground; livestock should be excluded from food plots
Plant Food Plots: grain plots may be planting in areas where food is lacking and to facilitate recreational hunting
Plant Native Grasses and Forbs: where food may be limiting, especially to increase some of the many native forbs that are extremely important sources of seed for mourning dove
Plant Shrubs: (in some ecoregions) to provide nesting, roosting, and loafing sites in areas where shrub/tree cover is limiting
Plant Trees: (in some ecoregions) to provide nesting, roosting, and loafing sites in areas where shrub/tree cover is limiting
Repair Spillway/Levee: if not functioning properly

Set-back Succession: *Disking*, *Prescribed Fire*, and *Herbicide Applications* can be used to maintain annual forbs and grasses and provide bare ground; *Chaining*, *Drum-chopping*, *Root Plowing*, *Herbicide Applications*, and *Prescribed Fire* may be used to reduce shrub cover; *Chainsawing* and *Root Plowing* may be used to remove trees and clear forests and promote early successional plant communities
Tillage Management: tillage may be eliminated in the fall to allow wildlife access to waste grain; tillage may be delayed in spring (in some ecoregions) to allow nesting in standing stubble (especially wheat)
Water Control Structures: should be installed if none are present in existing dams or levees to allow water level manipulation
Water Developments for Wildlife: where water is limiting, small ponds, shallow impoundments, guzzlers, and windmills may be created or installed to provide free-standing water
Wildlife or Fish Survey: point counts and observation counts are commonly conducted to estimate trends in populations

Northern bobwhite

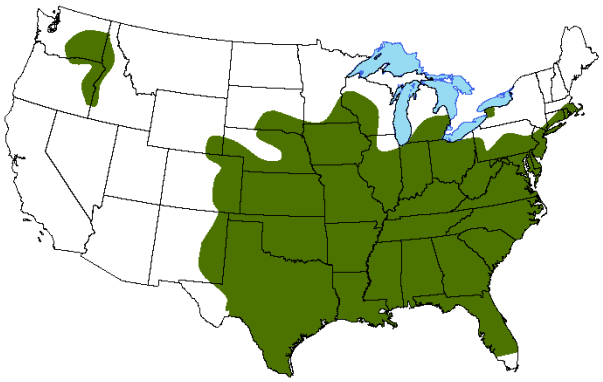
General information

Steve Maslowski

The northern bobwhite is a stocky game bird about 6 inches tall. They are considered shrubland obligates, which means they depend on low-growing shrubby cover, but also use grasslands, fallow fields, and savannas and woodlands with well-developed groundcover for foraging, nesting, brooding, and loafing. Ideally, bobwhite habitat is composed of scattered patches of shrubby cover well interspersed with native grasses, forbs, and bare ground. Nests are on the ground, usually made of dead grass leaves, and often located at the base of a clump of native warm-season grasses, such as broomsedge and little bluestem. A typical clutch is about 12 eggs. Both the male and female may incubate nests, with nesting primarily occurring May through August. Early successional areas dominated by forbs, such as ragweeds, are commonly used for brooding. Northern bobwhite eat a wide variety of seeds, leaves, and insects. Bobwhite chicks primarily eat insects during the first 6-8 weeks of life. Some agricultural crops can provide seasonal food for bobwhites, but they are not a substitute for diverse native plant communities. Northern bobwhite populations have been declining precipitously for more than 40 years. Habitat loss and degradation is the primary reason for the decline.

Habitat requirements

Diet: young quail eat insects and other invertebrates (such as spiders); adult quail eat a variety of seeds (especially legumes, ragweed, crotons, lespedeza, etc.), green vegetation (mostly forbs), invertebrates, various crops (corn, soybeans, wheat, millets, grain sorghum), and mast (such as acorns and blackberries)
Water: necessary water is obtained through the diet
Cover: shrub cover for escape and thermoregulation throughout the year; perennial native grasses for nesting; native forbs for brood rearing



Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species in some ecoregions
Control Nonnative Invasive Vegetation: nonnative sod grasses, such as tall fescue and bermudagrass, are especially problematic as they limit bobwhite mobility and provide poor cover and structure; there are many other nonnative invasive species that can degrade habitat quality for northern bobwhite across their range
Edge Feathering: to increase usable space and increase escape cover around row-crop fields
Field Borders: to increase usable space around row-crop fields

Forest Management: in pine forests, *Forest Regeneration*, especially *Clearcut* and *Seed Tree*, will enhance habitat for a few years until regenerating pines close canopy; *Timber Stand Improvement* can be used to reduce tree density in pine stands down to 50 square feet of basal area and enhance habitat; see ***Set-back Succession*** for managing hardwood forests for bobwhite
Leave Crop Unharvested: to provide additional food through fall and winter; corn, soybeans, wheat, and grain sorghum are readily eaten
Livestock Management: grazing pressure should be managed so sufficient groundcover remains for nesting and brood rearing; grazing management should discourage a uniform structure of plants across the landscape; cattle grazing in combination with prescribed fire can mimic historic natural disturbance events; grazing management should maintain dense shrub cover in some areas; up to one-third of an area can be grazed more intensively to encourage annual forb production for brood rearing cover, assuming the same areas are not repeatedly grazed the same way; livestock should be excluded from food plots
Plant Food Plots: relatively small linear food plots (one-fourth acre) may be established adjacent to escape cover where food is a limiting factor (this is rare; shrubby cover for escape and forb cover with bare ground are more often limiting factors)
Plant Native Grasses and Forbs: where nesting and brood cover is limiting and planting is necessary to develop nesting and brooding cover (suitable nesting and brooding cover usually establishes naturally after undesirable plants are controlled and after tree cover is removed or thinned)
Plant Shrubs: where shrub cover is limiting; if shrub patches are within 50 to 75 yards of each other, additional shrub cover is not needed
Set-back Succession: *Prescribed Fire* is strongly recommended to maintain and rejuvenate grasslands, native prairie, shrublands, savanna, and woodlands; fire consumes dense litter, limits succession of woody species, and encourages herbaceous groundcover; *Disking* can be used to reduce litter build-up, encourage annual forbs and grasses, and provide increased bare ground; *Chaining* can be used to set-back shrub cover when it becomes too dense and tall; *Chainsawing* and *Root Plowing* may be used remove trees and convert hardwood forest to early succession or savanna; *Herbicide Applications* may be used to remove undesirable woody encroachment
Tillage Management: eliminate fall tillage to provide waste grain
Decrease Harvest: may be necessary if populations are declining in areas of good habitat and where hunting pressure has been excessive
Wildlife or Fish Survey: covey counts, whistle counts, point counts, and hunter harvest and observation data are used to estimate trends in populations

Eastern cottontail

General information

Aubrey Deck

Eastern cottontails occur in the eastern half of the country. They prefer brushy cover interspersed with herbaceous openings. Eastern cottontails are also found in suburban areas, parks, golf courses, and stream corridors. Eastern cottontails are prey for the majority of carnivorous predators within its range. They are prolific breeders; females may have 7 litters per year, with 3 to 6 young per litter. This reproductive rate is required to perpetuate populations because 70 to 80 percent of all rabbits die each year.

Habitat requirements

Diet: forbs and grasses, browse, and soft mast from spring through fall; in winter, bark of shrubs and trees, as well as buds, grain, and browse
Water: necessary water obtained from diet
Cover: shrub cover, brushpiles, native warm-season grasses and forbs for loafing and escape cover; burrows are also used for denning and escape

Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and limiting habitat for cottontails
Edge Feathering: to increase usable space around fields
Field Borders: to increase usable space around fields
Forest Management: *Forest Regeneration* (*Clearcut*), provides optimal brushy cover for a few years
Leave Crop Unharvested: to provide additional food and cover, especially corn, alfalfa, and wheat
Livestock Management: should exclude livestock from food plots and prevent overgrazing to allow sufficient herbaceous vegetation for nesting, cover, and forage
Plant Food Plots: where additional forage or grain is needed; best situated adjacent to dense brushy cover
Plant Native Grasses and Forbs: where early successional cover is limiting and planting is required to promote additional grasses and forbs
Plant Shrubs: in relatively large openings with few shrubs; field borders, fence rows, and other idle land areas are good places to plant
Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* are recommended to maintain herbaceous openings, especially when litter accumulation or woody encroachment is excessive; *Chaining*, *Prescribed Fire*, and *Herbicide Applications* can be used to rejuvenate shrublands, especially where herbaceous groundcover is shaded out; in areas dominated by mesquite, *Chainsawing* and *Root-plowing* can be used to convert forest cover to early successional communities
Tillage Management: cropland tillage may be delayed in spring to allow use of standing stubble for cover; tillage may be eliminated in the fall to allow access to waste grain

Decrease Harvest: may be necessary when additional rabbits are desired and hunting or trapping efforts are limiting growth; low rabbit populations are almost always a result of inadequate habitat, not harvest levels

Increase Harvest: where populations can sustain additional hunting or trapping pressure for recreation or where populations need to be lowered

Wildlife Damage Management: shooting, trapping, and exclusion techniques can be used where there is damage to ornamental and garden plants

Wildlife or Fish Survey: observation counts, track counts, hunter harvest data, and transect flush counts can be used to estimate population trends

Mowing: can be used to maintain herbaceous openings in Urban areas

Eastern fox squirrel

General information


Joe Fischer

The eastern fox squirrel is found in the eastern half of the U.S., except for areas of New England. Eastern fox squirrels use mature forest interspersed small openings, as well as oak and pine woodlands and savannas. Riparian areas are important in the Midwest. Fox squirrels also may use urban areas where there are lots of trees. Fox squirrels spend much time foraging on the ground. They build a leaf nest, usually in the crotch of the main trunk of a tree more than 30 feet aboveground, but will regularly use natural cavities in trees, especially in winter.

Habitat requirements

Diet: a variety of hard mast, acorns, seeds, tree buds and flowers, mushrooms, soft mast, eggs, and corn
Water: necessary water is generally obtained through diet, but free-standing water may be needed in late summer
Cover: mature hardwood and pine forest, woodland, and savannas; nest in tree cavities or build a nest of twigs and leaves

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for eastern fox squirrels; kudzu, nonnative sod grasses, cogongrass, bush honeysuckles, Japanese stiltgrass may be particularly problematic in some areas
Edge Feathering: can enhance forest structure and increase food availability in forested areas surrounding fields
Forest Management: *Forest Regeneration* (*Single-tree Selection*, *Group Selection*) may improve forest or woodland structure and increase food availability; *Timber Stand Improvement* can encourage larger crowns of mast-producing trees and enable oaks, hickories, beech, and others to produce more mast; can also increase soft mast availability and provide snags for potential den sites
Leave Crop Unharvested: (corn fields) so squirrels can glean waste grain from the field; especially important during years of poor mast production
Livestock Management: should prevent overgrazing, especially in savannas and woodlands where grazing is allowed; livestock should be excluded from riparian areas, especially in open landscapes where tree cover is limited to riparian areas
Plant Food Plots: grain food plots, especially corn, can provide an important food source, during winters with poor mast availability
Plant Trees: in large open areas where tree cover is limiting
Set-back Succession: *Prescribed Fire* is required to maintain savannas and woodlands; *Prescribed Fire* and *Disking* are used to maintain relatively small early successional openings; *Herbicide Applications* can be used to reduce unwanted tree cover or woody encroachment

Tillage Management: eliminate tilling corn fields in the fall to provide additional food
Water Developments for Wildlife: in urban areas, a pool or pan of water may be used if water is not available
Decrease Harvest: may be necessary when additional fox squirrels are desired and hunting pressure is limiting growth
Increase Harvest: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Wildlife Damage Management: exclusion from buildings, trapping, or shooting may be necessary if damage is occurring
Wildlife or Fish Survey: observational surveys are most often used to estimate population trends
Artificial Feeders: in urban areas, corn or sunflower seeds spilled from feeders onto the ground may be eaten

White-tailed deer

General information

Craig Harper

The white-tailed deer is the most important game animal in North America. There are more than 30 subspecies of white-tailed deer that occur throughout the U.S. and southern Canada, except for California and Nevada. They are extremely adaptable and are found in a wide variety of areas including deciduous and coniferous forests, tropical evergreen forest, dry grasslands, and shrub desert. They are adaptable to humans and exploit suburban areas very well. Whitetails thrive in areas with fragmented habitat containing several well-interspersed vegetation types. White-tailed deer are ruminants and are classified as browsers, but have distinct dietary preferences through the seasons. Where overabundant, they can cause significant damage to ornamental plantings and row crops and can be hazardous for motor vehicles.

Habitat requirements

Diet: forbs, browse, acorns, beechnuts, grains, grasses, and mushrooms; in the northern parts of the range, coniferous browse is important in winter
Water: obtain most of their water from diet, but will drink free-standing water when available
Cover: dense woody vegetation as well as relatively tall early successional cover, including native grasses, forbs, and shrubs

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for white-tailed deer; sod grasses and sericea lespedeza can be particularly problematic in fields and Japanese stiltgrass often reduces forage availability in forests; although white-tailed deer may eat many nonnative invasive plants in some seasons to some extent, control of many of those plants, such as kudzu, Japanese honeysuckle, and Chinese privet, can lead to increased plant species diversity and increased forage quality during various seasons
Edge Feathering: to increase forage availability around fields and enhance fawning cover
Field Borders: to increase forage availability (forbs and brambles) around crop fields
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) will provide increased browse, soft mast production, and dense escape cover; *Timber Stand Improvement* can provide increased browse and soft mast production and stimulate better cover in stands with a poorly developed understory
Leave Crop Unharvested: to provide additional food resource, especially near escape cover
Livestock Management: livestock should be excluded from forests managed for deer to avoid destruction of the forest understory; livestock should be excluded from riparian areas, especially in the Great Plains Grassland Ecoegion; should prevent overgrazing in woodlands and savannas

Plant Food Plots: when naturally occurring food sources are limited, food plots may provide additional nutrition, particularly in late summer and winter of most ecoregions
Plant Native Grasses and Forbs: where early successional cover is limiting and planting is necessary for establishment
Plant Shrubs: where needed to provide additional soft mast, brushy cover, and browse; ravines, field borders, other idle land areas and across large open areas to provide travel corridors
Plant Trees: in large open areas to maintain at least 30 to 40 percent forest cover; where mast producers are lacking, particularly oaks
Set-back Succession: *Prescribed Fire* and *Disking* is recommended to maintain herbaceous openings; *Prescribed Fire* is recommended to stimulate the forest understory for increased forage and soft mast; *Chaining* can be used to rejuvenate shrub cover; in areas dominated by mesquite, *Root-plowing* combined with seeding grasses and legumes may be the best way to increase herbaceous groundcover; *Chainsawing* and *Root-plowing* when converting forest to early successional cover to increase forage and enhance fawning cover
Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source
Water Developments for Wildlife: where lacking (within one-half mile), dugouts, ponds, and shallow impoundments can provide free-standing water
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Increase Harvest: when populations can sustain additional harvest pressure for hunting recreation and when populations need to be lowered because of overpopulation and habitat degradation; in these cases, it is necessary to concentrate increased harvest on females
Wildlife Damage Management Techniques: fencing, repellents, and scare tactics may be helpful to keep deer from ornamental plantings, vegetable gardens, and crops; reducing the population through shooting is recommended when widespread overabundance is causing crop depredation and increasing vehicle collisions
Wildlife or Fish Survey: camera surveys, browse surveys, and hunter observation and harvest data are used to estimate population trends

Fish

Bluegill

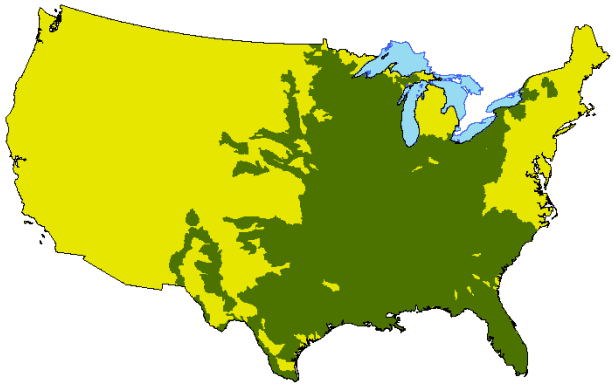
General information

The bluegill is one of the most abundant Sunfish species. It thrives in a variety of conditions, ranging from freshwater lakes, ponds, and slow moving streams, to brackish waters of coastal areas. The bluegill's native range is the eastern U.S. from southern Canada to Florida and Texas, but they have been successfully introduced throughout the U.S.

Eric Engbretson

Habitat requirements

Diet: a variety of zooplankton (microscopic animal life) during the first few months of life, progressing to insects and their larvae, eggs, earthworms, tadpoles, small minnows, and crayfish
Cover: submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide
Water: basic requirements include dissolved oxygen (minimum of four parts per million); pH between 6.5 and 9.0; and water temperature should reach at least 70 F during summer (one foot below surface in the shade)



Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be installed if none are present so water depth can be controlled
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest
Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey bluegill populations
Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam
Control Aquatic Vegetation: when necessary to discourage rooted aquatic vegetation
Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm
Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles
Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Largemouth bass

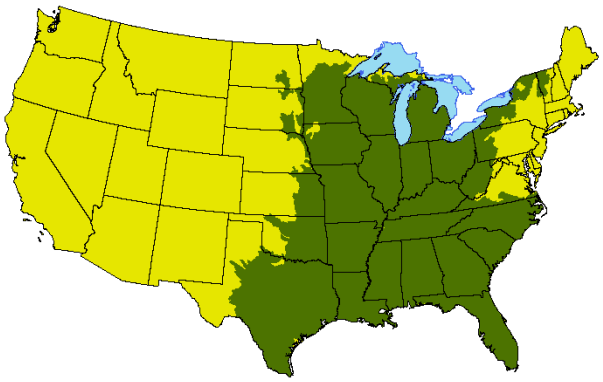
General information

Largemouth bass are not really bass but members of the Sunfish family. Largemouth bass are the most popular freshwater sportfish in states where they are found. They can be found in freshwater lakes, rivers, large streams, farm ponds, and brackish marshes.

Robert H Pos

Habitat requirements

Diet: young bass eat insects and other invertebrates (worms, crayfish and zooplankton); adults eat small fish, such as bluegill, and a variety of minnows, as well as tadpoles, crayfish, and even ducklings
Cover: submerged rocks, woody debris and near aquatic vegetation where small fish (prey) hide
Water: basic requirements include dissolved oxygen (minimum of four parts per million); pH should range between 6.5 and 9.0; water temperature should reach at least 70 F during summer (one foot below surface in shade)



Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be installed if none are present so water depth can be controlled
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest
Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey largemouth bass populations
Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam
Control Aquatic Vegetation: when necessary to discourage rooted aquatic vegetation
Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm
Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles
Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Habitat Management Practices

Conservation Easement

General description

A conservation easement is a legal agreement between a landowner and a land conservation organization (or "land trust") or government agency that places permanent restrictions on what can be done on a property. Landowners use conservation easements to permanently protect property from various land-uses (most notably future real estate development) that may degrade or destroy its natural resources. Common restrictions include limited or no new structures or roads can be built on the property. However, conservation easements offer flexibility. For example, if existing farmland is entered into a conservation easement, continued farming may be allowed while various vegetation types or habitat features are protected. In addition to the satisfaction of protecting the property in perpetuity, landowners also benefit by receiving reduced property taxes. Thus, landowners are much better able to continue to keep their land in the face of increasing property tax rates. Conservation easements do not transfer ownership of the property, but only place restrictions on what can be done on the property. The property can be sold, but the restrictions are maintained from owner to owner, in perpetuity.

Conservation easements are critically important in protecting property that contains or harbors rare vegetation types, habitat features, and endangered species. Examples include longleaf pine savanna, native grasslands, caves, and wetlands that provide habitat for species of conservation concern, such as red-cockaded woodpecker, gopher tortoise, grasshopper sparrow, Indiana bat, prairie-chickens, greater sage-grouse, marbled murrelet, and many others. Conservation easements are also a valuable tool in protecting land in areas where urban and suburban development is rapidly expanding. It is in these areas where property values are exceptionally high and the associated property tax rates often increase to the point landowners are no longer able to keep their property. The specific conservation purpose of the easement varies with the goals and objectives of the land trust or agency and the landowner. Common objectives include protection of a vegetation type or ecosystem, maintenance of a forested or riparian corridor, habitat for various wildlife species, wetland function, and water quality.

NOTE: Conservation easements can benefit any wildlife species, according to the area protected. However, for purposes of this program, ***Conservation Easement*** should be considered when evaluating property that is under threat of real estate development or some other major land-use change, such as surface mining or wind farming with turbines, which would degrade or alter its current natural resource value. Further, this practice should be restricted to those species that are in serious decline or are associated with rare vegetation types that are in need of protection.

Effect on habitat

- Maintain land in a natural state and protect it from real estate development.
- Protect rare vegetation types and habitat features, such as grasslands, wetlands, caves, and large forested tracts.
- Protect habitat for declining, threatened, or endangered wildlife species.
- Maintain corridors for migrating wildlife.
- Protect water quality, especially if riparian areas are included or if watersheds are protected.

Control Nonnative Invasive Vegetation

General description

Nonnative plants have been brought to North America for centuries. Some were introduced accidentally, but most were brought intentionally to provide livestock forage or to be used as ornamentals. Unfortunately, many nonnative plant species have become established and spread far beyond where they were initially introduced. This invasion has been detrimental to native plant communities because many nonnative plants out-compete native species for sunlight and nutrients and exclude them from a particular area. Exclusion of native plants has been detrimental for several wildlife species. Many nonnative invasive plant species do not provide suitable cover, structure, or food for wildlife. As usable space for wildlife decreases, so does the carrying capacity for that area. Thus, populations of certain wildlife species have declined as a result of nonnative invasive species.

Examples of nonnative trees that should be controlled include tree-of-heaven, mimosa, and paulownia. Examples of nonnative shrubs that should be controlled include Russian olive, privets, bush honeysuckle, saltcedar, and multiflora rose. Examples of nonnative vines that should be controlled include kudzu, Japanese honeysuckle, and Oriental bittersweet. Examples of nonnative grasses that should be controlled include tall fescue, bermudagrass, johnsongrass, cogongrass, and cheatgrass. Examples of nonnative forbs that should be controlled include sericea lespedeza, sicklepod, cocklebur, and spotted knapweed. Examples of invasive wetland plants include alligatorweed, purple loosestrife, phragmites, hydrilla, water hyacinth, Eurasian watermilfoil, and reed canarygrass.

Without management, nonnative invasive species continue to spread, limit plant species diversity and degrade wildlife habitat. Most often, herbicide applications are necessary to control nonnative invasive species. Some species can be controlled by hand-pulling or mechanical techniques. Of course, nonnative invasive species should never be planted.

There are few properties in the country that do not contain any nonnative species. When evaluating an area, consider the impact nonnative species are having on the native plant community and associated wildlife.

NOTE: When this WMP is recommended, it is implied that necessary action will be taken to implement the practice. For example, if this WMP is recommended to control mimosa or paulownia trees, it is not necessary to also recommend ***Chainsawing*** or ***Herbicide Applications*** (which are methods included in ***Set-back Succession***). Further, if this WMP is recommended to control nonnative grasses, such as tall fescue or bermudagrass, in a field to improve habitat for various wildlife species that might use the field, do not also recommend ***Herbicide Applications***. When evaluating ponds and other wetlands, implementing this practice applies only to plants within the pond or wetland, not the surrounding watershed (unless the surrounding watershed is also being considered).

Effect on habitat

- Killing nonnative plants where they limit growth of native plants can improve cover and increase foods for many wildlife species.
- Controlling nonnative invasive species often leads to increased plant species diversity, which can provide more types of cover and food for various wildlife species.
- Eliminating nonnative grasses that produce a dense structure at ground level will allow the seedbank to respond and result in better cover for nesting and brood rearing for several bird species, and also increase food availability for many wildlife species as various plants are stimulated and grow from the seedbank.

- Killing nonnative trees and shrubs can increase space for desirable tree and shrub species, which can lead to increased mast production.
- Nonnative species in ponds and wetlands may outcompete native plant species (such as phytoplankton) for nutrients, thereby reducing fish carrying capacity
- Certain nonnative species (such as giant salvinia) may effectively block sunlight and reduce oxygen content, resulting in fish kills


John Gruchy

Nonnative perennial cool-season grasses, such as this tall fescue, do not provide habitat for most wildlife species. Eradicating these undesirable grasses and allowing other plants to grow on the site is an extremely beneficial practice that enhances cover and increases food availability for many wildlife species.

Create Snags

General description

The presence of dying, dead, and down trees is critically important for a large number of wildlife species. Many birds, mammals, reptiles, amphibians, and a host of invertebrates and fungi are closely associated with (and some restricted to) standing dead trees or down woody material.

Standing dead trees are called *snags*. They provide perching sites and foraging opportunities for many bird species, such as red-tailed hawks, American kestrels, and bluebirds. Woodpeckers are attracted to snags to feed on the invertebrates under the bark and also to excavate cavities for nesting. Most woodpeckers are *primary excavators*. That is, they excavate cavities for nesting in snags. However, most woodpeckers need relatively soft wood for excavating. Thus, fungi aid woodpeckers by softening dead wood through decomposition. After woodpeckers nest and leave the cavity, other species may move in and use the cavity. These species are called *secondary cavity users*. Some secondary cavity users enlarge cavities to suit their needs. Most of the secondary cavity users are birds (such as prothonotary warblers and wood ducks), but there is a wide variety of secondary cavity users, from bats and bears, to various salamanders and snakes.

The value of snags does not end when they fall. Other wildlife species, such as salamanders, shrews, mice, and snakes, are closely associated with down woody material. These animals serve important ecosystem functions, such as nutrient recycling and prey for various predators. The food web in some ecosystems is thus strongly influenced by the presence of snags and down woody material.

In mature forests, snags and down woody material are usually available. However, if snags are limiting species that require cavities or down woody material, snags and down woody material may be created by killing some trees and leaving them standing. Trees can be killed and left standing by girdling the tree with a chainsaw or hatchet and applying the appropriate herbicide to the wound, or by topping the tree. Obviously, it is much easier to girdle a tree. Selection of trees to kill is important. Softwood species (such as conifers, poplars, and maples) and those trees that already have signs of injury and decay are good candidates because the wood is more easily excavated by woodpeckers and heart rot (rotting in the interior of the tree trunk) may have already begun.

Size of the snag is important. Larger diameter snags (>12 inches diameter) are suitable and used more often by a wider variety of wildlife species than smaller stems. Optimally, snags may be distributed throughout a stand, and may occur as individuals or as small clusters. Information on the number of snags per area is somewhat limited, but estimates suggest 5 – 15 snags per acre in forested areas will sustain populations of various woodpecker species, which thereby would sustain populations of secondary cavity users and other species associated with down woody material. Snags are also used in non-forested areas by other wildlife species not found in forests, such as bluebirds and American kestrels. Thus, snags may be created when they are limiting in both forested and open areas.

Effect on habitat

- Snags provide roosting and perching sites for many bird species.
- Snags provide insects as food for woodpeckers and other birds.
- Snags provide woodpeckers with sites for cavity construction.
- Secondary cavity species (such as bluebirds, owls, wood ducks, raccoons) may use old woodpecker cavities for nesting, roosting, or denning.
- When snags fall, they provide sites for denning, reproduction, foraging, and escape for various wildlife species.
- When snags fall, they provide drumming logs for ruffed grouse.
- Creating snags in forested areas allows additional sunlight to reach the forest floor, which stimulates additional groundcover that may provide forage, soft mast, and nesting cover for various wildlife species.


Craig Harper

Snags can be created by girdling the tree and spraying the wound with the appropriate herbicide. Snags provide perching, nesting, denning, and foraging sites for many wildlife species.

Delay Crop Harvest

General description

When landowners have an interest in wildlife, it may be beneficial to avoid harvesting crops during nesting and fawning seasons to reduce nest destruction and mortality. It is important to realize crop yield and quality are often reduced dramatically when harvest is delayed, especially when hay harvest is delayed until seedheads form. A much more important consideration than delaying crop harvest is making sure adequate usable space is available across the property for the focal wildlife species, which may mean reducing the amount of acreage cropped or hayed to increase acreage available for wildlife.

NOTE: this practice should be recommended only when a crop is present or is planned for the current growing season.

Effect of practice

Destroying fewer nests and young at a specific time, such as May/June when fawns and initial nests of songbirds are most vulnerable, can help maintain a sustainable population or population increase.

Blake Brown

Switchgrass grown for biofuels is normally harvested in November. Where wildlife is a consideration, native grass grown for biofuels should be harvested in March to provide cover through winter. Delaying the harvest until March should not reduce yield appreciably.

Edge feathering

General description

Edge feathering involves reducing tree density in woods adjacent to fields. Reducing the number of trees allows more sunlight to enter the forest canopy and stimulates the understory, which provides a more diverse structure of cover from the field into the woods.

Trees are usually thinned approximately 100 feet into the woods along at least one side, if not all sides, of the field where woods are adjacent. Trees are usually thinned more heavily in the 50 feet or so nearest the field (inner zone) by removing or killing at least 75 percent of the trees. Fewer trees (approximately 50 percent) are removed or killed 50 – 100 feet from the woods (outer zone). This gradation of tree density (few too many from field to forest) and sunlight availability (lots too little from field to forest) promotes an ecotone (an area with characteristics of two adjacent vegetation types) from field to forest.

Edge feathering can be implemented around any field with adjacent woods that have not already been thinned sufficiently. ***Edge Feathering*** and ***Establish Field Borders*** are excellent companion practices to enhance habitat for several wildlife species.

Effect on habitat

- nesting cover and escape cover are provided for various wildlife species
- foods (especially forage, browse, seed, and soft mast) are increased for various wildlife species

Field Borders

General description

Field borders are uncropped areas around crop fields or unhayed areas around hay fields designed to provide nesting, brooding and escape cover for many wildlife species. Field borders also help trap sedimentation and nutrient run-off. Field borders most often consist of native grasses and forbs, but may also include brambles and shrubs, depending on landowner objectives. Field buffers should be a minimum of 30 feet wide, but wider is better. Field borders up to 120 feet wide are highly desirable and recommended to provide adequate usable space for wildlife dependent upon early successional vegetation.

Field borders most often consist of native grasses and forbs, but might also include scattered brambles and shrubs depending on landowner objectives and focal wildlife species. Field borders may be established by allowing natural succession from the seedbank or by planting.

NOTE: ***Plant Native Grasses and Forbs*** or ***Plant Shrubs*** should not be recommended in order to establish ***Field Borders***. However, if there are existing field borders of undesirable species, such as tall fescue, bermudagrass, or sericea lespedeza, ***Control Nonnative Invasive Vegetation*** should be recommended to control those plants. Additional field borders should be recommended only if there are crop fields or hay fields without field borders, if additional field borders are needed around a field, or if existing field borders are too narrow.

Effect on habitat

- Provides increased usable space for many wildlife species
- Provides nesting and/or brooding cover for many songbirds, bobwhites, and wild turkeys
- Can provide increased forage and seed availability if desirable forbs are established
- Can prevent sedimentation and nutrient runoff


Craig Harper

Field buffers around crop fields provide increased usable space for species that require early successional cover. Field buffers don't have to be planted. Here, broomsedge, asters, and blackberry have established from the seedbank.

Forest Management

General description

A forest, unless relatively small, is most often a collection of stands. A forest stand is a contiguous group of trees that is usually designated with respect to species composition, site, and age-class distribution. Forests are managed by harvesting stands and allowing new stands to develop (forest regeneration), or by manipulating existing stands through partial cuts or thinning (timber stand improvement). *Silviculture* is the art and science of tending a forest. Managing forests for the appropriate structure (height and density of vegetation) and species composition (which trees and other plants are present) is essential when managing wildlife that use forested areas.

Forest Regeneration

Regenerating a forest stand involves harvesting the trees within the stand through various silvicultural methods *with the intention of renewing and maintaining that forest stand*. Stand age and health, as well as landowner objectives, determine when a stand should be regenerated. Following a regeneration harvest, a new forest is established through natural or artificial regeneration. Natural regeneration allows trees to grow back naturally from the site. Artificial regeneration involves planting trees.

The structure (and often the composition) of a forest stand changes when it is regenerated. Thus, some wildlife species benefit and others may not. For example, cottontails and northern bobwhite may use the cover and food resources available in a mixed hardwood stand recently clearcut, whereas eastern gray squirrels that were using that stand prior to harvest would have to move to another stand. At the same time, other species, such as wild turkeys and white-tailed deer, would use both the recently harvested stand as well as an adjacent mature stand of mixed hardwoods. When managing habitat for species that require young forest cover, such as ruffed grouse, it is crucial to regenerate stands over time and to make sure regenerating stands are dispersed across the area being managed.

NOTE: *Forest regeneration* should be recommended in order to regenerate stands and provide young forest cover — not to create "openings" or promote early successional communities. Regenerated forests result in new forests, **not** openings. Where additional early succession is needed, and the area is currently forested, ***Forest Regeneration*** should **not** be recommended for that objective. Instead, ***Set-back Succession* (*Chainsawing* and *Root Plowing*)** should be recommended.

The regeneration method recommended depends upon the forest type and composition, site quality, and landowner objectives. The **clearcut** regeneration method harvests all the trees in the stand. More sunlight is allowed into the forest floor with this method than with any other. Clearcutting generally releases shade-intolerant species (such as yellow poplar, black cherry, basswood) when present. The **shelterwood** regeneration method removes a predetermined number of trees to allow development of seedlings (regeneration) from the understory. Later (usually 6 to 8 years), the trees that were left standing (the shelterwood) are removed after the regeneration has developed (often 5 – 15 feet tall). The **seed-tree** regeneration method leaves a few seed-producing trees per acre to regenerate the new stand. This method is often used with pines and other species with lightweight, wind-carried seed. The seed trees are usually harvested after the crop of new trees (regeneration) becomes established. The **group selection** regeneration method harvests small groups of trees (no more than 2 acres) within a stand. This method creates more diverse structure within the stand and generally does not allow as

much light into the stand, which can allow both shade-tolerant and shade-intolerant trees to regenerate. The **single-tree selection** regeneration method harvests only select, individual trees out of the stand, not groups of trees. This method can create a diverse structure with small gaps in the forest canopy. This method generally regenerates shade-tolerant species in closed-canopy northern hardwood forests, but is also used to regenerate longleaf pine where prescribed fire is also used to control undesirable species.

Pines are most often planted (artificial regeneration) after harvest to establish a new stand. Hardwood stands are almost always regenerated naturally and not planted. A common exception is that bottomland hardwoods are often planted when reforesting a large bottomland field that was previously in row-crop agriculture.

Regardless of regeneration method used, it is important to make sure food, cover, and water for certain wildlife species are in close proximity. Regenerated stands should be adjacent to more-developed stands if providing travel corridors and space for wildlife that do not use young stands is a consideration. Also, whenever stands are harvested, it is important to leave relatively large standing dead trees (snags) and live trees with cavities for wildlife that might use them.

Craig Harper

Clearcutting removes all the overstory trees in a stand, allowing full sunlight onto the site. This 2-year-old mixed hardwood-pine forest was regenerated via clearcutting. It is now providing food and cover for many wildlife species, including black bear, bobcat, brown thrasher, eastern cottontail, great horned owl, white-tailed deer, wild turkey, and others.

Craig Harper

Not all trees are harvested initially when using the shelterwood method. Managers can leave trees that might provide an important food source, such as oaks, blackgum, black cherry, and persimmon, until the regeneration has developed. At that time, the remaining ovestory is harvested. Leaving mast-producing trees is an important consideration when managing for wildlife that eat acorns and other mast.

Craig Harper

The seed-tree method is most often used with pines. Scattered trees are left standing after the initial harvest. Wind scatters seed from these remaining trees across the harvested area and new pines establish naturally.

Dwayne Elmore

Group selection creates relatively small (<2 acres) canopy gaps within a stand. New trees regenerate naturally (without planting) in the openings. These small openings diversify the structure within the stand and are used by many wildlife species.

Craig Harper

Select, single trees are removed in single-tree selection. This method favors shade-tolerant species in hardwood stands. Thus, it is sometimes practiced in northern hardwood stands where species such as sugar maple, American beech, and white pine are managed. Single-tree selection is also practiced effectively in longleaf pine stands.


Craig Harper

Standing dead trees (snags), as well as relatively large live trees with cavities, should be left when practicing forest management to provide cavities and perches for various wildlife species. *Create Snags* should be recommended where additional snags are needed.

Effect on Habitat

- Forest regeneration produces new forest growth with greater stem density, which provides nesting and escape cover for several wildlife species.
- Clearcut, shelterwood, and seed-tree stimulate an initial flush of herbaceous growth for a few years until it is shaded out by the developing trees. Browse and soft mast are increased for a short time after harvest.
- Group selection creates considerable diversity in stand structure, providing characteristics of a young stand and an older stand. Browse and soft mast are increased in the group selection openings for a few years until regenerating trees reduce available sunlight to the forest floor.
- Single-tree selection maintains the overall structure of a mature forest, but an increase in understory growth where individual trees are removed will enhance nesting structure for some species and provide additional browse and soft mast.
- Regenerating stands provide cover for many prey species, which can benefit various predators.
- Snags and live den trees that are left standing provide perching, nesting, denning, and loafing sites for many wildlife species.
- The tops and slash of harvested trees remaining on the site provide what is called “down woody debris” or “coarse woody debris.” This material is very important for several reasons. As the material rots, nutrients from the organic material are returned to the soil for additional plants and animals to use. Not removing these nutrients from the site is important for ecological function. From a wildlife perspective, many reptiles and amphibians live in and under the decaying logs. Many small mammals also nest and den in and under decaying logs. Birds, such as wild turkeys and ruffed grouse, commonly nest adjacent to the brushy material and logs left behind, which simulate a tree blown over during a storm. Male ruffed grouse also use down logs as platforms to “drum” on and attract females. The brushy debris left behind after a logging operation also provides important cover for various species and actually helps forest regeneration as newly emerging seedlings are protected from browsing.

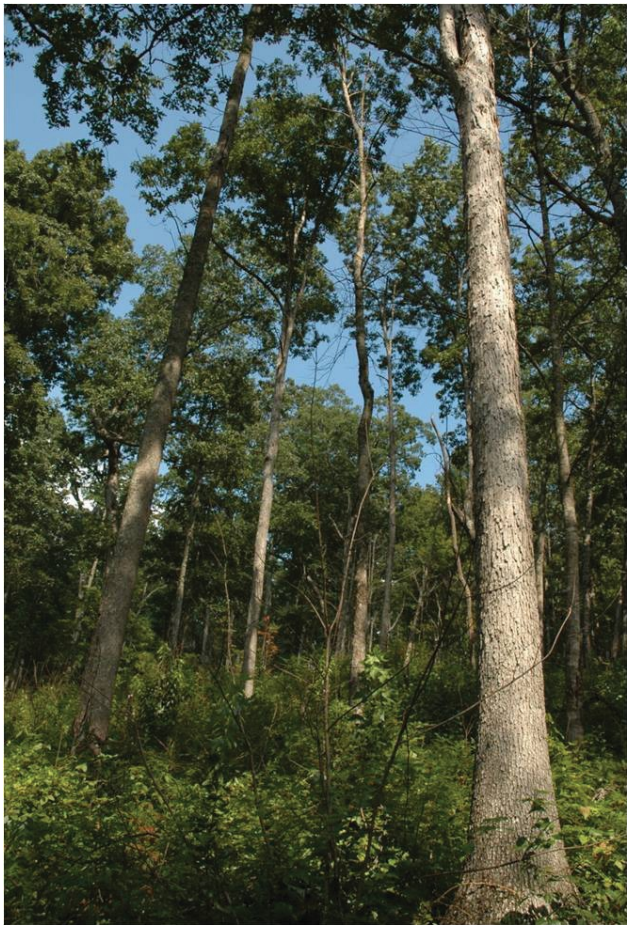
Timber Stand Improvement (TSI)

TSI may involve any of several practices used to improve the quality and composition of forest stands by shifting resources (sunlight and nutrients) to achieve an objective, which may include wildlife, timber, or aesthetics. TSI most often involves some type of **thinning**, which reduces overall tree density

to influence stand growth and development. **Improvement cuts** are implemented in stands past the sapling stage to improve composition and quality by removing undesirable trees. Regardless, when some trees are removed, the remaining trees are “released” from the adjacent competition for sunlight and nutrients, which often allows them to put on more volume and develop larger crowns that can provide more mast (such as acorns). Increased sunlight entering the forest canopy also allows the understory to better develop, which provides more cover and food (forage and soft mast) for various wildlife species.

Effect on habitat

- Increased understory growth enhances cover and provides additional forage, browse, and soft mast.
- Increased woody stem density in the midstory improves cover for some species.
- Trees retained following TSI are better able to grow larger crowns and produce additional mast.
- Snags and den trees that are left standing and down logs and other coarse woody debris left following TSI provide sites for feeding, denning, drumming, reproducing, hiding, and resting for many wildlife species.



Craig Harper

Timber stand improvement (TSI) can be implemented to remove undesirable trees and increase growth of selected trees that remain in the stand. Groundcover is stimulated when additional sunlight enters the stand, providing additional cover and food resources in the stand, which can be maintained with periodic prescribed fire.

Forest Road Maintenance

Forest roads (or "woods roads") are required for trucks and other equipment to enter the forest for management. Roads are easily constructed if none are present when regeneration harvests are implemented. However, critical consideration must be made to how roads are constructed. If not constructed properly, soil erosion is likely, which leads to sedimentation and nutrient run-off into streams, which results in reduced water quality. In fact, more than 95 percent of all soil erosion and sedimentation associated with forest management is a result of improperly constructed forest roads, not tree harvest. Forest roads should not be constructed with steep grades or perpendicular to slope. Roads should be constructed with a slight grade (not too steep). If roads are not constructed properly, they should be repaired or rebuilt.

The most important consideration when constructing forest roads in hilly or mountainous areas is getting water off the roads quickly. Rainwater is moved off forest roads most quickly if roads slant slightly to the downhill side. Diversion bars (similar to a speed bump on a school road) and broad-based dips with culverts also help divert water off roads in hilly or mountainous areas.

Forest roads may be vegetated to help prevent erosion and provide additional forage for various wildlife species. Roads may be vegetated with naturally occurring plants, or they may be planted to ensure adequate vegetation is present. Planting roads to wildlife-friendly vegetation, such as clovers, wheat, and oats, benefits many wildlife species by providing forage and associated invertebrates. Forest roads should not be planted to invasive species or plants that are not beneficial to wildlife (such as tall fescue). Adequate sunlight must be available in order for roads to support vegetation. If roads are completely shaded and additional vegetation is desired, trees may be removed along one or both sides of forest roads to provide adequate sunlight. Thinning trees along a forest road is called "daylighting." Usually, about 50 – 75 percent of the trees within 50 feet of the road are killed, felled, or harvested. Trees less desirable for wildlife are the ones targeted for removal. In addition to providing additional forage on the road, daylighted roads also provide additional browse, soft mast, and brushy cover in 50-foot-wide zones along the sides of roads, which is highly beneficial for some wildlife species.

Vegetation, whether naturally occurring or planted, on forest roads cannot stand very much vehicular traffic. Thus, those roads that receive considerable traffic from land managers may require gravel. Forest roads should also be gated where they intersect public roads to prevent trespassing and poaching (killing wildlife illegally).


Craig Harper

Forest roads should not be constructed perpendicular to slope. Roads such as this should be closed and planted to trees or shrubs.


Craig Harper

Forest roads, such as this one planted to clovers, provide nutritious forage as well as travel corridors for many wildlife species.


Craig Harper

This forest road was daylighted to provide additional browse, soft mast, and nesting cover for various wildlife species. The road was graveled to prevent erosion because it receives considerable traffic from land managers.

Leave Crop Unharvested

General description

Strips or blocks of grain or other crops (such as soybeans) can be left unharvested. This practice is especially valuable if the strips are left adjacent to cover. This practice should be recommended only if there is an unharvested crop present. It is not applicable to food plots.

Effect on habitat

- Provides additional food for many species, which can be particularly important when naturally occurring foods are in low supply and/or in years with poor acorn production.


Craig Harper

By leaving strips or blocks of grain unharvested, additional food is available for wildlife. Leaving this food resource can be an important consideration, especially in areas where winters are harsh.

Livestock Management

General description

The intensity and duration of livestock grazing directly impacts the structure (height and density) and composition of the vegetation community and, consequently, habitat quality for various wildlife species. Stocking rate is the amount of land allotted to each animal for the entire grazable portion of the year and is the most important consideration concerning livestock grazing management. Stocking rates are adjusted to manipulate the structure of vegetation to favor various wildlife species. Intensity and timing of grazing also favor various plant species over others. Thus, available nutrition for livestock and plant species diversity are also influenced by grazing intensity and duration. Heavier stocking rates typically result in shorter vegetation, more open structure, and earlier successional stages (annual and perennial grasses and forbs with little or no woody cover), whereas lighter stocking rates tend to favor taller vegetation, more dense structure, and more advanced successional stages (perennial grasses and forbs and considerable woody cover). Stocking rates are relative to different ecoregions. A heavy stocking rate in the Great Plains would be a light stocking rate in the eastern U.S. where annual precipitation is much greater.

This practice can also be used to exclude livestock from an area. Livestock distribution can be controlled with fencing, herding or fire. Livestock exclusion may be necessary for wildlife species that require considerable shrub cover. Livestock exclusion is necessary for many wildlife species that inhabit

forests, particularly those species that require a well-developed understory. Livestock exclusion is also required to protect sensitive areas, such as riparian zones and other wetlands where erosion, siltation, and livestock waste can cause problems for associated wildlife and fish and reduce water quality.

This practice should be recommended when evidence of livestock is present or information on livestock use is provided.

Effect on habitat

- Stocking rate can alter the vegetation structure and composition to favor various wildlife species.
- Livestock may be excluded from areas where advanced successional stages and increased vegetation structure is desirable for various wildlife species.
- Excluding livestock from riparian areas can help reduce siltation, turbidity and stream bank erosion, and reduce stream and pond pollution from livestock waste, which is beneficial for many wildlife and fish species. Excluding livestock from riparian areas may also improve habitat structure and composition for various wildlife species that use these areas.

Dwayne Elmore

Grazing can be used to manipulate cover for wildlife. Stocking rate greatly influences the vegetation composition and the resulting structure. Overgrazing severely limits cover and food resources for many species of wildlife. However, more bare ground and shorter structure is beneficial for some species.

Nesting Structures

General description

Some species den, nest, or roost in cavities they don't excavate themselves (such as bluebirds, wood ducks, and owls). If natural cavities are not available, artificial cavities (nest boxes) can be used. Many species need a certain kind of cavity (certain diameter of hole, depth, area) in a certain location (field, woods or water) and at a certain distance aboveground (height in feet). The particular design and placement of nest boxes often determines which wildlife species use the structures. Nest boxes should be monitored to ensure use by targeted species. Contact your county Extension office for specific designs of nest boxes and other artificial nesting/roosting structures.

NOTE: Nesting structures for Canada geese are not recommended because resident Canada geese have become too numerous and are a nuisance in many areas. In addition, nesting structures are not recommended for mallards. Instead, creation of high-quality nesting cover (native warm-season grasses and forbs) is required to impact population recruitment.

Effect on habitat

- In open areas, nest boxes are useful for bluebirds unless an abundance of nesting cavities in trees or fence posts are available. Nest boxes for bluebirds should not be placed any closer than 80 yards apart to prevent territorial fighting between males.
- Nesting structures near water sources provide secure nesting sites for wood ducks where trees with cavities suitable for nesting are limiting. Nest boxes for wood ducks should not be placed any closer than 100 yards apart and ideally, should not be visible from one box to another, to prevent dump-nesting by females not incubating a particular nest.


Craig Harper

Nest boxes provide artificial cavities for several species of birds. Nest boxes have been instrumental in helping bluebird and wood duck populations recover from drastically low levels in the early 1900s.

Plant Food Plots

General description

Food plots can be planted to provide a supplemental food source for many wildlife species when naturally occurring food is a limiting factor for maintaining or increasing the population. Food plots are also commonly planted for various game species to facilitate hunting. Regardless of reason for planting, a wide variety of wildlife species may benefit from food plots. In fact, food plots probably benefit more nongame species than game species. For example, all the seeds that are provided in bird feeders are also planted in food plots! Food plots are often planted to provide grains, such as corn, grain sorghum, and millets, and other plants with large energy-rich seed, such as sunflowers. Leafy forages, such as clovers, rape, chicory, jointvetch, winter peas, and lablab, are also commonly planted. Some plantings may provide both forage and grain or seed, such as soybeans, cowpeas, buckwheat, wheat, and oats. Food plots do not only benefit upland wildlife (such as deer, wild turkey, sparrows, and elk), but waterfowl as well. Canada geese, mallards, and American wigeon often feed in warm-season grain food plots and in winter wheat. Plots of millets, corn, rice, or grain sorghum may be flooded a few inches deep in the fall to provide an additional food source for many duck species through winter.

The size and shape of food plots and their distribution is largely determined by the focal species and habitat quality. Food plots may be long and narrow (150 to 400 feet long and 15 to 20 feet wide) or more blocky in shape (depending on the focal wildlife species and the type of food plot planted). Relatively small food plots located adjacent to escape cover and arranged in a linear shape may receive more use by animals with small home ranges and associated with brushy cover, such as cottontails or northern bobwhite. Larger food plots in more open areas may be necessary and receive more use by some species, such as elk, greater prairie-chicken, mallard, mourning dove, pronghorn, and sharp-tailed grouse. Regardless, if food is a limiting factor for a particular species, food plots should be distributed throughout the property in accordance with the minimum daily movement distances of the species. Further, if food is a limiting factor, it is critical to realize additional habitat management practices should be implemented to provide additional naturally occurring foods. In most situations, food plots should not be placed within view of property lines or public roads to discourage poaching and unnecessary stress on wildlife that may be using the food plots. Exclusion cages approximately 4 feet square and 4 feet tall may be placed in food plots to enable property managers to monitor planting success and amount of feeding pressure by wildlife.

NOTE: For purposes of this contest, ***Mowing***, ***Disking***, and ***Herbicide Applications*** are WMPs used to set-back succession. They should not be recommended in order to plant or maintain a food plot. If food plots are present on an area being evaluated and are in need of repair or replanting, ***Plant Food Plots*** should be recommended if they are still needed. However, if nonnative invasive species are present in a food plot, ***Control Nonnative Invasive Vegetation*** may be recommended. Many of the species listed above as commonly planted in food plots are nonnative, but they are not considered invasive.

Craig Harper

Warm-season grain plots, such as this corn, can provide an important source of energy through winter for many wildlife species.

Craig Harper

Warm-season forage plots, such as these soybeans, can provide an excellent source of protein (leaves) during summer and an energy source (beans) in winter.

Craig Harper

Cool-season food plots provide nutritious forage fall through spring when availability of naturally occurring forages may be relatively low. Depending on what is planted, such as this winter wheat, a nutritious seed source is also available the following late spring through summer.

Effect on habitat

- Grain food plots, especially corn and grain sorghum, as well as soybeans can supply a high-energy food source through fall and into late winter. Such a food source can influence winter survival for several wildlife species, especially during relatively cold winters and during years with low mast (acorn) production.
- In areas and seasons where nutritious forage is limiting, forage plots can supply highly digestible forage, which can be especially important during late summer and through winter and spring.

Plant Native Grasses and Forbs

General description

Native grasses and forbs are important for cover and food for many wildlife species. Native grasses and forbs represent early successional stages in all ecoregions and may represent the climax successional stage in some areas where shrub and tree growth is limited.

It may be necessary to plant native grasses and forbs in areas where there is not sufficient cover and where the seedbank (those seed occurring naturally in the soil) has been depleted and desirable native grasses and forbs do not occur naturally. An example of an area that may need planting is a field that has been in agricultural production for many years, often decades. Continued plowing and herbicide applications over many years can eventually deplete the seedbank of desirable native species and planting can expedite desirable groundcover.

Native grasses and forbs should not be recommended for planting if desirable native grasses and forbs are present and likely to provide adequate cover and food resources. Undesirable nonnative plants may be selectively removed through ***Control Nonnative Invasive Vegetation*** and thus release native grasses and forbs.

Plant Native Grasses and Forbs should not necessarily be recommended where additional early successional cover is needed. For example, in large forested areas where additional early successional cover might be required to provide habitat for some wildlife species, such as loggerhead shrike, northern bobwhite, or woodcock, it is likely that desirable native grasses, forbs, brambles, and other plants will establish from the seedbank after the forest is cleared by ***Chainsawing*** and ***Root-plowing*** (see ***Set-back Succession***).

Many nonnative grasses (such as tall fescue and bermudagrass) are not recommended for wildlife because they do not provide suitable cover or food for most wildlife, and their competitive nature often prevents native grasses and forbs from becoming established.

Examples of desirable native warm-season grasses

- broomsedge bluestem, little bluestem, blue bunch wheatgrass, big bluestem, sideoats grama, blue grama, switchgrass, indiangrass, buffalograss

Examples of desirable native cool-season grasses

- Virginia wildrye, Canada wildrye, povertygrass, low panicgrasses

Examples of invasive nonnative warm-season grasses

- bermudagrass, cogongrass, johnsongrass, crabgrass, dallisgrass, goosegrass

Examples of undesirable nonnative cool-season grasses

- tall fescue, orchardgrass, bromegrasses, timothy

Examples of desirable native forbs and brambles

- common ragweed, western ragweed, pokeweed, blackberry, dewberry, native lespedezas, beggar's-lice, old-field aster, partridge pea, Rocky Mountain beeplant, annual sunflower, perennial sunflowers, crotons

Examples of invasive nonnative forbs

- sericea lespedeza, curly dock, spotted knapweed, sicklepod, cocklebur

Craig Harper

Native grasses and forbs may be planted where sufficient and desirable native grass/forb cover is lacking.

Effect on habitat

- Native grasses and forbs provide nesting, bedding, roosting, and/or escape cover for many wildlife species, especially those that require early successional cover.
- Ground-nesting birds usually build their nests at the base of native bunchgrasses, such as broomsedge bluestem, little bluestem, or sideoats grama.
- Although some wildlife, such as elk, readily eat native grasses, forbs provide a greater food source for more species. Many forbs provide forage (leafy material) as well as a seed source. Forbs also provide optimal cover for many small wildlife species, including young upland game birds and cottontails.

Plant Shrubs

General description

Shrubs provide cover and soft mast, depending on species, that benefit many wildlife species, some of which are found only in shrublands or shrub cover. In large open areas, planting blocks or multiple rows of shrubs is beneficial for those species requiring additional shrub cover for nesting, loafing, or escape. Fruiting shrubs are beneficial for many species and can be planted in fencerows, hedgerows, field or woods borders, odd areas (such as field corners and gullies), riparian areas, and any other areas where soft mast may be lacking. Establishing hedgerows of shrubs to break-up fields is beneficial, especially when planted adjacent to high-quality early successional cover or a good food source (such as grain field). Shrubs should be planted in winter while they are still dormant. Shrubs should **not** be planted in the woods where there is not adequate sunlight for growth and development. Where additional shrub cover is needed in forested areas, ***Forest Management*** should be recommended.

Shrubs may be planted to create riparian buffers along streams and ponds. Vegetated buffers are important to maintain streambank stability as the roots of the vegetation along the stream help hold the soil in place along the stream. Additionally, the aboveground vegetation in buffers filters sediment from water moving into the stream or pond after rainfall events. Riparian buffers also may provide cover and travel corridors for various wildlife species. Finally, buffers of vegetation, especially trees and shrubs, provide shade to keep stream water temperatures during summer lower, which may benefit cold-water fish species. The minimum recommended width for riparian buffers is 100 feet, but width may vary with size and order of a stream, as well as topography and landowner objectives.

Effect on habitat

- Can provide additional food and cover for many wildlife species in areas where specific species of shrubs are lacking.
- Shrubs are an important component of travel corridors, which allow wildlife to move safely across open fields between two areas of cover.
- Establishing hedgerows with shrubs may be used to increase interspersion of cover types and create smaller fields in proximity that can be managed differently to meet the various food and cover requirements for different wildlife species.
- Shrub plantings may be useful in some urban settings where desirable cover or soft mast is lacking.
- Shrubs planted to develop a riparian buffer may reduce erosion and sedimentation.

Craig Harper

Shrub plantings, such as this hawthorn, provide nesting cover, escape cover, and an important source of soft mast.

Plant Trees

General description

Trees are planted to provide food (hard or soft mast) and cover for many wildlife species. Trees should be planted in winter while they are dormant. Planting a mixture of species is usually recommended when mast production is the objective. Planting a mixture reduces the chances of a mast failure in any given year. Ecoegion, site, and landowner objectives help determine which species are planted. Examples of hard mast producers that are important for wildlife include oaks, hickories, American beech, and pecan. Examples of soft mast producers that are important for wildlife include persimmon, black cherry, mulberry, apple, and pear.

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NOTE: It may not be appropriate to plant trees in some areas. Some species of wildlife, such as prairie-chickens avoid trees. Thus, in prairies that were historically treeless, planting trees is detrimental to some grassland species of wildlife.

Effect on habitat

- Provides hard or soft mast production, depending on the species planted.
- Large areas can be planted for afforestation (planting trees for a forest where there is currently no forest).
- Provides additional nesting, perching, denning, and roosting sites.
- Trees planted to develop a riparian buffer may reduce erosion and sedimentation.


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David Mercker

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Hardwoods are most often regenerated naturally. That is, after harvesting, they grow back naturally from stump and root sprouts and seed. However, when afforestation is desired on large open areas with few to no trees, planting is the best method to ensure desirable species composition. Here, a large field that was in agricultural production for decades was planted to bottomland hardwood species.

Repair Spillway/Levee

General description

Low water levels can cause significant problems in ponds and impounded wetlands. Improperly constructed or damaged spillways can lead to excessive dam or levee erosion and excessive aquatic vegetation along fish pond margins. The spillway should be repaired if it is eroding or otherwise damaged, keeping the pond or impounded wetland level too low and increasing the chance of the dam eroding during heavy rains. In special cases, leaks around the spillway or levee structure can be stopped with the addition of special clays or plastic liners.

Trees should not be allowed to grow on dams or levees because tree roots can fracture the dam and eventually cause it to leak and break. However, if there is a large, mature tree on a dam, and the dam is not leaking, it should be left alone. Killing or felling the tree will cause the roots to rot and decay and thereby create airspace, which will more likely lead to the dam leaking or breaking. Thus, it is important to not allow trees to become established on dams, and it is important to kill or remove smaller trees (<10 inches diameter at breast height) before their root systems grow large.

Effect on habitat

- Eliminates erosion and sedimentation from spillway/levee
- Enables pond or impounded wetland to fill to appropriate level
- Precludes vegetation from establishing around the inside perimeter of a fish pond


Craig Harper

Tree roots can cause dams to fracture, leak, and eventually break.


Billy Higginbotham

This fish pond dam will likely have problems with leakage (if not already) and breakage if the trees are not killed or removed.

Set-back Succession

General description

Succession is the orderly and predictable series of changes in plant species composition through time and occurs in all natural communities. Habitat for many wildlife species is managed by setting back succession in an effort to retain the successional stage(s) beneficial for focal wildlife species. The three primary techniques used by wildlife managers to set-back succession are **fire**, **mechanical applications, and herbicide applications**. Each of these may be applicable for setting back succession in any ecoregion for various wildlife species, but they may not produce the same effect. One or more may be recommended over another depending on the situation. In some cases, more than one technique may be applied. The recommended technique for setting back succession should be specified and reasons given as to why a particular technique was recommended in the written management plan and oral reasons.

Grazing livestock also arrest or set-back succession. However, wildlife managers do not typically use livestock to set-back succession, but may recommend a stocking rate to livestock producers who are interested in wildlife. For the purposes of this program, ***Livestock Management*** is included as a separate WMP because livestock often need to be excluded from an area when managing for many wildlife species. Thus, there are just as many applications for ***Livestock Management*** to advance succession as there are to set-back succession.

Prescribed Fire

Prescribed fire is often the most effective and efficient method for managing succession and maintaining early successional plant communities. Prescribed fire can be used in fields, openings, grasslands, savannas, woodlands, and forests. Intensity, timing, and frequency of fire strongly influence vegetation composition and structure. High-intensity fires and burning in late summer and early fall tend to reduce woody composition more than low-intensity fires or burning in winter or spring. Low-intensity fire is recommended when burning a forest understory if damaging trees is undesirable. Like other methods, fire sets back succession temporarily. With the exception of intense fire, frequent burning over time, will change vegetation composition more so than less frequent burning. For example, if an area is burned every 2 years, annual and perennial herbaceous vegetation will be promoted. Where there is adequate rainfall, if that same area is burned every 5 years, considerable tree and shrub cover will be present. If burned every 10 years, the site will be dominated by trees and shrubs. Intensity and timing of fire dictate whether woody species are killed or if only the leaf litter is consumed.

Although a very beneficial practice, prescribed burning is not possible in all locations. Sites in close proximity to urban areas, hospitals, or busy roadways may not be suitable for burning because of safety and smoke management concerns. **Burning should be conducted only when danger of wildfire is low (when the wind, temperature, and humidity allow a controlled burn) and should be conducted under the close supervision of forestry or wildlife professionals experienced with using prescribed fire.** Where fire can be used, it is highly recommended over mowing or mulching to set-back or maintain succession.

Effect on Habitat

- Sets back the successional process by killing existing cover and stimulating fresh plant growth.
- Burning during the dormant season does not significantly alter vegetation composition unless fire intensity is high. Small woody stems may be top-killed, but usually resprout. Burning during the growing season and particularly the latter part of the growing season may more effectively kill small trees and shrubs and thus encourage more herbaceous cover.
- Burning early successional cover provides an open structure at ground level the following growing season, which is desirable for several small wildlife species, including young upland game birds. An open structure at ground level facilitates mobility and foraging under a canopy of native grasses and forbs.
- Consumes litter layer and understory fuels (such as dead leaves and grass), which reduces chance of wildfire and enables the seedbank to germinate.
- Improves seed and invertebrate availability for many species.
- Scarifies (breaks down outside coating) some seeds so they can germinate.
- May release nutrients (from ashes) into the soil.

Craig Harper

Prescribed fire is the desired method for setting back succession and manipulating the composition and structure of the understory or groundcover in forests, woodlands, and savannas where fire historically occurred. Fire intensity, fire frequency, and season of burning strongly influence the effect of fire on the vegetation community.

Mechanical applications

Disking

Disking sets back succession by mixing the upper soil layer and incorporating organic material into the soil, facilitating decomposition, and stimulating the seedbank. **This soil disturbance technique sets succession back to the earliest seral stage that will occur on a given site**. Disking is a relatively inexpensive and effective practice for exposing bare ground and promoting annual grasses and forbs from the seedbank in the growing season following disturbance. Disking reduces coverage of perennial grasses and forbs and brambles for a short time and promotes more annual species. Disking is usually conducted every few years to maintain annual and perennial forbs and grasses. Disking is most often implemented in fields or open areas, but also can be done in-between rows of planted pines to encourage herbaceous groundcover. Similar to controlled burning, timing of disking and disking intensity influence vegetation composition and structure.

NOTE: When using prescribed fire, firebreaks are commonly maintained by disking; however, ***Disking*** should not be recommended as a WMP to facilitate burning. Also, ***Disking*** should not be recommended to control nonnative grasses (such as tall fescue and bermudagrass). Instead, ***Control Nonnative Invasive Vegetation*** should be recommended to control nonnative invasive species.

Effect on habitat

- Maintains an early successional plant community dominated by grasses and forbs.
- Promotes fresh herbaceous growth and enhances forage and seed availability for many wildlife species.
- Sets back succession where perennial grasses and forbs, brambles, and woody species dominate the plant community.

Craig Harper

Disking sets back succession, facilitates decomposition, provides bare ground, and stimulates the seedbank, encouraging early successional species.

Chainsawing

A chainsaw or fellerbuncher may be used to kill or remove trees where trees are not desired for the focal wildlife species or where additional areas of early successional cover are desired. Trees not removed may be killed and left standing by girdling the tree and spraying an herbicide solution in the wound. Stumps of felled trees may be sprayed to prevent sprouting. However, even with herbicide treatment following cutting or girdling, woody sprouts often dominate the site after felling trees. ***Root-plowing*** with a bulldozer (see section below) after tree removal helps prevent

woody sprouting and ensure more herbaceous groundcover as opposed to sprouts and saplings of woody species.

NOTE: Implementing this practice implies the intention is to increase and maintain an earlier successional community, not a forest. Thus, ***Forest Management*** should not be recommended to set-back succession and maintain an early successional community. ***Forest Management*** should be recommended to manage and maintain a forest, either through ***Forest Regeneration*** or ***Timber Stand Improvement*** practices. Indeed, herbaceous cover (such as native grasses and forbs) is stimulated when trees are cut and seed from the seedbank germinates. However, the herbaceous community will be short-lived and woody species will dominate the site (especially on hardwood-dominated sites) unless tree removal is followed with additional treatment. Root-plowing following removal of hardwood trees significantly reduces woody sprouting. Periodic prescribed fire, additional mechanical disturbance (such as disking), or herbicide treatment then will be necessary to maintain an early successional community. ***Plant Native Grasses and Forbs*** should not be recommended when using ***Chainsawing*** or another mechanical method to reduce tree cover and increase early successional vegetation because herbaceous groundcover should establish naturally from the seedbank after tree removal.
NOTE: do not also recommend ***Create Snags*** when killing trees in an effort to increase early successional cover
NOTE: do not also recommend ***Herbicide Applications*** to spray girdled trees or tree stumps.

Effect on habitat

- Reduces tree density and encourages earlier successional plant communities.

Craig Harper

Chainsawing can be used to increase early successional cover in wooded areas. On this property, trees were cut, not harvested, and the site has been burned every 2 years to maintain early succession. Nothing was planted. A forest was converted to an early successional plant community.

Drum-chopping/Chaining/Root-plowing

All three of these techniques involve large equipment and are implemented to reduce woody cover and stimulate more herbaceous cover. They are typically used where shrubs and trees have grown too large for a rotary mower and where prescribed fire may not be applicable.

Drum-chopping (or roller-chopping) involves a bulldozer pulling a large drum (or roller) with sharp metal blades to knock down and chop large shrubs and small trees. It is a fairly common technique for managing brush cover in arid ecoregions, such as **Prairie Brushland** in south Texas.

Drum-chopping effectively reduces the size of brush and generally increases herbaceous growth. However, chopped brush usually resprouts (depending on species), and stem density of brush can actually be greater (but smaller size) following treatment.

Chaining involves pulling a very large chain strung between two bulldozers running parallel to each other (50 to 100 feet apart) to knock down shrubs and small trees. Brush is knocked over in the first pass, then a second pass in the opposite direction uproots the brush.

Root-plowing involves a bulldozer with a rear-mounted blade that cuts tree and shrub roots and brings them to the soil surface, which significantly reduces sprouting. This technique is often used in brush country, such as south Texas, but also can be used in forested areas of the eastern U.S. following tree removal where the intent is to convert a forested area to an early successional plant community. Root-plowing facilitates this process by reducing sprouting of woody species. In arid ecoregions, it may be several years before brush species re-establish following root-plowing.

Effect on habitat

- Sets-back succession by reducing dominance of small trees and shrubs, and promotes grasses, forbs, and brambles.
- Promotes more open structure.
- Forage availability and quality may be increased.
- Soft mast and seed production may be increased.
- Woody species usually resprout following drum-chopping, which can be used to maintain a certain height and amount of brush cover.

Craig Harper

Drum-chopping can be used to set back succession where shrubs and trees have gotten too large to allow disking or mowing and where the application of prescribed fire is not an option.

Mark Bartoskewitz

Chaining is often used in shrub country to reduce woody cover and increase herbaceous cover.

Mowing/Mulching

Mowing is most often accomplished with a large rotary mower mounted behind a tractor. Much less often, a mulching machine is used to reduce large shrubs and small trees to chips. To avoid disrupting nesting birds and destroying nesting cover or winter cover, mowing should not be conducted until late winter or early spring. When mowing is the only option for setting back succession, it should be conducted when it is apparent that undesirable woody species are encroaching in the field. In other words, mowing fields of grass is unnecessary. Mowing and mulching are not the best techniques for setting back succession because they promote a deep thatch layer that creates undesirable conditions at ground level for young game birds and ground-feeding songbirds. A thatch layer also limits germination of the seedbank and can reduce plant diversity. When possible, prescribed burning, disking, or herbicide applications should be used to set-back succession instead of mowing or mulching.

Effect on habitat

- Helps maintain perennial grasses and forbs and reduces height of encroaching woody species.
- Helps remove competition from various shrubs and small trees, allowing grasses and forbs to grow better. Maintains low brushy cover of various shrubs and small trees by encouraging resprouting.
- Can improve and maintain nesting cover for some bird species if conducted outside the nesting season.
- Causes thatch build-up, which reduces availability of invertebrates and seed to young quail, grouse, wild turkeys, and other ground-feeding birds. Thatch build-up also reduces the ability of these animals to move through the field and suppresses the seedbank, which can lead to decreased vegetation diversity.

Craig Harper

Mowing, or "bushhogging," sets back succession. However, accumulation of thatch provides undesirable conditions for many wildlife species and limits germination of the seedbank. Mowing is not a desirable practice to set-back succession, and should be used only when more desirable methods are not possible.

Herbicide Applications

Herbicide applications can be used to set-back succession and kill selected plants. Applications can be made to individual plants or broadcast over an area. There are many different types of herbicides available. The herbicides used in natural resources management are environmentally safe. Many herbicides are "selective" in that they only kill specific plants, not all plants. Thus, in many cases, selective herbicides can be used to remove specific undesirable plants from an area (such as small

trees in a field) and leave desirable plants. Herbicide applications thus can be used to adjust plant species composition in an area (such as a field or thinned pines) and improve habitat for many wildlife species.

NOTE: this practice is intended to set-back succession, not specifically to control nonnative species. Although herbicide applications are often used to control nonnative species, ***Control Nonnative Invasive Species*** should be recommended for that purpose.

Effect on habitat

- In some open areas, encroachment of hardwood trees reduces vegetative diversity and limits many plants important for wildlife. Proper herbicide applications control unwanted woody growth and encourage more herbaceous groundcover.
- Can be used to maintain grasses, forbs, and shrub cover, and thus increase foods and enhance cover for some wildlife species.
- Can be used to prevent unwanted hardwood growth in pine stands, particularly those that have been thinned to allow increased sunlight to reach the ground and stimulate herbaceous plants.


Craig Harper

Herbicide applications can be used to set-back succession. Selective herbicide applications, as shown here, can be used instead of mowing and help transition plant species composition toward more favorable species by killing undesirable species.

Tillage Management

General description

Tilling cropland can be delayed from fall until early summer to allow wildlife access to waste grain and to allow wildlife to use standing stubble and fallow vegetation for nesting. When fall tillage is necessary, inversion tillage (such as mold-board plowing, which turns soil over and covers crop residue) should be avoided. Instead, implements such as chisel plows that do not turn the soil over should be used. No-till agriculture would be recommended over any tillage method.

NOTE: This practice should be recommended only if a grain crop is present.

Effect of practice

- Increases supply of waste grain, which is eaten by many wildlife species, and may increase nesting success.

Craig Harper

Delaying tillage from fall into spring allows wildlife access to waste grain from harvested crops through winter.

Water Control Structures

General description

Various structures made of concrete, metal, or wood are used to control the water level in ponds and impounded wetlands. They are usually placed within a dam or dike. This practice should be recommended when inadequate or no structure is present on an existing dam or dike. This practice can also be used to control the water level of beaver ponds. A Clemson Beaver Pond Leveler can be placed through the beaver dam, restricting the pond level from exceeding a desired height and helping prevent flooding into undesirable areas, such as crop fields, roads, woods, etc.

Craig Harper

Water control structures allow manipulation of the water level in ponds and areas flooded for wildlife using a dike or levee.

Effect on habitat

- Allows ponds to be drained for managing water quality and control of unwanted fish.
- Allows management of water levels to increase or decrease the amount and type of aquatic vegetation in ponds and wetlands.
- Useful for creating a desirable mix (interspersion) of open water and emergent aquatic vegetation in wetlands.
- Can be used to create shallow water areas.
- Can be used to control water levels in flooded timber, drawing water down to prevent tree mortality.

Water Developments for Wildlife

General description

Water is a critical habitat component. Some wildlife species obtain necessary water from their diet, whereas others require free-standing water for drinking or for aquatic habitat (they live in water). Many species require a water source for obtaining food, reproduction, loafing, or escaping predators. Developing a source of water is a critical consideration for many wildlife species when little or no water is available. There are several ways to make water available to wildlife.

Small ponds can be created with backhoes or bulldozers. These are usually designed to collect water from runoff and/or precipitation, but may be created where there is an existing spring or seep, which facilitates water collection and helps ensure a reliable water supply. Side slopes for these ponds should be gentle to provide easy access for wildlife.
NOTE: these ponds are designed for various wildlife species, not fish.

Shallow impoundments may be created by constructing earthen dikes to retain water (usually run-off water from precipitation) in natural drainage areas. Placement of the dike is critical to avoid damage from floods and to collect sufficient water. When recommending shallow impoundments for waterfowl, bottomland areas (including grain fields and mature bottomland hardwoods) and existing wetlands should be considered for flooding. A water-control device in the dike allows the water level to be manipulated. Water can be removed from the field or woods prior to spring (similar to draining the water out of a bathtub) so the field can be planted again or so the trees will not die.
NOTE: When this practice is recommended, it is assumed an adequate water control structure will be included and should **not** be an additional recommendation.

Guzzlers and windmills are also used to provide water. Guzzlers are built by covering an area with an apron of fiberglass or some other material that sheds rain. Water is collected in a storage tank and slowly released into a trough from which wildlife can drink.

Small backyard ponds can be constructed in suburban backyards to provide water for a variety of wildlife. **Birdbaths** are also useful for providing water in Urban settings.

NOTE: ***Water Developments for Wildlife*** can be recommended when an additional water source is needed or when an existing water development for wildlife is essentially not functioning because it is in need of repair.

Craig Harper

Small ponds can be created where water is relatively scarce to provide water and habitat for several wildlife species.

Craig Harper

Shallow impoundments can provide excellent habitat for migrating and wintering waterfowl and other wildlife species.

Effect on habitat

- Can provide drinking water and wetland habitat.
- Grain fields or mature bottomland hardwoods flooded in fall/winter can provide important migrating and wintering areas with abundant food resources for waterfowl.
- Temporary flooding can improve existing open wetlands for nesting and brooding for some waterfowl, such as blue-winged teal and northern pintail.
- Temporary flooding can improve wooded and brushy areas for nesting and brooding wood ducks.
- Can provide a source of prey for many predators.

Craig Harper

Windmills are often used in the western U.S. to provide a water source for many wildlife species.

Population Management Practices

Decrease Harvest

General description

Regulated hunting, trapping and fishing regulations are primary tools used to manage many wildlife and fish species. State and federal wildlife agencies set regulations for hunting, trapping, and fishing seasons and bag and creel limits. Landowners can choose to take the maximum allowed or less than that, depending on local populations and personal management objectives.

Game birds and mammals

Decreasing harvest may be necessary when harvest data or observation data indicate populations are declining, especially in areas with good habitat. However, harvest through hunting and trapping are seldom the reason for declining wildlife populations. Rather, habitat quality is usually the reason for low or declining populations. If food, cover, water, or space is limiting, populations may remain low or decline. Appropriate habitat management practices should enhance habitat and allow populations to stabilize or increase.

Disease and, less often, unsustainable mortality from predation are other reasons for low or declining populations. If populations are low or declining because of predation, it is likely related to habitat (poor-quality cover) or possibly an abnormally high predator population. In this scenario, habitat management and possibly a reduction in the predator population can address low or declining game bird or mammal populations. Possible examples, though relatively rare, include abnormally high predation rates on deer fawns by coyotes or abnormally high predation rates on wild turkey eggs and poults from raccoons.

NOTE: ***Decrease Harvest*** is not an option for migratory species, such as waterfowl and mourning dove, because bag limits are set by the U.S. Fish and Wildlife Service and individual landowners cannot influence population levels of migratory species.

Largemouth bass/bluegill

Balanced Bass/Bluegill Populations

Documented via Seine Sampling: Young largemouth bass present. Many newly-hatched bluegills and some intermediate (3-5 inches) bluegill present.

Documented via Angler Sampling: Percentage Size Distributions (PSDs) – Between 40 percent and 70 percent of 8 inch or larger largemouth bass caught are also at least 12 inches long and 40 percent to 60 percent of 3 inch or larger bluegill caught are also at least 6 inches long.

Decrease Bass Harvest When:

Seine sampling reveals young bass may or may not be present, many intermediate bluegills in poor condition but no recent hatch of bluegills. If angling reveals few bass present but > 60 percent of the bass caught are at least 12 inches long while < 50 percent of bluegill are at least 6 inches long, return all bass.

Intended Result: The lack of bluegill reproduction and poor condition of intermediate bluegill suggests the bluegill population may be too high and food is a limiting factor. Reduce bass harvest (catch and release is ok) to increase predation pressure on intermediate-sized bluegills.

Decrease Bluegill Harvest When:
Seine sampling reveals no young bass present and many recently hatched bluegills but few intermediate bluegills present. If angling reveals < 20 percent of bass caught are at least 12 inches long and > 80 percent of bluegill are at least 6 inches long, return all bluegill.
Intended Result: Assess if other species of fish (such as green sunfish) may be competing with bluegill and if so, consider draining or renovating pond and restocking.

Cutthroat and Rainbow trout
Decrease trout harvest when seine and fishing records of a pond reveal that fish are in good condition or there are few medium and large fish and many small fish.

Coho salmon
A number of populations of Coho salmon in the southern portion of its range are in decline and have been listed as federally endangered or species of concern; therefore harvest is not allowed.

Increase Harvest

General description

Regulated hunting, trapping and fishing regulations are primary tools used to manage many wildlife and fish species. It is the responsibility of state and federal wildlife agencies to set hunting, trapping, and fishing seasons and bag and creel limits. Landowners can choose to take the maximum allowed or less than that, depending on local populations and personal management objectives.

Game birds and mammals

Increased harvest of game birds and mammals may be needed when animals show signs of stress and overpopulation, such as destruction of habitat by overgrazing or overbrowsing, poor body condition and weight loss, low reproductive rate, and increase in prevalence of parasites and diseases. Regulated hunting and trapping is the most effective and efficient practice to remove surplus animals and keep wildlife populations in balance with available habitat. When scientific data indicate animals are above carrying capacity, it is often necessary to increase harvest. Increased harvest through regulated hunting or trapping also can be used to reduce numbers of a particular game species if that species is causing damage to another species. Examples may include increased harvest of raccoon if they are limiting wild turkey recruitment, increased harvest of coyotes if they are limiting white-tailed deer recruitment, or increased harvest of white-tailed deer if they are degrading habitat for various forest songbirds. See **NOTE** under ***Wildlife Damage Management Techniques*** on page 296 for discussion on determining whether to recommend ***Increase Harvest*** or ***Wildlife Damage Management Techniques***.

NOTE: ***Increase Harvest*** is not an option for migratory species, such as waterfowl and mourning dove, because bag limits are set by the U.S. Fish and Wildlife Service and individual landowners cannot influence population levels of migratory species.

Craig Harper

Increased harvest may be necessary where populations approach or exceed carrying capacity of the area being managed. When population reduction for white-tailed deer is necessary, the harvest should concentrate on females which will reduce animal numbers and can adjust the sex ratio.

Largemouth bass/bluegill

Balanced Bass/Bluegill Populations
Documented via Seine Sampling: Young largemouth bass present. Many newly-hatched bluegills and some intermediate (3-5 inches) bluegill present.
Documented via Angler Sampling: Percentage Size Distributions (PSDs) – Between 40 percent and 70 percent of 8 inch or larger largemouth bass caught are also at least 12 inches long and 40 percent to 60 percent of 3 inch or larger bluegill caught are also at least 6 inches long.

Increase bass harvest when:
Seine sampling reveals young bass may or may not be present while there are many recently hatched bluegills but few or no intermediate bluegills. If angling reveals < 20 percent of the bass caught are at least 12 inches long and in poor condition while > 50 percent of bluegill are at least 6 inches long, increase harvest of bass < 12 inches beginning with 10-20 per surface acre per year).
Intended result: The increase in bass harvest will reduce competition for food among small bass and allow the remaining small bass to grow more quickly making more of the forage resource available to them (bass can only swallow bluegill about one-third of their length, for example, a 12-inch-long bass can only consume bluegill < 4 inches long). **NOTE**: This existing pond scenario is desirable if the pond owner is willing to sacrifice bass size for a primary goal of producing large bluegill.

Increase bluegill harvest when:
Seine sampling reveals no recently hatched bluegills but many intermediate bluegills in poor condition present. If angling reveals 20 percent to 60 percent of bass caught are at least 12 inches long but < 50 percent of bluegill are at least 6 inches long, increase intermediate bluegill harvest by angling, seining and/or shoreline rotenone application.
Intended Result: Increased bluegill harvest should decrease competition for food among intermediate bluegill. Make sure excessive turbidity (visibility <15 inches) or weed growth (> 50 percent coverage of the pond) is not limiting largemouth bass access to bluegill.

Cutthroat and Rainbow trout
Needed when seine of angler harvest records reveal many small fish and in poor condition. In many areas, extremely cold water reduces trout growth. In these situations, increased harvest may not be beneficial.

Coho salmon
Coho salmon populations in Alaska remain robust and support thriving commercial and recreational fisheries. Harvest can be increased based on state and federal statutes when population estimates trend upward for these Alaskan populations.

Wildlife or Fish Survey

General description

Wildlife surveys

Monitoring trends of wildlife populations and physical attributes (such as body weight) is important for wildlife managers. Data on various species are routinely collected by wildlife biologists using observation counts, roadside counts, call counts, point counts, check-in stations, infrared-triggered cameras, transects, questionnaires, and other techniques. These data are used to prescribe future harvest or land management strategies.

Wildlife Survey Techniques

***Observation counts*:** species and number of animals are recorded as they are seen. Counts may be made while conducting other activities or during official observations, such as counting ducks on a wetland

***Roadside counts*:** usually involve driving a predetermined route and counting the number of individuals of a species while driving the route

***Call counts*:** recording the number of individuals or groups (such as a northern bobwhite covey) of a species while waiting and listening at a specific location

***Point counts*:** recording the numbers of a species observed or heard at specific, predetermined points along a transect

***Check-in station*:** data are collected from game animals when hunters bring the animals to an official check-in station, which may be at various places, such as a Wildlife Management Area or local country store

***Infrared-triggered cameras*:** "trail" cameras are placed in areas where animals frequent and the pictures are used to estimate population density, sex ratio, age structure, etc.

***Transects*:** predetermined routes are used to collect observation data, point counts, dropping ("pellet") counts, call counts, etc.

***Questionnaires*:** groups of people, such as hunters or school bus drivers, are asked about their observations of animals

Fish surveys

Pond balance should be checked during early summer by seining at intervals around the pond. Balance is determined by comparing age groups, condition, and numbers of bass and bluegill caught in the seine during the summer months, and from year-round angler catch records. Recent young-of-the-year fingerlings of both bass and bluegill collected in the seine indicate the fish population is balanced (see ***Decrease Harvest*** and ***Increase Harvest*** sections under WMPs for more information). Angler catch records should be used to record the numbers, total lengths, and weights (fish caught in the fall only) of all bass and bluegill harvested. Fish caught by hook-and-line can be evaluated on body condition or Relative Weight (fat, skinny, size of head in relation to body) and population size structures based on Percentage Size Distributions. Trout do not often reproduce in ponds, so overall health of the fish is used as an indicator of pond balance. Unwanted species (such as bullheads and crappie) also may be caught in the seine or when fishing, indicating the fish population may be killed (with Rotenone) or drained.

Seining is usually not effective for collecting fish in streams. Fish in streams are usually collected by electro-shocking or by fishing. Electro-shocking involves running a small electrical current between two conducting rods, which are moved up and down the stream. Stunned fish float to the

surface and the age, condition, and numbers are recorded to determine stream balance. The fish are then returned to the stream.

NOTE: Although information from wildlife and fish surveys is always important, surveys should not be recommended if information is provided by contest organizers that indicate a survey has been completed recently.


Craig Harper

Infrared-triggered cameras are a great tool to survey populations of several wildlife species.

Wildlife Damage Management Techniques

General description

Wildlife managers often have to manage wildlife to control damage. Wildlife damage management is most common in urban and suburban areas where wildlife and humans frequently interact. Examples of wildlife damage include woodpeckers hammering on the side of the house; bats or squirrels in the attic; snakes in the house; deer eating ornamental plants in the yard or depredating soybean crops; bobcats, coyotes, and owls preying on livestock or pets; rabbits and raccoons eating vegetable gardens; beavers killing trees or flooding crops and roads; red-winged blackbirds eating crops; bird strikes at airports; rock pigeons defecating on buildings; starlings roosting in urban trees and defecating on sidewalks; and Canada geese loitering on lawns and golf courses.

Wildlife managers use both lethal and nonlethal methods to control these problems. Fencing and other exclusion devices, habitat modifications, harassment techniques, scare tactics (such as propane cannons, dogs), and taste and odor repellents are examples of nonlethal methods. Changing human activity also can be effective. For example, removing the dog food or bird feeder from the deck is the easiest way to keep raccoons, rodents, and other wildlife off the deck. Often, nonlethal methods do not work and lethal methods are required. Lethal methods are intended to kill wildlife quickly without suffering and may include body-gripping traps, trap-and-euthanize (put to death without pain or suffering), shooting, and poisoning. There are advantages and disadvantages to both lethal and nonlethal management methods.

One advantage of lethal methods is they can immediately decrease the numbers of animals in a population that are causing damage or health hazards, thereby immediately reducing the damage or hazard. In some cases, only one or a few animals are causing the problem, and lethal methods can then eliminate the damage once the individual(s) causing the damage is eliminated. Nonlethal methods typically cause the animals causing the problem to move to another location. Although nonlethal methods may reduce or eliminate the problem at one location, the animal(s) causing the

problem may relocate and cause the same problem at a different location. An advantage of nonlethal methods is they are generally accepted by the public better than lethal methods and they can be more easily used in areas with high human density. Education can help the public understand the efficacy and sensibility of many lethal methods.

Regardless of the method used, there are some general guidelines that can increase the success of a wildlife damage management program. It is important to identify the species causing the damage. An integrated wildlife damage management program that employees two or more methods is strongly recommended, especially when using nonlethal methods. It is imperative to know all the local, state, and federal laws related to the species causing the problem and the wildlife damage management method(s).

NOTE: For the purposes of this contest, it sometimes can be confusing when deciding whether to recommend ***Increase Harvest*** or ***Wildlife Damage Management Techniques***. If the problem is related to an overabundant population of a game bird or mammal and hunting or trapping is allowed on the property, ***Increased Harvest*** should be recommended. If the problem is related to a nongame animal, or if regulated hunting or trapping is not allowed on the property, or if control is necessary outside the regulated hunting and trapping seasons, or if the problem is related to one or a few individual animals (whether game or nongame), then ***Wildlife Damage Management Techniques*** would be the appropriate practice to recommend. For example, if cottontails are causing problems in a garden, control would be necessary outside the regulated hunting or trapping season (fall and winter). Thus, ***Wildlife Damage Management Techniques*** could be recommended during spring or summer when the problem is occurring. ***Wildlife Damage Management Techniques*** should be used to control nongame and nonnative species for which there is no hunting or trapping season, such as woodpeckers damaging a building or house sparrows outcompeting bluebirds.

Although not common, ***Wildlife Damage Management Techniques*** could also be required if increased harvest has not been effective. Situations can occur where local regulated hunting and trapping pressure is not able to effectively lower a population and professional wildlife damage management specialists are needed to address the situation. Examples may include population reduction for white-tailed deer, raccoon, coyote, and American beaver. The person in charge of the contest will give you clues as to which WMP (***Increase Harvest*** or ***Wildlife Damage Management Techniques***) would be most appropriate.

Craig Harper

House sparrows often displace bluebirds from nest boxes constructed for bluebirds. This invasive nonnative species should be removed whenever possible.

Dwayne Elmore

Netting can be used to protect crops, such as grapes and blueberries, from birds and other wildlife.

Jim Phillips

Coyotes play an important role as a predator. However, they can be problematic in various situations. Problems associated with livestock depredation are often a result of one or a few local individuals. Problems associated with limiting recruitment of other wildlife species, such as white-tailed deer, are more often a result of a dense coyote population. Sustained *Increased Harvest* can help lower coyote populations. *Wildlife Damage Management Techniques* are employed to target problem individuals. Regardless, trapping is usually the recommended technique for controlling coyotes.

Fish Pond and Stream Management Practices

Construct Fish Pond

General description

Fish ponds can be created using dams, dikes, and levees to provide relatively permanent water for fish. Pond design varies, depending on the purpose for constructing the pond and the ecoregion where it is constructed. Ponds with a high-shoreline length to surface-area ratio provide maximum access to the pond by anglers. The local Extension office or Natural Resource Conservation Service office can provide design details.

This practice should be recommended when creating new fish ponds with relatively permanent water. When constructing ponds, artificial reefs can be included for additional cover. These structures are usually constructed of rock piles, sections of plastic or cement pipe (a minimum of 6 inches in diameter and 18 inches long), and brush piles. Artificial reefs are normally recommended only for ponds larger than 10 surface acres.

NOTE: ***Restock Fish Pond*** should not be checked when ***Construct Fish Pond*** is recommended.

Effect on Habitat

- Ponds provide habitat for some fish and wildlife species.

NOTE: Although many wildlife species may use ponds for various reasons, this practice and the other ***Fish Pond*** practices are intended primarily for fish habitat. For the purposes of this contest, when additional water or wetland habitat is needed for wildlife species, ***Water Developments for Wildlife*** should be recommended. This distinction avoids management conflicts when both fish and wildlife species are managed on the same property. For example, steep-sloping sides help reduce aquatic vegetation and favor balanced fish populations, whereas gentle-sloping banks with abundant emergent aquatic vegetation benefit various wildlife species, such as American bittern or wood duck.

Control Aquatic Vegetation

General description

Aquatic vegetation should be controlled when it begins to limit use of a fish pond for recreation or interferes with access. As surface area coverage by vegetation exceeds 33-50 percent, the ability of predator species (such as largemouth bass) to access forage species (such as bluegill) may become reduced and therefore negatively impact the balance of the fish populations. Prevention of rooted aquatic vegetation growth can be accomplished two ways: 1) Deepening the edges of the pond to a minimum of two to three feet with steep side slopes, which minimizes shallow water areas exposed to sunlight. Pond edges can be deepened in drained ponds with a bulldozer or tractor with rear blade or in existing ponds with a backhoe. The soil removed can be piled on the bank or levee and smoothed for planting with native grasses and forbs, and 2) Initiating a spring-through-fall fertility program, which reduces light transmission and prevents rooted submerged plants from becoming established (see **Fertilize/Lime Fish Pond** for more information). Existing aquatic vegetation can be controlled chemically, biologically, or mechanically. Chemical control is accomplished by applying a labeled

aquatic herbicide following identification of the targeted plant species. Biological control is also plant species specific. Potential biological control agents for aquatic vegetation include fish species (such as white amur/grass carp, tilapia) and insects (such as salvinia weevil). Regulations as to which biological control agents may be used vary from state to state. Mechanical control includes physically removing existing vegetation by seining, dragging with chains or ropes, cutting, and raking.

Effect on habitat

- Reduces rooted aquatic vegetation within and around the edge of a pond, making prey more easily available to predator fish.


Billy Higginbotham

Filamentous algae and cattails must be controlled in this pond before fertilization is possible. Dense cattails can also provide cover for many small fish and lead to an imbalanced fish pond.

Fertilize/Lime Fish Pond

General description

Fish ponds can be fertilized to increase natural food organisms (phytoplankton and zooplankton) and prevent rooted aquatic weeds from becoming established. However, every pond should not be fertilized. Fertilization should **not** be used in ponds infested with weeds, ponds with excessive water flow, turbid (muddy) ponds, or ponds that will not be fished heavily. If ponds are infested with weeds, fertilization will only increase weed growth and spread. If ponds have excessive water flow, fertilization will be diluted. Suspended mud in ponds blocks sunlight, preventing an algae bloom. If ponds are not fished sufficiently, the fish population will become out of balance and growth will become stunted.

Fertilization is needed in fish ponds with water clear enough that you can see clearly to 18 inches below the water surface. Total alkalinity (the measured of total bases expressed as carbonates) and pH of the pond water should be tested before beginning a fertilization program. Total alkalinity should be at least 20 parts per million (ppm) with a pH of 6.5 to 9.0. Total alkalinity and pH can be assessed by collecting water samples; pH can also be measured by collecting samples of the pond bottom (substrate) and having them tested. Agricultural limestone (calcium carbonate) should be applied evenly over the pond surface area per recommended rate.

Fish ponds should be fertilized in the spring when the water temperature reaches 60 F. For ponds with moderate hardness (50 mg/l to 100 mg/l calcium hardness), apply 15 pounds of 12-52-4 (or

its equivalent) powder, or one gallon of 11-37-0 liquid fertilizer, or 15 pounds of granular 0-46-0 per acre at two-week intervals, or until a good green color (phytoplankton bloom) develops in the pond. Make additional fertilizer applications (at the same rate per surface acre) every three to four weeks, or when the water clears (becomes less green). Fertilization may be continued until water temperatures drop below 60 F in the fall. Methods for applying fertilizer vary with the type of fertilizer used. Granular fertilizer must be distributed from a fertilizer platform. Liquid fertilizer should be mixed with pond water and broadcast from a boat for large ponds or from the bank of small ponds. Water soluble powdered fertilizers can be broadcast from a boat or from the bank.

Effect on habitat

- Pond fertilization stimulates phytoplankton production, which is the first step in the food chain of a fish pond.

Reduce Turbidity in Fish Pond

General description

Turbid or muddy water limits fish production because natural food organisms need sunlight to grow. Turbidity can be caused by sediment being washed in from the pond banks or watershed, cattle using the pond, feeding activities of bottom-dwelling fish, such as carp or buffalo fish, or negatively charged clay particles suspended in the water column.

Turbidity is most often caused by sedimentation (erosion) from the watershed or the pond bottom (cattle or fish) and will usually clear in a relatively short period of time. Reducing erosion in the watershed is best accomplished by reseeding relatively large bare areas of soil around the pond where there is evidence of erosion. Turbidity from pond sediments can be controlled by restricting cattle to a small area of the pond and eliminating bottom-dwelling fish.

Turbidity from suspension of negatively charged clay particles is a more difficult problem. The addition of positively charged compounds, such as limestone, gypsum, or alum crystals, can cause the clay particles to settle.

Effect on habitat

- Improves water quality by removing or settling silt.
- Allows sunlight to stimulate phytoplankton.

Restock Fish Pond

General description

Restocking a pond is a drastic measure and should only be considered after other management approaches have been attempted. Ponds containing wild fish species, such as carp, shad, green sunfish or bullhead catfish, should be restocked with a balanced predator-prey combination. Restocking should be done only after all fish in the pond have been removed, either by draining or applying a fish toxicant. In warm-water ponds, bluegill fingerlings should be stocked in late fall and bass fingerlings are stocked the following June. Although various states have different stocking recommendations, typical stocking rates are 1,000 bluegill and 100 bass per surface acre if the pond is to be fertilized, or 500 bluegill and 50 bass per surface acre if the pond will not be fertilized.

Effect on habitat

- Draining ponds and using fish toxicants remove unbalanced fish populations and allow establishment of desirable balanced fish populations.

Streams: Create pools

General description

Pools and riffles are important habitat features for various fishes that inhabit streams. Stream flow varies with elevational change and width of channel. Stream flow is faster where there is more elevational change and tends to be slower where the stream channel is wider. Flowing water carries material, such as gravel, sediment, and debris, and redistributes them along the stream course. Where the stream is wider and the water flow is reduced, the material is deposited and forms riffles. Riffles are preferred areas for spawning for many fish species and some fish species occur primarily in riffles.

Topography restricts stream channels and causes a stream to bend. Where this occurs, pools are created. Pools are deeper than the stream channel and the water flow is slower. Pools provide areas for fish to feed and find refuge from fast-moving water that requires more energy for swimming. Some fish species occur primarily in pools.

Large boulders, rocks, or logs can be placed strategically in streams to create pools and enhance habitat for some fish species where there are considerably more riffles than pools and the amount of pools in the stream is limiting for a species. Rocks must be large enough so small floods will not move them. Any structures put in a stream have the potential to alter stream currents in an undesirable manner. It is important that fish have the ability to move freely between pools and riffles. The placement and design of such structures should be done with advice from experts. Although some species can complete their life cycle within a small portion of the stream, other species, such as salmon, must migrate to the ocean and return to the stream to spawn.

Effect on habitat

- Used to create pools for various fish to hide, feed, and rest.
- If designed properly, can be used to reduce some kinds of stream erosion.

Streams: Remove Fish Barriers

General description

Remove or replace culverts or large dams that prevent fish passage upstream. Culverts with great drops below them or with water flowing too fast through them can block fish from going upstream. These culverts can be replaced with arched or bottomless culverts or with bridges. In some cases, “fish ladders” or steplog structures can allow fish passage around barriers.

Effect on habitat

- Allow fish to access and migrate within the stream system and between the stream and ocean to complete their life cycles.

Activity II-A: Written Management Plan (125 Points)

The Written Management Plan is a team event where team members discuss, consider, and provide written recommendations that address current conditions and objectives regarding wildlife populations and habitat on a specified property. A written scenario describing the property, current conditions, and landowner objectives is provided to teams prior to starting the activity. Each team interprets the objectives, identifies the focal species, recommends WMPs and their intended impact, and states how the plan will be evaluated.

The "Judges' Scoring Sheet – Written Management Plan," shown below, details how plans are judged. All plans must be written using paragraph format. A sample management plan worksheet is provided below to help teams prepare for writing management plans.

Teams may use **one side** of each of three pieces of paper provided. Two of these sheets are for writing the plan, and the third sheet is for sketching a map of the property illustrating where practices should be implemented. An aerial photo of the area may be provided to assist with the sketch. The team number should be written on the blank back side of each sheet. Plans not written in the proper format or correctly identified will not be judged. Teams will have two hours to complete this activity.

Example of Written Plan Scenario
2013 National WHEP Written Plan Scenario
Atterbury Fish and Wildlife Area, Trafalgar, Indiana

The Atterbury Fish and Wildlife Area (AFWA) is 6,500 acres and was historically owned by the Department of Defense (DoD, Camp Atterbury) and is now managed by the Indiana Department of Natural Resources (IDNR). Historically, DoD leased fields to local producers for row-cropping, but there were no efforts to manage the area for wildlife. The IDNR has decided to manage particular sections of the property, including the one you are on, for species that use early successional stages, such as eastern cottontail and brown thrasher. The northern bobwhite has been identified as the focal species because bobwhite populations in the ecoregion have declined sharply over the past few decades; therefore, quail hunting has been suspended.

Funding for land management is a limitation. Thus, the IDNR has decided to continue to lease fields for row-cropping, specifically corn, soybeans, and wheat. The IDNR has calculated at least 50 percent of the area must be leased to provide sufficient income for management activities. AFWA is open for hunting. The IDNR foresees hunting opportunities for mourning dove and eastern cottontail, which are relatively common in the area.

The area you are considering is approximately 115 acres and includes 60 acres of soybeans. This section is bordered on the north side by a firebreak and a treeline, on the east side by a firebreak, on the south side by the road, and on the west side by a firebreak and woods.

Your task is to prepare a management plan that provides information and recommendations to meet IDNR's objectives and property limitations. You have 2 hours to complete your plan. This is a team activity. Prepare your plan on 2 sheets of paper, but write only on one side of each sheet. Sketch a map of the area including placement of your management recommendations on the third sheet. Include your **team ID number** on the back of each sheet. Do not write your name or the name of your state on the sheet. Good luck and have fun coming up with your recommendations!

Part I: Plan Background (10 Points)

What are the species to be managed and what are the management objectives?

The species to be managed include northern bobwhite, eastern cottontail, and brown thrasher. The management objectives are to manage the area for wildlife species that use early successional stages, particularly those listed above, and provide hunting opportunities.

Part II: Plan Development (40 Points)

Species Habitat requirements (20 Points)

Northern bobwhite use scattered patches of shrubby cover, well interspersed with native grasses, forbs, and bare ground. Areas dominated by forbs are commonly used for brooding cover. A variety of seeds, leaves, and insects are eaten.

Eastern cottontails require brushy cover interspersed with herbaceous openings. They eat forbs and grasses, bark of shrubs and young trees, buds, and browse.

Brown thrashers are found in shrub and bramble thickets, brushy hedgerows, young forests, and forest edges. They eat invertebrates and various seed found on the ground among the leaf litter. They usually nest in shrubs up to 10 feet aboveground.

Mourning dove use areas with annual and perennial grasses and forbs with considerable bare ground for feeding. They nest in shrubs and trees or on the ground. They commonly use agricultural fields for foraging. They require free-standing water daily.

Habitat Assessment (20 points)

The area under consideration is 115 acres and includes 2 fields of soybeans that have been planted via no-till agriculture that encompass 60 acres. There are field borders surrounding some portions of the soybean fields. There are 2 small woodlots with an open canopy of scattered trees and a dense brushy understory. The remainder of the area contains dense grass (tall fescue) with scattered forbs, brambles, and tree saplings. Brooding cover for northern bobwhite is limited because of a lack of mobility in the thick grass. Brushy cover used for escape and winter loafing by bobwhite is limiting. Cover for brown thrasher only exists in the 2 small woodlots. Cover for eastern cottontail is largely limited to the small woodlots. The tall fescue does not provide overhead cover. Winter cover will be severely limiting for all species after the soybeans are harvested. There is no free-standing water available.

Part III: Plan Implementation (40 Points)

Control Nonnative Invasive Species to reduce coverage of tall fescue and allow the seedbank to germinate, which will provide more food and better cover for all 4 species.
Field Borders should be established around portions of the soybean fields where there are none. This will increase usable space for northern bobwhite and eastern cottontail.
Leave Crop Unharvested will provide soybeans for northern bobwhite, mourning dove, and eastern cottontail into winter.
Plant Shrubs between sections of soybean fields that will be retained to provide a corridor connecting the two woodlots. This will increase usable space for northern bobwhite, eastern cottontail, and brown thrasher, and increase loafing and nesting cover for mourning dove.
Set-back Succession: Prescribed Fire will set-back and rejuvenate the understory in the woodlots and provide more forage for eastern cottontail and northern bobwhite.
Water Development for Wildlife (small pond) should be established to provide free-standing water for mourning doves.
Wildlife Survey should be conducted to monitor populations of all 4 species. Point counts may be used for mourning dove and brown thrasher, covey counts may be used for northern bobwhite, and observation counts and hunter harvest data can be used for eastern cottontail.

Part IV: Plan Evaluation (15 Points)

Wildlife survey data will be evaluated annually and tracked over time to estimate population trends. Hunter success and satisfaction will be accessed through surveys. Vegetation surveys will determine if additional treatment is needed to reduce tall fescue, evaluate success of shrub plantings, and evaluate habitat quality for all species.

Activity III: Wildlife Challenge (50 Points)

The ***Wildlife Challenge*** combines wildlife identification and general knowledge. Participants visit stations where they may be presented with a wildlife specimen and questions related to the species. Participants may be asked to identify an animal by specimen or portion of specimen, photo, animal sign, or sound. Alternatively, stations may be located outdoors and questions may be related to various habitat features. When identifying species in the Wildlife Challenge, the correct spelling and capitalization must be used in order to receive credit. Refer to **Index of Wildlife Species** beginning on page 86 for proper spelling and capitalization.

The objective of Activity III is to demonstrate knowledge of wildlife identification, ecoregions involved, wildlife management concepts, wildlife management terminology, wildlife management practices, and the biology and ecology of wildlife species. Questions for Activity III may be from information within ***Concepts and Terms***, ***Ecoregions***, ***Wildlife Species***, ***Wildlife Management Practices***, and the ***Glossary***.

Wildlife food items and questions pertaining to wildlife foods also may be included in the Wildlife Challenge. Appendix B provides definitions of various wildlife foods. Refer to species accounts to learn what various species eat.

Example questions for Wildlife Challenge:

Specimen at station is mounted scaled quail.
Name this species. (**scaled quail**)
Is hard mast included in the diet of this species? (**no**)

Specimen at station is a bobcat skull.
This species can be a significant source of mortality for which species?

a) white-tailed deer
b) ruffed grouse
c) wild turkey
d) eastern cottontail
e) northern bobwhite

Station is in the field along a recently disked firebreak.
What is the management feature you are standing in? (**firebreak**)
Which management practice does this feature facilitate? (**prescribed fire**)

Southeast Mixed and Outer Coastal Plain Forest	barred owl	loggerhead shrike	mourning dove	northern bobwhite	prothonotary warbler	red-cockaded woodpecker	red-eyed vireo	wild turkey	wood duck	coyote	eastern cottontail	eastern fox squirrel	raccoon	white-tailed deer	wild pig	eastern indigo snake	gopher tortoise	bluegill	largemouth bass
Habitat Management Practices																			
Conservation Easement																			
Control Nonnative Invasive Vegetation																			
Create Snags																			
Delay Crop Harvest																			
Edge Feathering																			
Field Borders																			
Forest Management																			
Leave Crop Unharvested																			
Livestock Management																			
Nesting Structures																			
Plant Food Plots																			
Plant Native Grasses and Forbs																			
Plant Shrubs																			
Plant Trees																			
Repair Spillway/Levee																			
Set-back Succession																			
Tillage Management																			
Water Control Structures																			
Water Developments for Wildlife																			
Population Management Practices																			
Decrease Harvest																			
Increase Harvest																			
Wildlife Damage Management																			
Wildlife or Fish Survey																			
Fish Pond/Stream Management Practices																			
Construct Fish Pond																			
Control Aquatic Vegetation																			
Fertilize/Lime Fish Pond																			
Reduce Turbidity in Fish Pond																			
Restock Fish Pond																			
Streams: Create Pools																			
Streams: Remove Fish Barriers																			

Appendix B. Definitions of Food Groups

Aquatic Plants: a plant that grows partly or wholly in water, whether rooted in the mud, or floating without anchorage; plants that require constantly moist conditions without standing water are included in this group; for the purpose of this contest, only examples from the following genera will be considered. algae of various genera; American lotus, *Nelumbo*; arrowhead/duck potato, *Saggitaria*; big duckweed, *Spirodela*; bladderworts, *Utricularia*; bulrushes, *Scirpus*; burreeds, *Sparganium*; cattails, *Typha*; coontail *Cerratophylum*; cordgrass, *Spartina*; duckweed, *Lemna*; floating hearts, *Nymphoides*; naiads, *Najas*; pondweed, *Potomageton*; rushes, *Juncus*; sedges, *Carex*; smartweed, *Polygonum*; spikerush, *Eleocharis*; waterlily, *Nymphaea*; watermeals, *Wolffia*; watermiloil, *Myriophyllum*; waterprimrose, *Ludwigia* and waterweed, *Elodea*
Bark: tough outer covering of trees and shrubs
Birds: may be represented by feathers, bones, skulls, feet or any part that distinguishes the class
Buds: a small protuberance on a stem or branch, sometimes enclosed in protective scales and containing an undeveloped shoot, leaf or flower; the bud may be represented on the branch or stem, or removed from the branch or stem
Carrion: stinking, rotting flesh; to be considered in this group, the item must have a definite odor of decomposition, be presented in a plastic bag or have the words "this stinks" on the display; a dry bone, a dry skin, or other body part does not represent carrion, but will represent other food groups; maggots are a natural occurrence with decomposition and may be present on the carrion, but they should not be considered in grouping the specimen as carrion
Centipedes and Millipedes: elongated arthropods having many body segments; millipedes have pairs of legs
Crayfish: small freshwater decapod crustacean that resembles a lobster; regionally, they have many names including crawdads and crawdaddys
Earthworms: terrestrial worm that burrows into and helps aerate soil; often surfaces when the ground is cool or wet; used as bait by those who fish
Eggs: only the eggs of vertebrate species (mammals, birds, reptiles, amphibians, fish) are considered in this category; invertebrate eggs (insect and spider) represent the group of the adult invertebrate
Ferns: flowerless, seedless vascular plants with roots, stems and fronds; reproduce by spores; may be represented by the whole plant or a part of the plant that defines it
Fish: a poikilothermic (cold-blooded) water-dwelling vertebrate with gills
Forbs: broad-leaved herbaceous plant, not including grasses, sedges, rushes or ferns; forbs may be represented by a single leaf or by the entire plant including the flower
Salamanders: may be represented by the organism in any life stage except the egg
Fruit and Berries: display must include the soft, fleshy, pulp-covered seed
Fungi: kingdom of plantlike spore-forming organisms that grow in irregular masses without roots, stems, leaves and that lack chlorophyll
Grains: will include only wheat, oats, rye, barley, rice and corn; may be represented by the seed, seed head or entire plant including the seedhead
Grass: leaves of grasses are usually tall and thin with a mid-rib and parallel veins; grasses may be represented by the entire plant including the seedhead, or by a single leaf or group of leaves
Hard mast: includes nuts from walnut, hickory, oak, beech, pecan, almond, and common hazel; may be shown with or without the husk
Insects: small invertebrate (*without a backbone*) animals, **except for** spiders, centipedes and millipedes, which are segmented
Leaves and Twigs: this food group is represented by leaves and/or twigs of woody species only; ***not*** forbs, grasses or other herbaceous plants
Lichens: a fungus that grows symbiotically with algae, resulting in a composite organism that characteristically forms a crust-like or branching growth on rocks or tree trunks; lichens may be shown with a rock or branch or without

Lizards: lizards are reptiles of the order Squamata, which they share with the snakes (Ophidians); they are usually four-legged, with external ear openings and movable eyelids
Mammals: any mammal regardless of size fits in this category; may be represented by a photograph, live animal, museum mount or any part of the mammal representative of the class, such as teeth or hair
Mussels: freshwater mollusks that may be represented by the whole organism or just a single shell or group of shells
Nectar from flowers: represented by the flower with no other plant parts present
Scorpions: arachnid having a long segmented tail ending in a venomous stinger
Seeds: a fertilized ovule containing an embryo, which forms a new plant upon germination
Snails: applies to most members of the molluscan class Gastropoda that have coiled shells
Snakes: cold-blooded legless reptiles, which share the order Squamata with lizards
Spiders: arachnid that usually has silk-spinning organs at the back end of the body; they spin silk to make cocoons for eggs or traps for prey
Tubers: represented by either the nutlet of the yellow nutsedge (chufa) or by potato
Turtle and Tortoise: animals with a special bony shell developed from their ribs; “turtle” is often used for aquatic species, but aquatic freshwater turtles are also often called “terrapins;” in North America, “turtle” is usually used to refer to all members of the order, including tortoises, which are predominantly land-based

Glossary

aerate: to supply or expose water with air to increase dissolved oxygen and release harmful gases
anadromous: behavioral term for fish that breed in fresh water, but mature in salt water, such as Coho salmon (see catadromous)
annual: when referring to plants, those that complete their life cycle from seed to mature seed-bearing plant in one growing season
arid: dry, receives little precipitation
basal area: space or area represented by tree stems at 4.5 feet above ground; for example, a basal area of 60 square feet per acre means that of 43,560 square feet of available space (1 acre), tree trunks represent 60 square feet of that space 4.5 feet above ground
broadleaf: a plant with wide blade leaves such as an oak or cottonwood. Seeds are born from flowering parts in contrast to conifers which bear seeds in cones
browse: *n*. leaves and ends of twigs of woody species; *v*. to eat browse
butte: a hill that rises abruptly from the surroundings; sides are steeply sloped or with cliffs, and the top is nearly flat.
cacti: plants adapted to dry conditions; often store water in leaves and other parts of the plant; usually have small leaves and thorns
canopy cover: the amount of ground covered by the branches, leaves and stems of plants; can specify as herbaceous, shrub, tree or all canopy cover; expressed as a percentage
carnivore: a meat-eating animal
carrying capacity: the maximum population that an area can sustain without causing some type of damage; usually related to food, cover, water, or space for a particular species (biological carrying capacity), but the term is sometimes applicable to cultural limitations for humans (see *Carrying Capacity* on page 23)
catadromous: behavioral term for fish that breed in salt water, but mature in fresh water (see anadromous)
coastal plain: large, nearly level areas of land near ocean shores
conifer: usually refers to needleleaf trees that bear seeds in cones; examples include spruces, pines and firs
corridor: a strip or block of cover that connects otherwise isolated areas for a particular wildlife species
cover: vegetation and other land features that provide areas for wildlife to hide, sleep, feed and reproduce
crepuscular: a behavioral term that describes primary activity near dawn and dusk
decadent: declining in health and/or productivity
deciduous: plants that shed their leaves annually
decomposer: organisms that reduce animal carcasses and waste and dead plant material into nutrients
decomposition: the natural breakdown and decay of dead plant and animal material
defecating: elimination of solid body waste by animals
detrimental: having harmful effects
dominant: the plant or animal species that is the most common in an area
drought: lack of normal precipitation for an extended period of time; long period with little or no rain
ecosystem: the plant community along with the animal community together with soil, air, water, and sunlight
ecotone: where two vegetation types or seral stages meet and blend gradually with characteristics of both communities represented
edge: where two vegetation types or seral stages meet
endangered species: a species in danger of becoming extinct
environment: the surroundings that affect the growth and development of an organism including other plants and animals, climate and location
ephemeral: temporary; often seasonal; not long lasting
evergreen: plants that do not lose all their leaves at one time, including some conifers, but also many broadleaf trees and shrubs such as live oak and American holly
excavate: to make a cavity or hole
exclusion: keeping something out of an area

fertile: usually referring to soil high in available nutrients
fingerling: a small fish, especially up to one year of age
fluctuate: to vary, or rise and fall irregularly
food chain: step by step passage of energy and nutrients through an ecosystem; for example, clover—deer—mountain lion
food web: a complex network of food chains
forage: *n*. refers to the vegetation eaten by animals; *v*. to search for food
forb: broad-leaved herbaceous plant
forest stand: a contiguous area of trees of similar species composition, age and structure that can managed as a unit
fragmentation: most often used in natural resources management to describe disruption of continuity of a vegetation or type community; for example, an interstate highway can cause fragmentation of a forest
glean: to gather food in a systematic manner
ground litter: dead and decaying organic matter found on the ground such as leaves, branches and dead plants
habitat: the physical and biological resources (food, cover, water) required by a species within an area of sufficient size (space) for that species
hardwoods: usually refers to non-coniferous trees bearing leaves
herbaceous plants: grasses, forbs, sedges, rushes and ferns; plants having soft rather than woody stems
herbicide: chemicals used to kill or control the growth of undesirable plants
herbivore: a plant-eating animal
home range: the area used by an animal; usually described as the area that encompasses the daily, seasonal, and annual movements of an animal
insecticide: chemicals used to control insects
insectivore: an insect-eating animal
interspersion: the mixing of vegetation types or successional stages; high interspersion represents a lot of mixing; low interspersion represents little mixing
invertebrates: animals lacking a backbone; examples include insects, spiders, mollusks and crustaceans
irrigate: to water through diversion ditches and pipes
juxtaposition: the arrangement of vegetation types or successional stages
keystone species: plant or animal species with a disproportionate influence in its community relative to its abundance
landscape: an area that represents several interacting ecosystems; usually regional in reference
legume: plants that bear seeds in a pod; examples include lespedezas, clovers, soybeans, peas and black locust
migration: usually used to describe the periodic movement to and from a breeding area; may also be used to explain other seasonal movements, such as altitudinal migration in elevation in response to snow cover and food availability
mortality: (compensatory and additive) – death of individuals (see *Compensatory and additive mortality* on page 24)
native: plant and animal species originating historically or migrating naturally to a particular ecoregion
nutrients: chemicals required for plants and animals to grow and exist
omnivore: an animal that eats both plant and animal material
perennial: plant species that grow from a root system that remains alive more than two years
phytoplankton: microscopic floating and suspended aquatic plants
plateau: an elevated, relatively level expanse of land; sometimes called tableland
point count: a census method commonly used to monitor relative abundance of songbirds
population: a group of individuals of the same species living in a given area that interact with each other
regenerate: to replace lost or damaged parts with new tissue
rejuvenate: to stimulate and return to good health and vigor
riparian: the area adjacent to and influenced by a water source such as a creek, stream, river, pond, lake, swamp or other wetland
savanna: an area with scattered trees maintained by fire and/or grazing

scarifies: breaking down the protective coating on various species of seed allowing the seed to germinate; often facilitated by fire or digestion
secluded: occurring in a remote or other area where visibility is obstructed or reduced
sedge: grass-like plant, often associated with moist areas and usually with triangular stems
seedbank: seed occurring naturally in the top few inches of soil
senescent: the growth stage in a plant or plant part (like a leaf) from full maturity to death; old age
sere: a series of successional stages at a particular site, leading to a mature, climax community
seral stage: a successional stage in a sere
silviculture: the process of tending and managing a forest
slash: residue left on the ground after trees are harvested
softwood: usually refers to coniferous trees, though some deciduous trees such as red maple and aspen also have relatively soft wood
species: a type of organism whose members can freely interbreed with each other and genetically are very similar; do not necessarily interact or located together
stagnant: sluggish; not producing to potential
stocking rate: amount of land allotted to each animal for the entire grazable portion of the year
subclimax: successional stage occurring prior to climax stage, but further development is inhibited by some factor(s) other than climate
succession: replacement of one vegetation type or seral stage by another
succulent: having thick fleshy leaves that conserve moisture
terrain: referring to topography
thatch: accumulation of dead grass and leaves on the ground
transitional: the process of changing from one form to another
vegetation type: a community or assemblage of plants commonly found in association with each other
woody: referring to trees and shrubs
zooplankton: microscopic animals that float/swim in water