Missouri Envirothon
Wildlife Resource Guide
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Before an individual can evaluate wildlife habitat and make management recommendations, some basic concepts about habitat and its relationship to different wildlife species should be understood. In this section, some of the basic concepts are described. Since most of the contest will be based on these concepts, it is important that you study and understand them.

Wildlife management is both an art and a science that deals with complex interactions in the environment. For the purposes of this program, a number of assumptions and simplifications have been made to make the materials more understandable. In actual management cases, trained, experienced professionals should assist you in making proper decisions to meet your goals and objectives.

Look up the definition of words or terms you do not understand in a dictionary or in the glossary found at the back of this handbook.

**Concepts**

Habitat Requirements  
Featured Species  
Species Richness  
Plant Succession and Its Effect on Wildlife  
Vertical Structure (Layering)  
Arrangement and Interspersion  
Edges and Contrast  
Area Sensitive Species  
Migration and Home Range  
Carrying Capacity  
Pond Dynamics and Balance  
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Food Webs
Concept 1

Habitat Requirements

Wildlife have life requirements that must be supplied by the habitat to ensure their well being. These are known as habitat requirements. The four basic habitat requirements are food, water, usable space, and cover (shelter). Each species has its own set of specific requirements. For example, the gray squirrel uses acorns for food, while the woodpecker eats insects. Mallards use thick grass and forb cover for nesting, while thrashers nest in shrubs. Habitat requirements for wildlife change during the seasons of the year. The food they eat in the winter may be much different than what is eaten in the summer. The cover they need for nesting may be much different than the cover needed for a winter storm.

Concept 2

Featured Species

There are two basic goals in wildlife habitat management. One is to provide the best habitat possible for featured wildlife species. The other, which is explained later in this handbook under the concept "Species Richness," is to provide habitat for as many different wildlife species as possible in an area.

When evaluating habitat for featured species, one must first decide which species are to be favored. This can be done in several ways. Landowners may have specific objectives for certain species, or the general public may have concerns about a particular game or endangered species. Once the species are selected, identify the habitat requirements for each species and evaluate the capability of the environment to provide the requirements. If the area is unable to supply or only partially provides the necessary habitat requirements, management practices may be used to improve the area’s ability to supply needed requirements.

It is usually best to select management practices that provide the habitat requirements that are most lacking and thus limiting the population. For instance, if a species requires trees for cover with water nearby and the habitat you are evaluating has plenty of trees but no water, a management practice that supplies water will improve the habitat more effectively than planting trees. When determining which management practices to apply, remember that management practices that improve habitat for some wildlife species may be detrimental to other wildlife species. It is impossible to manage habitat for any one species without influencing other species in some manner.
**Concept 3**

**Species Richness**

“Species richness” is the number of different kinds of wildlife species that are found in an area. One goal in wildlife habitat management may be to provide habitat for as many species and as many individuals within a species as possible, as contrasted to managing for a featured species (see Concept 2).

Lands that are high in species richness usually have many of the following characteristics:

1. **A mixture of areas in different successional stages**
2. **A balance of edges with unbroken blocks of vegetation in one successional stage**
3. **Unbroken (unfragmented) areas of at least 10 to 40 acres**
4. **Edges with low contrast**
5. **A wide variety of vegetation layers present within each area**

These characteristics can be used to estimate the relative number of different wildlife species that may be present in separate areas. They can also be used to identify management practices that could increase species richness. For example, consider an area that is in stage 6 of plant succession (see Concept 4). It has been proposed to harvest the trees by clear-cutting 1/2 of the area. Clearcuts of 40-acres that leave adjacent unharvested areas of 40 acres in size would be desirable. Strips or corridors of trees that link the larger unharvested areas together could be left uncut (see Wildlife Management Practice 6).

Remember, when managing habitat for species richness, often it is not possible to provide the best habitat for featured species. Instead of providing the best habitat possible for a few species, the goal is to provide some habitat for as many species as possible.
Concept 4

Plant Succession and Its Effect on Wildlife

Vegetation and water are the basis of habitat management. Every acre of soil and water has a definite sequence in plant cover that occurs over time. The different stages of this sequence are called successional stages. We can generally predict the type of vegetation that will occur in each stage until a final or “climax” stage is reached. When not disturbed, the climax vegetation will remain the same for long periods of time. If people or nature disturb the vegetation, soil, or water level, succession may be set back and the cycle will continue forward from the new starting point. Note that different wildlife species are often associated with the different stages of plant succession. Not all species require the climax stage.

In this handbook, areas in different stages of plant succession are often referred to as areas with different vegetation types or habitat types. In general, the stages of plant succession that occur on land are as follows:

1. Bare ground
2. Annual forbs and/or grasses
3. Perennial forbs and grasses
4. Shrubs
5. Young woodland or trees (less than 70 years old)
6. Mature woodland or trees

In some regions, natural factors such as the soil or the climate will prevent succession from proceeding past a certain stage. For instance, in the Great Plains Shortgrass Prairie Region, lack of precipitation often prevents succession from proceeding past stage 3. In this case, stage 3 would be considered the climax stage. Many wildlife species found in this region do not require trees.

Descriptions of typical successional stages found in different regions of the United States can be found in the Regions section of this handbook. A description of the typical successional stages occurring in relation to water can be found in the Wetland Region.
description. The stages of plant succession are illustrated below.

A single step in this succession may take weeks, months, years, or even centuries, depending on a variety of natural and human-caused factors. If vegetation is disturbed, succession will revert to an earlier stage and begin again. Disturbance can be caused by natural factors such as insect or disease outbreaks, tornadoes, hurricanes, avalanches, or fires. Some wildlife species require periodic disturbance.

However, succession is more frequently altered by humans through plowing (agriculture), burning, cutting of forests, grazing, and clearing shrubby areas, all of which may mimic natural disturbances in many cases.

Nature never gives up. Even abandoned concrete parking lots are eventually taken over by plants. Plants first grow in the cracks and around the edges, then if left alone, a concrete parking lot will eventually become “habitat” for some wildlife species.

**Concept 5**

**Vertical Structure (Layering)**

Vegetation can be classified by how it grows. Grasses and forbs generally grow close to the ground and make up the ground layer. The next higher level is usually composed of shrubs and is called the shrub layer. The tallest stratum is made by trees and is called the tree canopy.

How different layers of vegetation are arranged in relation to each other is important to many wildlife species. For instance, some species may require a herbaceous layer for food but also need a tree canopy for cover. Not all areas in a single stage of succession are alike. One woodland in stage 6 of succession may have a variety of layers comprised of grasses, forbs, shrubs, and trees, while another stage 6 woodland may have only one distinct layer of tall trees. The trees may be widely spaced or close together, with or
without a shrub layer.

**Concept 6**

**Arrangement and Interspersion**

How different successional stages or vegetation types are situated in relation to each other (for example, size, shape, distribution of habitats) is often referred to as horizontal arrangement. Many wildlife species need more than one successional stage to provide all their habitat requirements. To be of value to a wildlife species, the required successional stages must be close to each other or linked by corridors (see Wildlife Management Practice 6) to allow for safe travel. Some species obtain all their habitat requirements from only one successional stage. Managing for areas of different successional stages within a landscape is called “interspersion.” Usually, more interspersion supports a greater variety of wildlife. A way to measure interspersion is explained in the Activities section.

Fig. 1. Area with low interspersion
Concept 7

Edges and Contrast

The boundary where two or more types of vegetation or successional stages meet is called “edge.” Sometimes there is an abrupt change where one type of vegetation stops and another begins (see Figure 1), or the change can be less distinct, with a gradual transition from one stage to another (see Figure 2). In places where a gradual change occurs, an edge looks a little like both successional stages or vegetation types. Where abrupt changes occur, the edge is narrow. Edges attract many different wildlife species because the variety of food, cover, and other habitat requirements are arranged close together.

Fig. 1. Abrupt edge with high contrast
Edges that are produced when extremely different successional stages of vegetation meet are defined as having high contrast. There is high contrast where an area in stage 2 (annual forbs and grasses) meets an area in stage 6 (tall mature trees) of plant succession. A boundary between stages 2 and 3 has low contrast. Edges with low contrast may have more different species of wildlife than edges with high contrast. In general, edge may benefit wildlife species that have low mobility and do not require large areas. However, many landscapes already have sufficient edge. Creation of edge may even be detrimental to some wildlife species, particularly area sensitive species. Edges with low contrast will benefit those wildlife species that need an interspersion of several successional stages.

Fig. 2 Gradual edge with low contrast.
**Concept 8**

**Area Sensitive Species**

Edge is not beneficial for all wildlife. Some wildlife species need large, unbroken (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 of vegetation in one successional stage are desirable. A forest or rangeland in one successional stage that has at least 100 acres of unbroken (unfragmented) area is considered to be the minimum requirement for many area sensitive species. However, some species may require 1,000 acres or more at a minimum.

**Concept 9**

**Migration and Home Range**

Some wildlife travel during different seasons of the year and times of day. These movements are called “migration.” Migration distances may be short or very long depending on the species. This requires that necessary habitats are available along the route. For many species, corridors that provide areas for safe travel are very important during migration. Two examples of migration are:

1. Deep snow covers the vegetation used for food by mule deer and wapiti (elk) during the winter in the Subalpine Zone. To find food they travel to lower elevations (Intermountain Foothills or Intermountain Sagebrush Regions) where the snow is not as deep.

2. Ducks that nest in the northern United States must fly south to warmer climates to find food sources and wetlands that are not frozen during winter.

Other animals reside in the same area all year. The area of constant use is referred to as an animal's *home range*. For example, in average habitat a northern bobwhite spends most of its life on an area of approximately 80 acres. If the habitat requirements of a species are met in a smaller area (i.e., the habitat is better) in a given locale, then the home range would be smaller.
Concept 10

Carrying Capacity

There is a limit to how many animals can live in a habitat. That limit is called the habitat’s “carrying capacity.” The quantity and quality of food, water, cover, and space determines the carrying capacity. If one basic requirement is in short supply, the carrying capacity is lowered. By adding the missing ingredient, a manager can increase the habitat’s carrying capacity.

Carrying capacity varies from year to year and from season to season. It is usually greatest from late spring through fall. This is when most young are born and grow. With the coming of winter or summer drought, food and cover gradually diminish, as does the habitat’s carrying capacity.

More animals are produced each year than will survive to the next. Surplus animals are generally lost to starvation, disease, and/or predation. Young wildlife and animals in poor health experience the highest death rates. Harvesting of game or fish for human consumption is one way to utilize the surplus. The obvious way to increase the number of animals is to increase the number born and reduce the number that die. However, if the habitat cannot support any more animals, those efforts will fail.

A long-term increase in population can be accomplished only by increasing the habitat’s carrying capacity.
No two ponds are ever exactly alike. Even ponds located side-by-side and in the same watershed can look very different from one another and respond differently to management efforts. These visual differences are usually associated with water quality and algal bloom differences. Management efforts are meant to control water quality, improve fishing, and attract wildlife.

Dissolved oxygen, alkalinity, hardness, and pH are water quality factors that can be managed in ponds. Water quality affects the natural production of food in the pond and the health of the fish.

Oxygen dissolves in water from the atmosphere through the action of wind and waves or is produced by plants in the water in the process of photosynthesis. Oxygen is only slightly soluble in water and its solubility is dependent on water temperature (cooler water holds more dissolved oxygen). Dissolved oxygen is measured in parts per million (ppm). Ponds seldom have more than 10 or 12 ppm dissolved oxygen, even on sunny or windy days. Dissolved oxygen below 4 ppm is stressful to most warmwater fish species (like bass and bluegill), while 6 ppm is stressful to coldwater species (like trout). When dissolved oxygen is below 2 ppm, many species of warmwater fish will die, and below 4 ppm, trout might die. Aquatic plants, particularly planktonic algae (or phytoplankton), produce most of the oxygen dissolved in the pond water during daytime photosynthesis. Therefore, dissolved oxygen concentrations tend to increase throughout the day. At night everything living in the pond (fish, plants, insects, bacteria, etc.) consumes oxygen and the dissolved oxygen concentrations fall. Under normal conditions dissolved oxygen will not fall below 4 ppm overnight.

Alkalinity, hardness, and pH of pond water are related to soil and vegetation in the watershed and the pond. Many soils are acidic and need to be limed to adjust the pH, alkalinity, and hardness upward to a range that will promote the growth of planktonic algae and other natural food organisms. A pond should have a pH that fluctuates between 6.5 and 9, and an alkalinity and hardness of at least 20 ppm. Ponds with low pH, alkalinity, and hardness should be limed based on soil tests of the pond mud. Usual liming rates can range from one to five tons per surface acre.

Plankton is the term used for all microscopic and near-microscopic life that floats in water. Plankton is divided into plant (phytoplankton) and animal (zooplankton) groups. Phytoplankton (microscopic algae) are the base of the pond food chain (see Concept 13). Zooplankton and aquatic insects feed on phytoplankton and they in turn are eaten by small fish. Small fish are eaten by larger fish and so on. Managing phytoplankton through fertilizing and liming (if necessary) is the key to producing abundant and
healthy fish populations. Suspended mud in ponds blocks sunlight, and algal blooms cannot be established. In this case, muddy pond water must be cleared before a photoplankton bloom can be achieved.

Pond balance occurs when a balance between prey and predator fish is established and maintained. Each state has specific stocking recommendations which are designed to establish balanced pond populations for the first year or two. In most warmwater ponds, the bluegill sunfish is the prey species and the largemouth bass the predator species. In coldwater ponds, the trout is usually the predator species and insects and small fish are the prey. Balance between predator and prey is achieved by establishing an adequate food chain for the prey species and controlling the prey and predator species numbers through fishing. Removal of the predator species is accomplished by selectively harvesting certain sized individuals to maintain a population that has balanced numbers of the various size classes of the predator species. In this way, the prey species is balanced through the selective feeding by the predator species.

**Concept 12**

**Wildlife Damage Management**

Wildlife damage management is the art and science of working with habitats, wildlife, and humans to minimize or eliminate damage or danger to people’s health or property or other species of wildlife. Behaviors of individual wild animals are sometimes troublesome because of health hazards, or the destruction of crops or other natural resources, or because the animals are a general nuisance. Professional wildlife biologists often must catch (trap), release, euthanize (put to death in a humane manner), repel, poison, shoot or frighten individual animals in order to reduce or eliminate damaging behaviors. Examples of wildlife causing damage are coyotes that prey on sheep or pets, rabid raccoons, bats in the attic, deer eating ornamental plants in the yard, skunks under the house, snakes in the house, cormorants eating catfish fingerlings at an aquaculture facility, or starlings roosting in urban trees and defecating on sidewalks, creating a health hazard. Wildlife damage management specialists are professionals who solve such problems for compensation.

**Concept 13**
Food Webs

Plants are primary producers in a food chain because they supply food at the lowest level of a food chain. It takes an enormous number of individual plants to support the other parts of a food web. At the next level of a food chain are primary consumers, that is, 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.

Primary consumers are eaten by secondary consumers, or carnivores (meat-eaters). This group includes predators such as birds of prey, snakes, foxes, wild cats, and people. Secondary consumers are eaten by tertiary consumers, which may be predators or scavengers such as turkey vultures, crabs, and sometimes people. Note that these categories are very broad and general. Many animals fit into more than one group, and there are more complex levels of the web.

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.
Regions

Areas of the country can be separated into regions having similar climate, vegetation, and wildlife. They are described in very general terms. The Wetland and Urban Regions should be used in any of the regions where they occur.

Use the regions that most nearly describe your local area, your state, or the area where the national contest will be held. Remember this is a local decision that individuals familiar with the area should make.

At the end of each region's description is a list of the wildlife species recommended to use while evaluating habitat in that region. You can use any or all of the listed species, or when applicable, use species listed under other regions. Some of the species listed are considered to be a nuisance in some areas and circumstances, but they also have significant roles in habitats. Contest organizers may wish to exclude such species from local activities or center the activities on why the species are pests and what can be done to decrease problems.

Each region's description is followed by a table that identifies some of the practices used to manage habitat for the species listed. Specific information on recommended habitat management practices for each species can be found in the Wildlife Species section of this handbook.

At local and state contests, you may wish to use more than one region and/or substitute local species for those listed. However, at the national contest, only the appropriate region descriptions, species, and wildlife management practices listed in this handbook will be used.
Eastern Deciduous Forest

Physical Description:
Most of the terrain is rolling except for the Appalachian Mountains which are steep. The average annual precipitation ranges from 35 to 60 inches and is well distributed throughout the year. Summers are hot and dry. Winters are cold.

Dominant Vegetation:
The final stage of succession is dominated by tall broadleaf trees. Depending on the geographic location, trees such as oaks, beech, basswood, buckeye, hickory, hemlock, walnut, maple, and birch can be indicators of climax vegetation. There are many lower canopy trees and deciduous shrubs that are important including American hornbeam, hophornbeam, sassafras, eastern redbud, flowering dogwood, and striped maple. Common shrubs are pawpaw, spicebush, arrow-wood, black huckleberry, blueberry, hawthorn, witch-hazel, and viburnums. A wide variety of forbs are also found on the forest floor. Grasses and annual forbs are mostly limited to areas recently disturbed.

Farming and Ranching:
Large areas of this region have been cleared of the native vegetation for the production of crops and live-stock forage. In many areas, only steep slopes, frequent floods, or water associated with rivers and swamps have prevented the total clearing of forests. Depending on how croplands are managed, some species of wildlife benefit from farming, especially if trees and shrubs are nearby.

Plant Succession Stages:
Stage 1 — bare ground;
Stage 2 — annual forbs and grasses;
Stage 3 — perennial forbs and grasses;
Stage 4 — shrubs;
Stage 5 — young woodland;
Stage 6 — woodland.

Species Recommended for Judging:
Bobcat
Broad winged hawk
Brown thrasher
Eastern bluebird
Eastern cottontail
Eastern gray squirrel
Great horned owl
Hairy woodpecker
Ovenbird
Ruffed grouse
Wild Turkey
White-tailed deer
Wood duck
Northern Bobwhite Quail
Largemouth bass/Bluegill
### Eastern Deciduous Forest

<table>
<thead>
<tr>
<th>Activity</th>
<th>Bobcat</th>
<th>Broad Winged Hawk</th>
<th>Brown Thrasher</th>
<th>Eastern Bluebird</th>
<th>Eastern Cottontail</th>
<th>Eastern Gray Squirrel</th>
<th>Great Horned Owl</th>
<th>Harry Woodpecker</th>
<th>Largemouth Bass/Bluegill</th>
<th>*Northern Bobwhite Quail</th>
<th>Ovenbird</th>
<th>Ruffed Grouse</th>
<th>Wild Turkey</th>
<th>White-tailed Deer</th>
<th>Wood Duck</th>
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<td>5. Controlled (prescribed burning)</td>
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<td>12. Fish (pond) or wildlife survey</td>
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<td>14. Grain, leave unharvested</td>
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<td>15. Harvest timing (crops/hay)</td>
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<td>17. Livestock grazing management</td>
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<td>18. Nesting boxes/structures/platforms</td>
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<td>20. Plant grass and forbs</td>
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<td>21. Plant mast trees</td>
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<td>22. Plant trees or shrubs</td>
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<td>24. Ponds, clear muddy water</td>
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<td>25. Pond construction</td>
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<td>27. Ponds, deepen edges</td>
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<td>28. Ponds, remove trees near dike</td>
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<td>30. Ponds, reseed watershed/filter strip</td>
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<td>37. Snags, dead, down woody material</td>
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This section discusses habitat requirements and practices useful for managing habitat for the birds, mammals, and other species listed in the Regions section. You should find and mark species for your area, and then begin to learn about their needs and the appropriate management techniques.

Not all of the practices are applicable in every region. Wildlife managers must decide which practices are appropriate for their specific area. **However, the practice of increasing or decreasing bag/creel limits to meet population objectives applies to all game, furbearer, and fish species but does not always appear in the narrative for each species.** Likewise, the practice of making fish or wildlife surveys is not always listed in the narrative, but monitoring populations of game or non-game is always important in wildlife management.

Reading additional materials and experience in the field are recommended for making good habitat management decisions. Learning the information in this section for the appropriate species in your regions is a good place to start. Published field guides to North American birds and mammals are good sources for seeing what the species look like and learning more about them.
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**Birds**

**American Kestrel**

**General Habitat Preference:**

Stages 2 and 3 of plant succession for feeding, and stages 4, 5, and 6 for nesting. Large open areas where adequate nesting sites are available.

**Habitat Requirements:**

- **Food:** Primarily insects and small mammals associated with open areas.
- Brush chop, chain, or roller beat small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 4 (shrub) vegetation.
- Control burn small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 4 (shrub) vegetation.
- Clear-cut small areas in large expanses of stage 5 and 6 woodlands.
- Livestock grazing management should leave enough herbaceous canopy to support insects and small rodents.
- Plant grasses and forbs to provide habitat for rodent prey.

- **Cover:** Kestrels nest in tree cavities and other sites including holes in cliffs, canyon walls, and artificial nesting boxes.

Maintain areas of stage 5 and 6 vegetation interspersed with stage 2 and 3 vegetation.

- Plant trees in large open areas (irrigate if necessary) on idle lands.
- Provide kestrel nesting boxes in areas lacking adequate nesting cavities. Boxes can be placed on fence posts in open areas.
- Manage livestock grazing to maintain trees in riparian areas.

- **Water:** Kestrels obtain necessary water from diet, and do not need water for drinking.

**American Robin**

**General Habitat Preference:**

Urban settings with large open areas and nearby trees and shrubs. Parks, golf courses, and lawns in residential areas are favorites.

**Habitat Requirements:**

- **Food:** Insects and worms in warm seasons. Fruits and berries from shrubs and trees in winter. Do not often use artificial feeders.
  - Plant fruit- and berry-producing shrubs such as sumac, Nanking cherry, golden currant, and Russian olive.
  - Leave open areas of short grass and forbs.
  - Use insecticides only when necessary. When using insecticides, carefully follow the instructions given on the label.

- **Cover:** Nesting sites and hiding areas in shrubs, evergreen trees, and broad-leaf trees. Evergreen trees are preferred for early nests. Will use nesting platforms.
  - Plant and maintain trees and shrubs. Include some evergreen trees in plantings.
  - Provide nesting platforms in areas lacking nest sites.
  - Corridors provide important travelways connecting habitats.

- **Water:** Robins require water daily in warm seasons. They obtain water from yard irrigation, rain-filled gutters, low-lying areas, ponds, etc.
  - Bird baths and pans of water can be provided. Do not place water in areas where cats and other pets can catch the birds.

**Black-capped Chickadee**

**General Habitat Preference:**

Stages 4, 5, and 6 of plant succession.

**Habitat Requirements:**

- **Food:** Insects and spiders gleaned from the branches and boles of shrubs and trees. Seeds of shrubs and trees are eaten in winter.
  - Selective-cut timber in stage 5 and 6 woodlands when tree canopy closure exceeds 80 percent. Optimum canopy closure is between 50 percent and 75 percent.
  - Plant softwood trees and shrubs (shelterbelts, hedgerows, field borders). Usually not necessary in Subalpine Region.
Manage livestock to protect shrubs as a source of food and cover.

**Cover:** Black-capped chickadees nest in cavities, usually in a dead or hollow tree. They can excavate a cavity only in soft wood or rotted wood and will use woodpecker holes, natural cavities, and man-made boxes. Thick shrub and tree canopies provide hiding cover.

If selective-cut timber management is used, leave at least 3 snags per acre.

**Provide nesting boxes in young forests or areas where nesting cavities are not available.**

**Water:** Black-capped chickadees obtain necessary water from snow and surface water, usually in sufficient supply.

In summer these birds are attracted to watering facilities such as birdbaths in urban areas.

---

**Broad-winged Hawk**

**General Habitat Preference:**
Continuous dry woodlands of oaks, beeches, maples and mixed coniferous-hardwoods arounds lakes, streams, and swamps. Stages 5 and 6 of woodland.

**Habitat Requirements:**

**Food:** Hunts from perches in deep shady woodlands when flying over treetops or open meadows. Feeds largely on small mammals such as mice, moles, and shrews, occasionally red squirrels and chipmunks; also eats snakes, frogs, lizards, large larvae of night flying moths, caterpillars, grasshoppers, beetles, crickets, fiddler crabs, crayfish, small fish, and some small birds.

**Cover:** Nests near water in a variety of tree species from 25-90 feet high but sometimes as low as 3 to 10 feet. Sometimes uses old crow, hawk, or squirrel nests.

Leave snags and cavity trees when clear-cutting timber or using selection cutting systems in timber.

Leave corridors.

---

**Brown Thrasher**

**General Habitat Preference:**
Stages 3 and 4 of plant succession. Dense, woody vegetation associated with shrub thickets, hedgerows, shelterbelts, forest edges, riparian areas, and young forests.

**Habitat Requirements:**

**Food:** Invertebrates and plant seeds are the principal foods. These birds forage primarily on the ground and occasionally feed on fruits and berries in shrubs and trees. More food is available when there is more ground litter. The management practices listed under "Cover" will usually supply sufficient food.

**Cover:** Nesting and hiding cover are supplied by dense shrubs with some trees. Brown thrashers will use areas that have shrubs only. They need a minimum of 2.5 acres of woody vegetation to support a breeding population.

**Selectively cut forests in large expanses of stage 5 or 6 woodland.**

**Clear-cut timber harvest can improve habitat once succession proceeds to stage 4 after harvest.**

**Plant shrubs and trees (shelterbelts, hedgerows, field borders, clumps).**

**Create corridors of stage 4.**

**Brush chopping, chaining, roller beating and controlled (prescribed) burning can be used to rejuvenate and improve habitat in large areas of old decadent stage 4 vegetation or to keep areas in stage 4.**

**Manage livestock grazing in riparian areas and other woody areas so shrubs and trees can regenerate and ground litter is present.**

**Manage livestock grazing to prevent succession moving back to stage 2 or 1.**

**Water:** Requirements unknown.
Canada Goose (Breeding Habitat)

General Habitat Preference:
Canada goose nest and rear young in or near stage 2 wetlands interspersed with some stage 3 wetlands. Wetlands containing 20 percent tall emergent aquatic vegetation and 80 percent open water are usually good habitat, as are frequent riparian areas adjacent to rivers.

In some areas, Canada geese have become a problem, causing damage to lawns, golf courses, and in winter wheat fields. Wildlife damage management may be necessary.

Habitat Requirements:
- **Food:** During the nesting season and summer Canada goose prefer new green forbs and grasses. They also eat some aquatic insects and pond weeds.
  - Plant grasses and forbs.
  - Livestock grazing management or burning can be used to produce the preferred lush green vegetation.
  - Burn or brush chop small areas (40 acres maximum, 10 to 20 acres preferred) every three to five years.

- **Cover:** Nest in a variety of places such as mats of bulrushes, tops of muskrat houses, in trees, and most of all, on islands. Use artificial nest structures. Usually nest within 200 feet of water’s edge.
  - Construct ponds and wetlands.
  - When possible, use water control structures for managing water levels to maintain approximately 80 percent open water and 20 percent emergent vegetation.
  - Provide artificial nest structures, preferably on islands and/or peninsulas surrounded by open water.

- **Water:** Water is required as described above.

Common Nighthawk
Lesser Nighthawk

Eastern Bluebird
Western Bluebird

General Habitat Preference:
Stage 1, bare ground for nesting. Stages 2 and 3 of plant succession interspersed with areas in stages 4 and 5 of plant succession. Areas such as grasslands, open woodlands, cities, and towns. In cities and towns they are often seen flying over city parks and other open areas in late evening and early morning.

Habitat Requirements:
- **Food:** These birds eat flying insects captured on the wing. Flying ants, mosquitos, moths, and June bugs are examples.
  - Use insecticides only when necessary. Carefully follow the directions on the label.

- **Cover:** They do not build nests, but lay their eggs on the ground, often gravelly or sandy, and on flat roofs of buildings. Riparian areas, ridge tops, and other places with numerous sand and gravel areas are favorite nesting locations.
  - Do not disturb nests during nesting season (May through June). Stay off roof tops that are used for nesting.

- **Water:** Nighthawks do not drink water often. They obtain ample water from their diet.

General Habitat Preference:
Stages 2 and 3 of plant succession interspersed with stages 5 and 6 vegetation.

Habitat Requirements:
- **Food:** Insects and spiders make up a large portion of the diet. A limited amount of fruit is also eaten. Bluebirds usually forage in open areas.
  - Clear-cut small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 5 and 6 woodland.

- **Cover:** Brush chop, chain, or roller beat, small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 4 vegetation.

- **Water:** In areas dominated by mesquite, root plowing combined with the seeding of grasses and legumes may be the best way to maintain areas in stage 3 vegetation.
Control burn small areas in large expanses of stage 4 and 5 vegetation.

**Cover:** Nesting sites are in natural cavities and old woodpecker holes.

- Leave 3 to 4 standing dead or nearly dead large trees per acre during timber harvest operations.
- Place nest boxes 4 to 5 feet high in or adjacent to open areas. Boxes should be spaced more than 200 feet apart.
- If there is no tree cover, plant trees where they may have been historically protected from fire.
- Manage livestock grazing to protect young trees.

**Water:** Bluebirds obtain necessary water from diet, but will use other water sources when available.

**Special:** House Sparrows and European Starlings often take over bluebird nest boxes. Control of these species may be necessary.

- Use pesticides carefully in urban areas.

---

**European Starling**

**General Habitat Preference:**

European starlings prefer older urban residential areas with large trees and shrubs. Most urban areas that have large trees or old buildings with holes and cavities are used.

*Starlings were introduced to the United States from Europe and are considered pests, as they are numerous and often out-compete native birds for available habitat. In such situations the management objectives may be to reduce the quality and quantity of available habitat. However, in the inner cities, where there are few wildlife species, management may include providing for the only wildlife that exists.*

**Habitat Requirements:**

- **Food:** Insects, fruit, seeds, human garbage, even dog and cat food.

  Starlings usually do not use artificial feeders. However, starlings can be attracted to an area by spreading bread crumbs and small grains on the ground in yards, etc.

  **Cover:** They nest in cavities in trees, old buildings, and old houses. Will use artificial nest boxes.

  - Provide nest boxes where adequate nest sites are lacking.
  - Plant and maintain deciduous trees.

  **Water:** They require water during warm seasons.

  - Bird baths, pans of water, or puddles of water can attract starlings.

**Grasshopper Sparrow**

**General Habitat Preference:**

Associated with grasslands (stage 3 of plant succession), these areas are not used when shrub canopy exceeds 25 to 35 percent.

**Habitat Requirements:**

- **Food:** Grasshopper sparrows eat insects of all types. As you might have guessed, grasshoppers are a favorite. In winter they eat forb (weed) seeds.

  Use insecticides only when necessary. Carefully follow the directions on the label.

  **Cover:** These birds prefer to nest in dense grass with abundant litter (residual vegetation from previous years growth).

  - Proper livestock management would include leaving some residual vegetation for nesting habitat and only grazing areas lightly to moderately during nesting season.
  - Plant grasses in large areas with little grassland.
  - Controlled (prescribed) burning and brush chopping can be used as alternatives to grazing for rejuvenating older, less productive grasslands and pastures.
  - Chaining can be used to revert succession to stage 3.
  - Delay haying and mowing of grass in areas such as roadsides, ditches, and grass hay fields until mid-summer.

  **Water:** Grasshopper sparrows obtain necessary water from diet.
Great Horned Owl

**General Habitat Preference:**

The great horned owl occurs in a wide variety of forested habitats, mainly open woodlands of stages 5 and 6 of succession, interspersed with areas of stages 2, 3, and 4, including orchards, farm woodlots, and city parks. It is occasionally found in rocky canyons away from forest cover.

**Habitat Requirements:**

- **Food:** The great horned owl prefers open areas near woodlands, such as marshes or meadows, for hunting. It consumes an extremely varied diet; but prefers small- to medium-sized mammals and birds. It also preys upon reptiles, amphibians, large insects, and fish; it rarely consumes carrion.
- **Cover:** Abandoned nests of hawks, herons, or crows, large tree cavities, crotches, stumps, caves and ledges.
- Leave snags and cavity trees for nesting/perching when clearcutting or harvesting with a group selection system.
- Roosting/perching poles or platforms may be constructed where no large trees, caves, or ledges exist.
- Nesting boxes or platforms may be established where nest sites are limited.
- Plant grasses and forbs for rodent prey.
- Use timber harvest, either selective cut or small clear-cuts to create openings in broad expanses of stage 5 and 6.
- Livestock grazing management may be necessary to leave adequate grass and forb cover for small mammal prey.
- **Water:** These birds obtain necessary water from their diet.
- **Special:** In a few areas this species can cause damage to free ranging poultry and wildlife damage management may be needed.

Greater Prairie Chicken

**General Habitat Preference:**

Unbroken blocks (160 acres minimum) of vegetation in stage 3 of plant succession that is relatively free of shrubs. Flat to gently rolling terrain with some mixing of cropland. Croplands are not necessary, but can furnish important foods, especially in the northern part of the United States.

**Habitat Requirements:**

- **Food:** Prairie chickens primarily eat seeds, grains, and herbaceous greens. During the first few weeks after hatching, the young eat insects. All necessary food can be found in grasslands. Management of grasslands as explained under "Cover" will supply ample food.
- Eliminate fall tillage of grain stubble on croplands adjacent to areas in stage 3 of plant succession.
- Unharvested grain and small annual food plots can attract prairie chickens. If adequate grasslands are present, these practices are not necessary for survival.
- **Cover:** Thick, tall grass cover is used for nesting and winter cover. If not periodically disturbed, grasses often become too thick and are less valuable for nesting cover.
- Livestock grazing should be managed to provide nesting and winter cover. Grass should be a minimum of six inches tall in the fall when grazing is finished. Some areas of grass should be left ungrazed during the nesting season (May through June).
- Controlled (prescribed) burning every three to five years and brush chopping can be used to improve plant vigor and reduce excessive buildup of old vegetation in areas that are not grazed.
- Chaining can be used to revert succession to stage 3.
- Plant large fields of grasses and forbs. When possible, use grass species that are native to the area.
- Time harvest of crops so nests will not be disturbed.
- **Water:** Prairie chickens do not need water on a regular basis. They obtain necessary water from their diet.
Special: Prairie chickens require sites with short vegetation that offer good visibility for breeding displays. They gather on these sites in the spring, and males display in front of females to win a mate. These areas are called “booming grounds.”

Hairy Woodpecker

General Habitat Preference:
Stages 4, 5, and 6 of plant succession are best habitat. Hairy woodpeckers will use stage 3 of plant succession if areas with mature trees are nearby. They also use wooded urban and riparian areas.

Habitat Requirements:
Food: Majority of food is animal matter such as ants, beetle larvae, caterpillars, and adult beetles. The diet is supplemented with fruits and nuts. They forage on a variety of places such as tree trunks, stumps, snags, downed logs, and the ground. Where adequate cover exists, food is usually not limiting.
Cover: Holes are excavated in mature and dying trees and snags for nesting.

Maintain areas with large mature and dying trees, especially in open areas. Within wooded areas maintain at least one large snag per acre.

Plant softwood trees.

Manage livestock grazing in riparian areas to maintain trees. Grazing when woody vegetation is not growing fast (fall and winter) usually does less damage to woody vegetation than at other times of the year.

Develop corridors to connect isolated woodlands in urban and other areas.

Retain or develop snags.

Water: Not limiting, these birds probably obtain necessary water from their diet.

House Finch

General Habitat Preference:
Found in a wide variety of urban areas that have trees, shrubs, and some open areas. Not as abundant in inner cities.

Habitat Requirements:
Food: Soft fruits, buds, and weed seeds. In the warm season house finches eat some insects.

They use artificial feeders of all types. Millet and sunflower seeds are favorites.

Cover: These birds prefer nesting sites on low branches of trees, on branches of bushes, in natural cavities, in old holes excavated by woodpeckers, and any projection or ledge they can find on houses and buildings. They prefer to place the nest from five to seven feet above the ground. The nest is built of weed stems, small branches, and leaves.

Plant shrubs adjacent to open areas for nesting and hiding cover.

Do not disturb nests found on houses and buildings unless they are causing a problem such as plugging a rain gutter.

Water: They require water daily in warm seasons.

Bird baths and pans of water can be provided, or a low area in the yard can be filled with water. Try not to place water in areas where cats and other pets can catch the birds.

House Sparrow

General Habitat Preference:
This introduced species is found in a wide variety of urban categories that have buildings, trees, shrubs and some open areas.

They compete with native house finches and other birds for habitat requirements. They can become a nuisance, and management objectives may be to reduce the quality and quantity of available habitat. In the inner city, management for wildlife may be limited to this species and a few others. Wildlife damage management may be needed in some areas.

Habitat Requirements:
Food: House sparrows eat a variety of insects, fruits, buds, and weed seeds.

They will use artificial feeders of all types. Millet and sunflower seeds are favorites.

Cover: They nest on low branches of trees, on bushes, in natural cavities, in old holes excavated by woodpeckers, and on any projection or ledge they can find on buildings or other structures. They prefer to place nest from five to seven feet above
the ground. Nests are built of weed stems, small branches, and leaves.

- Plant shrubs adjacent to open areas for nesting and hiding cover.
- Do not disturb nests found on houses and buildings unless they are causing a problem such as plugging a rain gutter.

**Water:** House sparrows require water daily in warm seasons.

- Bird baths and pans of water can be provided, or a low area in the yard can be filled with water. Try not to place water in areas where cats and other pets can catch the birds.

## House Wren

**General Habitat Preference:**

In urban setting, house wrens prefer older residential areas with large shrubs and trees.

**Habitat Requirements:**

**Food:** Spiders, grasshoppers, crickets, beetles, caterpillers, ants, bees, ticks, and millipedes. Artificial feeders are usually not used.

- Plant and maintain shrubs and trees.
- Use insecticides only when necessary. Carefully follow instructions on the label.

**Cover:** House wrens nest in natural cavities in trees, old buildings and other structures. They will use artificial nest boxes.

- Plant and maintain shrubs and trees.
- Provide nest boxes where adequate nesting sites are lacking. Boxes should be placed high on a tree trunk or under the eaves of a house. The hole should be small to keep out house sparrows, starlings, and other birds.
- Do not disturb nests found on houses and buildings unless they are causing a problem.

*For specifics on nest box design and placement, visit your local Cooperative Extension office.*

**Water:** These birds obtain necessary water from diet. They do not need to drink water.

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# Hummingbird

**General Habitat Preference:**

Hummingbirds are found in or near mixed woodlands and forests rich in flowering plants. They prefer stages 5 and 6 of plant succession mixed with areas in stages 2, 3, and 4. In urban settings, they prefer areas with large trees and nearby flowering plants.

**Habitat Requirements:**

**Food:** Nectar from flowers and insects found on flowers. Hummingbirds require high energy foods. Nectar is high in sugars that supply needed energy. Insects are an important source of protein.

- Plant flowers. Hummingbirds seem to be attracted to the color red. Some preferred flowers are petunias, gladiolus, nasturtiums, begonias, morning glory, evening primrose, columbine, and cardinal flower.
- Plant flowering shrubs and trees. Favorites are honeysuckle, mesquite, lilac, flowering dogwood, and various fruit trees.

Hummingbirds use artificial feeders filled with sugar-water (1 part sugar to 4 parts boiled water). Keep feeders clean. Never give honey-water to hummingbirds. Honey ferments faster than sugar and quickly develops a mold that kills hummingbirds.

*For specifics on artificial feeder design and placement visit your local Cooperative Extension office.*

- Use insecticides only when necessary. Carefully follow instructions on the label.

**Cover:** Hummingbirds construct small nests on tree branches, usually 5 to 20 feet above the ground. Occasionally they build nests in secluded areas on houses and buildings. The nest is made out of leafy materials and spider silk.

- Plant and maintain trees. Trees with rough bark are preferred.
- Do not disturb nests found on houses and buildings unless they are causing a problem such as plugging a rain gutter.

**Water:** Hummingbirds obtain necessary water from diet. They do not need to drink water.
Mallard (Breeding Habitat)

General Habitat Preference:
Mallards nest in tall forb and grass vegetation or in shrubby cover. They need open water (stage 2 of wetland succession) with associated emergent aquatic vegetation (stage 3) to raise young.

Habitat Requirements:
Food: Aquatic plants and insects are common foods. Ducklings eat mostly aquatic insects. Most food is associated with wetlands.

- In areas without wetlands, build ponds and reservoirs with gently sloping banks or re-establish old wetlands.

- Construct small dikes to provide temporary open water areas mixed with aquatic emergent vegetation through the breeding season.
- Provide some shallow water areas (less than two feet deep) adjacent to deep water where emergent and submergent vegetation can grow. Use water control structures.
- Unharvested grain and grain stubble that has not been tilled can provide high energy food needed by nesting hens.

Cover: Mallards nest in grass and forb vegetation (sometimes they nest under shrubs) preferably within 1/2 mile of a wetland that provides open water with some adjacent emergent aquatic vegetation. After ducklings hatch they use open water and adjacent emergent aquatic vegetation for protection from predators. Ideally, wetlands will have a minimum of 50 percent open water and 10 percent to 20 percent emergent vegetation.

- Cover can be created with practices described under "Food."
- Water developments constructed for wildlife and livestock drinking such as dugouts and catchment ponds are often used to raise broods.
- Control water levels to create some deep water areas (more than two feet deep) where emergent vegetation won’t grow, and manage the vegetation in wetlands (stage 2). Water control structures are useful for this purpose.

- Control (prescribe) burn, brush chop, or use livestock grazing to rejuvenate dense, stagnant vegetation in nesting areas. Burn or chop every three to five years in spring before nesting begins. These practices can be used to increase or maintain proper water and vegetation interspersion in wetlands.
- Nesting structures are occasionally used by mallards.
- Plant grass and forb (legumes) vegetation within 1/2 mile of wetlands that meet the above criteria.
- Livestock grazing should be managed to provide areas with tall, healthy, herbaceous vegetation that are not disturbed during the nesting season.
- Delay mowing. Harvest hay and crops adjacent to wetlands after nesting season.
- Riparian buffers may be needed where cover is limited in some regions.

Water: Mallards require and use water as previously described.

Note: In California, more than 50% of the birds harvested are hatched in California and the highest nest density ever has been recorded in that state, with fledgling success generally higher than that on the Great Plains; thus, California has both mallard breeding and winter habitat.

Mallard (Winter Habitat)

In some areas large flocks of mallards can be a nuisance, therefore wildlife damage management may be necessary.

General Habitat Preference:
Wetlands with open water, harvested grain crops, and riparian areas with open water.

Habitat Requirements:
Food: Preferred foods include waste grain from agriculture, aquatic plants, and invertebrates. Mallards will fly long distances to feed. However, the closer the food is to cover the more valuable it is.

- Provide waste grain in winter by not tilling grain fields in the fall.
- Leave some grain unharvested.
- Use small dikes to flood grain fields, planted food plots, and oak woodlands in winter.
Build ponds and reservoirs with some shallow water (less than two feet deep) where aquatic vegetation can grow.

Planting food plots is beneficial if adequate moisture is available in the Hot Desert Region.

**Cover:** Mallards rest on open water bodies such as streams, rivers, and warm-water sloughs that are not frequently disturbed. They also rest on the ice in the middle of lakes.

Build ponds, reservoirs, and warm-water sloughs.

Water developments constructed for livestock drinking such as dugouts and catchment ponds are also used for resting.

Livestock should be managed so that some cover is retained in shallow areas.

Keep human disturbance to a minimum.

**Water:** Mallards use water as described above.

### Mourning Dove

**General Habitat Preference:**

Stages 2 and 3 of plant succession with some shrubs and trees nearby. Mourning doves often use agriculture areas for feeding. Small areas of bare ground are also beneficial.

**Habitat Requirements:**

**Food:** Waste grain from cropland and livestock feed lots and a variety of grass and forb seeds.

- Do not till in fall after harvest of small grain crops. Leave waste grain available.
- Disk areas to provide bare ground.
- Leave some areas of small grains (wheat, barley, millet, milo, or oats) unharvested.
- Plant annual food plots in areas lacking grain.
- Brush chop, chain, or roller beat small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 4 vegetation.
- Clear-cut small areas (40 acres maximum, 10 to 20 acres preferred) in large areas of stage 5 and 6 woodland.
- Control burn small areas (40 acres maximum, 10 to 20 acres preferred) in large areas of stage 4 and 5 of plant succession.
- Livestock grazing can be used to keep some areas in stage 2 and 3 vegetation.

**Cover:** Mourning doves prefer tall shrubs and trees for nesting and loafing. Nests are made of twigs placed on branches of shrubs or trees. Nests are also placed on the ground.

- Plant shrubs and trees in large areas of stage 2 and 3 of plant succession or in agricultural areas having few trees or shrubs. Plant on field borders, along fence rows, or on any other idle land area.
- Mourning doves often construct loose, flimsy nests. High winds and rainstorms often destroy many of them. To provide secure nesting sites, wire cone nesting structures can be placed where tree limbs fork 6 to 15 feet above the ground. This practice is most useful in regions where high winds and large open areas are common.

**Water:** Mourning doves require water daily. They prefer shorelines and banks without vegetation.

- Where water is limited or absent, development of water sources is desirable.

Catchment ponds

Guzzlers

Windmills

Spring development

### Northern Bobwhite

**General Habitat Preference:**

Stages 2, 3, and 4 of plant succession interspersed. Ideally, habitat components are made up of 1/4 grassland, 1/2 cropland, 1/8 shrub cover, and 1/8 woodland.

**Habitat Requirements:**

**Food:** Young quail eat insects. Adult quail eat a variety of seeds, green vegetation (mostly forbs), insects, and small grains.

- Plant 1/8 to 1/4 acre annual food plots in areas with too little cropland, one plot per 15 acres maximum.
- Leave some grain unharvested.
- Eliminate fall tillage.
- Plant 1/8 to 1/4 acre perennial food plots in areas with too little permanent food and cover, again, one plot per 15 acres maximum.
Clear-cut small areas (small 40 acre patches or strips) in large expanses of stage 5 and 6 woodland.

Selective-cut stage 6 woodlands.

Brush chop, chain, root plow, or roller beat small areas (40 acres or less) in large expanses of stage 4 vegetation.

Control (prescribe) burn small areas (40 acres or less) in large expanses of stage 3 and 4 vegetation. Annual burning in stage 5 and 6 woodlands is also beneficial.

Time haying to protect nesting areas.

Disk small areas in large expanses of stage 3 and 4 to encourage annual forbs and grasses used by bobwhite.

Keep livestock from grazing planted food plots. Ample amounts of herbaceous vegetation used for food by quail should be left in appropriate areas. This is especially important in riparian areas. Livestock grazing also can be used to revert or maintain vegetative succession in stages 2 and 3 vegetation.

Cover: Thick shrubs for hiding and roosting cover.

Plant grasses and forbs.

Plant shrubs in areas where cover is scarce.

Construct brush piles.

Manage livestock grazing to maintain dense shrub and herbaceous cover. Again this is important in riparian areas.

Water: Bobwhite do not require free-standing water. However, in arid regions water development is beneficial.

In the Woodland and portions of the Prairie Brushland Regions where available water is limited or absent, development of water sources is desirable. Examples are ponds, dugouts, guzzlers, windmills, and spring developments.

**Northern Flicker**

**General Habitat Preference:**

Open areas in stages 2 and 3 of plant succession interspersed with areas of stages 5 and 6 of plant succession. Northern flickers are often found in riparian and urban areas. They prefer older urban residential areas with large trees, golf courses, and parks. Flickers can become problems in urban areas where they may create holes in wood siding on houses or damage ornamental trees. Wildlife damage management may be necessary.

**Habitat Requirements:**

Food: Ants are a favorite and over 50 percent of the diet is insects. They also eat seeds, fruits, and berries and are partial to the fruit of poison ivy. They usually feed in open areas.

Clear-cut small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 5 and 6 forests.

Selective-cut timber management in stages 5 and 6 of plant succession.

Mow herbaceous vegetation to keep relatively short in height for foraging.

Artificial feeders are used in urban areas. They prefer suet feeders fastened to tree trunks.

Use pesticides with caution in urban areas.

Cover: Holes are excavated in trees for nesting. They use softwood trees like poplar, cottonwood, and willow and prefer old mature trees that show signs of dying or rotting. In treeless areas, they will nest in posts, holes in banks, and holes in houses and structures.

Maintain some large mature and standing dead trees (snags) when harvesting timber.

In large expanses without trees, plant softwood trees.

Manage livestock grazing, so that herbaceous vegetation is kept at medium to short heights.

Water: Not much is known about daily water requirements. They probably obtain sufficient water from diet.

Special: European starlings often take over flicker cavities for their own nests.
Northern Goshawk

**General Habitat Preference:**
Stages 5 and 6 of plant succession.

**Habitat Requirements:**
- **Food:** A variety of mammals and birds such as varying hare, blue grouse, red squirrel, and various small birds.
- **Cover:** These birds nest in stands of mature trees. Nests are usually placed 20 to 80 feet above the ground on a large horizontal limb of a mature tree. The same nest site is often used for up to 5 consecutive years.
- **Water:** They obtain necessary water from diet.

## Northern Harrier

**General Habitat Preferences:**
Stages 3 and 4. This species typically inhabits sloughs, wet meadows, fresh or salt marshes, swamps, prairies and plains. It generally roosts on the ground or perches on low objects such as fence posts or tree stumps.

**Habitat Requirements:**
- Install perching poles.
- **Food:** Mammals, birds, amphibians, reptiles, insects, and fishes. The northern harrier eats mostly small mammals and hunts for food while on the wing over fields, marshes, and meadows.
- **Cover:** Open country with herbaceous or low woody vegetation for concealing nests. The northern harrier nests on the ground in tall grass or on a sedge tussock, willow clump, or over water on a stick foundation.
- **Water:** They obtain necessary water from diet.

## Ovenbird

**General Habitat Preference:**
Associated with stages 5 and 6 of plant succession. Lives on or very near the ground.

**Habitat Requirements:**
- **Food:** Mainly insects (ants, caterpillars, and beetles) slugs, snails, and earthworms. Seeds and fruits are also occasionally eaten.
- **Cover:** Ovenbirds nest on the ground. They construct a unique nest out of grasses and weed stems that is arched over in the shape of a Dutch oven. The nest is usually well hidden in herbaceous vegetation on the forest floor. The herbaceous vegetation is also used for hiding cover.
- **Water:** They usually obtain necessary water from diet, but will use other water sources when available.

## Red-eyed Vireo

**General Habitat Preference:**
Associated with stages 5 and 6 of plant succession. The red-eyed vireo inhabits open deciduous and mixed forests with dense understory of saplings, in wooded clearings, or borders of burns. It is found in both upland and river bottom forests and sometimes in residential areas where abundant shade trees provide a continuous canopy.
It is seldom found where conifers make up 75 percent or more of the basal area.

**Habitat Requirements:**

**Food:** Mainly insects gleaned from leaf surfaces in mid to upper tree canopies. The red-eyed vireo also eats spiders, a few snails, wild fruits, and berries.

- Selective-cut forest management in large expanses of stage 6 woodland can increase the amount of insects.

**Cover:** These birds nest in deciduous or coniferous trees or shrubs. They suspend deep cup nests from a horizontal fork of a slender branch, usually in dense foliage five to ten feet above the ground, but sometimes as high as 60 feet.

- Livestock grazing has little or no effect on this species.
- Selective-cut forest management in large expanses of stage 6 woodland could increase cover used by this species.
- Plant trees and shrubs in large areas of stages 3 and 4 of plant succession.

**Water:** They obtain necessary water from diet.

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**Redhead Duck**

**General Habitat Preference:**

Stage 2 wetlands for most activities. Redhead ducks usually nest in emergent aquatic vegetation associated with stage 3 wetlands that are adjacent to stage 2 wetlands.

**Habitat Requirements:**

**Food:** Especially young ducks, eat primarily aquatic invertebrates (mollusks, snails, crustaceans) during late spring and early summer. During the rest of the year they prefer aquatic plants such as pond weeds, muskgrass, bulrush seeds, wild celery, water lily seeds, and coontail.

- Control water level with water control structures to promote growth of tall emergent aquatic vegetation (stage 3 wetland) adjacent to stage 2 wetlands with an abundance of floating and submerged aquatic vegetation (water depth three to five feet).
- Build ponds/wetlands with a minimum size of one surface acre of water, and manage water levels to provide habitat similar to that described above.
- Construct small dikes to temporarily flood areas dominated by tall emergent aquatic vegetation during the nesting season.

**Cover:** Build nests out of emergent vegetation. Nests are usually placed above water or very near the shore in dense vegetation that provides concealment.

- Control water levels to promote growth of tall emergent aquatic vegetation. Strive for wetlands comprised of 50 percent stage 3 interspersed with 50 percent stage 2 wetland.
- Manage livestock grazing to maintain tall emergent aquatic vegetation adjacent to the water. Prolonged protection of nesting areas from disturbances such as grazing and fire can result in deterioration of the vegetation. Intense grazing of such areas every three to five years (after nesting season) often rejuvenates the vegetation. Usually only 1/3 to 1/2 of the nesting area should be treated during any one year.
- Controlled (prescribed) burning every three to five years and brush chopping or mowing can be used to rejuvenate deteriorated vegetation (see livestock grazing).

**Water:** Redhead ducks require water as described above.

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**Red-tailed Hawk**

**General Habitat Preference:**

Open areas (stages 2 and 3 of plant succession) interspersed with trees (stages 4, 5, and 6 of plant succession). Single trees in open areas are often utilized.

**Habitat Requirements:**

**Food:** Small mammals such as ground squirrels, rabbits, and mice are the major food items. Some birds and reptiles are also eaten.

- Manage livestock grazing to maintain some areas with an adequate herbaceous ground layer for small mammals to live in.
- Control (prescribe) burn, brush chop, chain, or roller beat small areas (40 acres maximum) in large expanses of stage 4 vegetation. Burning and brush chopping can also be used to rejuvenate stage 3 vegetation and improve small mammal habitat.
Clear-cut small areas (40 acres maximum) in large expanses of stage 4, 5, and 6 woodlands.

Provide perch poles or plant trees in areas where trees are absent.

**Cover:** Nests are usually built 30 to 90 feet above the ground in the crotch or fork of a tree. Cliffs are used less frequently.

- Plant trees where trees are not present (irrigate if necessary).
- Maintain large mature trees in areas where trees are not plentiful.
- Provide nesting platforms.

**Water:** Red-tailed hawks obtain necessary water from diet.

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**Red-winged Blackbird (Breeding Habitat)**

**General Habitat Preference:**

Stage 3 wetlands dominated by emergent aquatic vegetation.

*This species can be a pest in agricultural areas where they may damage crops. In such situations management objectives may be to reduce the quality and quantity of habitat. It is often more appropriate to manage for this species in urban wetlands and other areas where crop damage is not common.*

**Habitat Requirements:**

- Food: Red-winged blackbirds use waste grain and seeds of annual forbs in fall, winter, and early spring. They eat a variety of insects in the summer. Many of the insects used for food are associated with tall emergent aquatic vegetation such as cattails, bulrushes, marsh grass, and a variety of shrubs and trees.
- Control water levels with water control structures and small dikes to provide shallow water where emergent vegetation can grow.
- Construct ponds and wetlands with shallow water (less than two feet deep) where tall emergent aquatic vegetation can grow.

- Livestock grazing adjacent to and/or in wetlands should be managed to maintain cattails, shrubs, and trees.
- Controlled (prescribed) burning and brush chopping every three to five years can be used to rejuvenate old, decadent emergent aquatic vegetation.

**Cover:** These birds nest close to the ground or water in dense clumps of emergent aquatic or other herbaceous vegetation. They often roost (rest) in the same areas or in nearby trees and shrubs.

- The practices listed under food could also be used to manage cover.
- Plant trees and shrubs adjacent to wetlands and ponds (not on the dike or dam).

**Water:** Red-winged blackbirds frequent areas associated with water.

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**Ring-necked Pheasant**

**General Habitat Preference:**

Stage 2 and 3 of plant succession interspersed with croplands used for growing grain crops.

**Habitat Requirements:**

- Food: Waste grain is a preferred food when available. Weed seeds, green forbs, and insects are also used, especially during late spring and early summer.
- Pheasants need grain for food. Do not fall till.
- Leave strips of unharvested grain adjacent to cover areas.
- Maintain areas of stage 2 vegetation for food in the spring. Don’t burn, mow, or spray weeds along ditches, roadsides, and other idle land areas until after nesting season.
- Plant annual food plots in areas where grain crops are scarce.

- Cover: Pheasants use herbaceous cover for nesting (tall grass and forbs are preferred). Hay fields are attractive for nesting, but harvesting often destroys nests. They also nest in small grain stubble (wheat, barley, and oats) left standing from crops of previous year.

- Pheasants use tall dense herbaceous cover that is not filled with wind-blown snow for resting and winter survival. Tall emergent aquatic vegetation
associated with wetlands is often used for cover in winter. To be valuable for winter survival and nesting cover, areas of herbaceous cover should be at least one acre in size and at least 25 to 30 feet wide. Although it is not necessary for survival, pheasants use shrubs, trees, and other woody vegetation for hiding and loafing. In general, all cover vegetation should be in close proximity (1/2 mile or less) to grain fields.

- For winter and nesting cover, plant or maintain areas of tall grasses and forbs (irrigate if necessary) adjacent to grain fields so such areas will not be disturbed by harvesting or other human activities.
- For winter cover, plant trees and shrubs on idle land adjacent to grain fields (irrigate if necessary).
- Control (prescribe) burn, brush chop, or use livestock grazing to rejuvenate dense stagnant vegetation in nesting areas. Burn or chop every three to five years in late winter before nesting begins.
- Do not till standing small grain stubble and delay harvest of hay until after nesting season, if possible.
- Manage livestock grazing. Do not graze cover areas during nesting season. Allow vegetation to re-grow after grazing so cover will be available the following winter and nesting season.
- Construct ponds and/or wetlands to provide tall emergent aquatic vegetation for winter cover.
- Control water levels and provide shallow water to encourage the growth of tall emergent aquatic vegetation.

**Water:** Pheasants use water in warm seasons when it is available. It is usually not a limiting factor.

**Caution:** This introduced species has been documented to compete with other ground nesting game birds such as bobwhite quail, prairie chickens, and ducks. In some cases, hen pheasants may dump eggs into other species’ nests.

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**Ruffed Grouse**

**General Habitat Preference:**

Stages 4, 5, and 6 of plant succession. Optimum habitat includes all three stages interspersed in close proximity to each other.

**Habitat Requirements:**

- **Food:** Primarily twigs, buds, and flowers of shrubs and trees. Buds of aspen or other deciduous trees are needed for winter survival. Young grouse eat insects.

  - Clear-cut small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 6 woodland. The benefits of this management practice will not be seen until stage 4 and 5 vegetation becomes established on the cut area.

  - Controlled (prescribed) burns can be used to maintain succession in stages 4 and 5.

  - Selective-cut forests in large areas of stage 6 woodland.

  - Livestock grazing should be managed so that young deciduous trees and shrubs are maintained in the area.

- **Create drumming log sites if not available.**
Cover: Winter cover is considered most critical. Grouse use shrubs, deciduous trees, and conifer trees for cover. In cold weather they use low branches of conifer trees. However, deciduous trees provide the best cover.

Cover can be improved with practices listed under "Food."

Water: Grouse obtain necessary water from diet.

Rufous-sided Towhee (Eastern Towhee and Spotted Towhee)

General Habitat Preference:
Stage 4 of plant succession. Associated with a wide variety of shrubs.

Habitat Requirements:
Food: These birds forage on the ground, eating invertebrates such as ants, beetles, caterpillars, and grasshoppers. About half of the diet is made up of seeds and green foliage of forbs, grasses, and shrubs.

Livestock grazing management should leave adequate herbaceous vegetation needed for food.

Cover: Use shrubs for hiding and protective cover. Nests are on the ground, usually under shrubs.

Clear-cut small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 5 and 6 woodland.

Controlled (prescribed) burning of small areas (40 acres maximum, 10 to 20 acres preferred) in old decadent stands of stage 4 vegetation will promote resprouting of shrubs.

Chaining, roller beating, or brush chopping small areas (40 acres maximum, 10 to 20 acres preferred) in old decadent stands of stage 4 vegetation will also promote resprouting of shrubs.

Plant shrubs in large areas of stage 2 and 3 vegetation.

Water: Necessary water is obtained from diet.

Song Sparrow

General Habitat Preference:
Open areas of stages 2 and 3 with nearby shrubs and small areas of stages 5 and 6. Often nest along forest edges.

Habitat Requirements:
Food: Weed seeds and insects of all kinds. Artificial feeders of all types can be used.

Provide artificial feeders. Millet and sunflower seeds are favorites.

Use insecticides only when necessary. When using insecticides, carefully follow the directions on the label.

Cover: Thick shrubs for nesting and hiding.
The nest is often placed on the ground under a shrub or in thick herbaceous cover and made of grass, leaves, and weeds.

Avoid disturbing nests.

Plant and maintain shrubs.

Water: Frequent water in warm seasons is required.

Birdbaths and pans of water can be provided. Remember, try to place water in areas where cats and other pets can’t catch the birds.

Western Kingbird

General Habitat Preference:
Stage 2 and 3 of plant succession interspersed with trees and tall shrubs.

Habitat Requirements:
Food: Primarily insects such as bees, wasps, grasshoppers, crickets, beetles, and caterpillars.

Usually food is plentiful; however, excessive use of insecticides can reduce food.

Cover: Nests are in trees or large shrubs 15 to 30 feet above the ground.

Plant trees in large areas void of trees.

Cottonwood, elm, ash, willow, oak, and sycamore are examples of trees to plant (irrigate if necessary).

Plant grass and legumes.

Controlled (prescribed) burning, brush chopping, chaining, roller beating, and root plowing can be
used to maintain and/or revert vegetation to stage 3 of succession.

- Maintain trees in areas where they are not plentiful.
- Avoid excessive livestock grazing in small shrub and tree thickets (field windbreaks, shelterbelts, etc.)

**Water:** Necessary water is obtained from diet.

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**Wild Turkey**

**General Habitat Preference:**
One-third to 2/3 of range in stages 5 and 6 of plant succession interspersed with areas in stages 3 and 4 of plant succession.

**Habitat Requirements:**

- **Food:** Turkeys forage mostly on the ground for herbaceous plant seeds, nuts, acorns, and insects. They will use waste grain from croplands if adjacent to woodlands.
- **Brush chop or disk small areas to maintain some stage 3 or 4 vegetation.**
- **Control (prescribed) burn every three to five years in stage 4 and 5 vegetation in eastern and southern United States.**
- **Clear-cut small areas (40 acres maximum) in large expanses of stage 5 and 6 woodland.**
- **Selective-cut forests in large areas of stage 6 woodland.**
- **Plant several perennial food plots and small (2 to 10 acre) fields to grasses and forbs in large expanses of stages 4, 5, or 6 vegetation, and in any other areas where food is limited.**
- **Plant mast trees in regions where suitable.**
- **Eliminate fall tillage of grain crops, especially adjacent to woodlands.**
- **Leave small areas of grain crops unharvested.**
- **Plant annual food plots near woodlands.**
- **Livestock grazing management should leave some forbs and grasses available for food. This is especially important in riparian areas and may include the development of livestock watering facilities on adjacent uplands to discourage congregation in and overuse of these areas.**

**Cover:** The nest is a shallow depression on the ground lined with leaves and grass that is well concealed in thick shrubs or woodlands. Usually the nest is within 1/2 mile of available water. Turkeys roost in trees or tall shrubs at night.
- **Retain hardwood corridors in pine plantations in the southeast U.S.**
- **Maintain a significant component of vegetation in stages 5 and 6 of succession, especially near streams.**
- **Plant trees and shrubs where cover is sparse or roost trees are limited.**
- **Livestock grazing management should leave thick herbaceous cover for nesting. Spring grazing can be detrimental to nesting habitat, especially in riparian areas.**

**Water:** Turkeys will use free-standing water when available.
- **Where water is limited or absent, development of water sources is desirable.**
- **Catchment ponds**
- **Guzzlers**
- **Spring developments**
- **Windmills**

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**Wood Duck**

**General Habitat Preference:**
Stage 5 woodlands flooded with water and open water adjacent to stage 5 and 6 woodlands. Or stage 3 and 4 wetlands dominated by trees adjacent to stage 2 wetlands.

**Habitat Requirements:**

- **Food:** Fruits and nuts of woody plants, some grain, seeds of water lily and other aquatic plants, and some insects. Insects are used by young wood ducks.
- **During late fall and winter, temporarily flood stage 5 deciduous woodland with mast trees, such as oak, and grain crops. Natural flooding may occur, or small dikes and water control structures may be used.**
- **Leave small areas of cropland that are near wetlands and open water unharvested if flooding of the cropland to a 6” to 12” depth during the fall and winter if possible.**
- **Plant mast trees adjacent to wetlands or in areas that can be temporarily flooded.**
- **Selective cutting of woodlands that can be flooded is desirable to improve mast production.**
Construct ponds and/or wetlands and provide shallow water areas for aquatic emergent vegetation.

**Cover:** Wood ducks nest in cavities in trees of flooded woodlands or adjacent to water. They use stage 2 and 3 wetlands with an abundance of aquatic vegetation to raise young.

- Provide nest boxes if adequate nest sites are limited.
- Plant trees for future nesting sites.
- Construct ponds and wetlands. Provide shallow water areas where aquatic emergent vegetation can grow.
- Control water level to provide open shallow water areas (stage 2 wetlands) adjacent to areas dominated by emergent aquatic (stage 3 wetlands) vegetation.

**Water:** Water is required as described above.

### Yellow-rumped Warbler

**General Habitat Preference:**
Associated with stages 4 (with aspen trees), 5, and 6 of plant succession.

**Habitat Requirements:**

- **Food:** Mainly insects (ants, caterpillars, and beetles) that are gleaned from branches and leaves of trees and shrubs.
- **Cover:** These birds nest in both coniferous and deciduous trees. Occasionally they nest in shrubs. The nest is placed on small branches from 10 to 30 feet above the ground and is made of twigs, bark strippings, and weed stems. Trees and shrubs also provide hiding and protective cover.
- **Livestock grazing** should be managed so that adequate shrub cover is maintained.
- **Selective-cut forest management** in large expanses of stage 6 woodland encourages the growth of shrubs and young trees that will provide future cover for this species.
- **Plant trees and shrubs** in large areas of stages 3 and 4 of plant succession.

**Beaver**

**General Habitat Preference:**
Riparian areas in stages 4 and 5 of plant succession, and wetlands that have permanent water with a variety of shrubs and trees adjacent to the water.

*In some areas beaver are a nuisance. They can cut down trees that people want to save. They can dam up ditches and streams in undesirable places, flooding cropland and causing trees to die from flooding.*

**Habitat Requirements:**

- **Food:** Primarily the bark and wood of shrubs and trees, also some forbs and grasses. Beaver store shrub and tree cuttings in caches (piles of branches) for use during the winter.
- **Selective-cut forest management** in large expanses of stage 6 woodland can increase the amount of insects.
- **Cover:** Beaver construct lodges from sticks and mud or dig burrows in banks of streams and rivers. Beaver prefer slow-moving or still water with a constant water level. They will build dams from tree branches, shrubs, and mud to form ponds.
- **Control beaver populations. Increase/decrease bag limits.** Beaver can become too numerous and eat all available shrubs and trees. To prevent this it may be necessary to periodically remove some beaver.

- **Livestock grazing** should be managed so that shrubs and trees are maintained adjacent to waters that may be used by beavers. This may include developing livestock watering facilities in upland areas to discourage congregation in and overuse of riparian areas.
- **Plant willows, other shrubs and deciduous trees near water** that can be used by beaver. If beaver are already in the area, new plantings will need protection or the beaver will need to be temporarily removed while plantings become established.

- **Livestock grazing** should be managed so that shrubs and trees are maintained adjacent to waters that may be used by beavers. This may include developing livestock watering facilities in upland areas to discourage congregation in and overuse of riparian areas.
- **Control beaver populations. Increase/decrease bag limits.** Beaver can become too numerous and eat all available shrubs and trees. To prevent this it may be necessary to periodically remove some beaver.

**Cover:** Beaver construct lodges from sticks and mud or dig burrows in banks of streams and rivers. Beaver prefer slow-moving or still water with a constant water level. They will build dams from tree branches, shrubs, and mud to form ponds.

**Water:** Usually necessary water is obtained from diet, but other water sources are used when available.
which stabilize water levels, slow water movement, and provide shelter beneath the ice in winter.

- Protect and maintain beaver dams. When beavers construct dams in places that cause problems for people, removal of the beaver is usually the best solution. If the dam is destroyed and the beaver remain, they will usually build the dam again.

- Provide dam building material such as precut logs and branches in areas where such materials are scarce.

**Water:** Water requirements are discussed under cover requirements. Water should be of sufficient depth (5 feet) to allow free movement under the ice in winter.

**Bobcat/Lynx**

**General Habitat Preferences:**

Bobcats occur throughout the U.S. except for some areas in the northern midwest states where intensive agriculture occurs or in areas lacking rugged or rocky mountainous terrain or extensive bogs and swamps. Lynx occur in the northernmost forests of the U.S. and into Colorado and Nevada. Both occur in a wide variety of habitats and are often associated with rocky outcrops (stage 1) and canyons. They are also found in semi-open farmlands (stage 2 and 3), brushy areas (stage 4), heavily wooded uplands and bottomland forests (stage 5 and 6). Both the bobcat and lynx are nocturnal and are seldom active in the daytime. The bobcat is classified as a furbearer game species in most states.

**Habitat Requirements:**

**Food:** Rodents (squirrels, chipmunks, voles, rats and mice), domestic poultry, rabbits, opossum, raccoons, skunks, birds, and snakes are prey of the bobcat. Lynx are dependent on the varying hare as a primary food source. Bobcats are capable of killing a deer, but the bobcat is not a significant cause of deer mortality. Deer, in the form of carrion, is eaten mainly during autumn and winter coinciding with deer hunting season. Bobcats have caused excessive mortality in pronghorn fawns in western states. The cottontail rabbit appears to be the principal prey of the bobcat throughout its range.

- Protect poultry from predation by bobcats by enclosing poultry in cages or predator-proof exclosures.

- Timber harvest using small clear-cuts can increase prey abundance.

- Control bobcat populations. Increase or decrease bag limits. Bobcat can become too numerous and attack livestock, pets, or game animals. To prevent this from happening, it may be necessary to periodically remove some bobcat. Bobcat pelts also have value as a fur.

**Cover:** The importance to bobcats of rock piles or broken rocky ledges for dens is well known.

- The bobcat also uses brush piles and cavity trees and hollow logs as rest areas and birthing dens.

- Manage livestock grazing so that adequate cover for prey is retained.

- Plant shrubs where cover is sparse.

**Water:** Although water requirements are not well documented, they are known to use free standing water. Much of their water requirements may be met in their diet.

**Coyote**

**General Habitat Preference:**

Coyotes are found throughout the continental United States. Coyotes have also been observed in large cities and urban areas. Stages 2, 3, and 4 are primary coyote habitats, particularly grasslands and areas where timberlands have been cleared for agriculture. They may occasionally be seen in woodlands. Coyotes den in a wide variety of places, including brush-covered slopes, steep banks, rock ledges, thickets, and hollow logs. Coyotes may be active throughout the day but tend to be more active during the early morning and around sunset. Coyotes may live in packs, alone, or in mated pairs.

**Habitat Requirements:**

**Food:** Coyotes eat poultry, rodents, persimmons, songbirds, cattle, rabbits, deer, woodchuck, goats, and watermelon. Livestock and
wild ungulates (deer, elk, pronghorn) are represented in coyote stomachs PRIMARILY as carrion. However, in some cases, coyotes have been shown to prey heavily on deer and pronghorn fawns; limiting reproductive success. In 16 studies, coyotes were responsible for 82% of all sheep losses that were due to predators, but it is important to stress that only a few flocks typically showed sizeable losses. Often it is individuals that cause large livestock losses and control of that individual is warranted. It is also important to consider that coyote predation is not the major cause of loss in many cases.

- Timber harvest using small clear-cuts can increase prey abundance.
- Cover:
  - Manage livestock grazing so that adequate cover for prey is retained.
  - Plant shrubs where cover is sparse.
- Water: Water requirements for coyotes are not well documented. Much of their water requirements should be met in their diet.

Special: In some instances the predatory habits of the coyote can be a problem for wildlife managers and livestock producers; therefore wildlife damage management may be necessary.

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**Eastern Cottontail**

**General Habitat Preference:**

Stages 3 and 4 of plant succession. Ideally, habitat components made up of 1/3 grassland, 1/3 cropland, and 1/3 shrub cover all interspersed together. Eastern cottontails also use parks, golf courses, and stream corridors in urban areas.

When overabundant, they can cause damage to ornamental and garden plants and may require wildlife damage management.

**Habitat Requirements:**

- Food: A variety of forbs and grasses are eaten from spring through fall. In winter bark of shrubs and trees are often eaten.

- Plant 1/8 to 1/4 acre annual food crops (grain sorghum is good) in areas with too little cropland. One plot per 15 acres maximum.
- Plant 1/8 to 1/4 acre perennial food crops (grass and clover) in areas with too little grassland, again, one plot per 15 acres maximum.
- Brush chopping, chaining, roller beating and controlled (prescribed) burns can be used to maintain or rejuvenate small areas of stage 3 and 4 vegetation. In areas dominated by mesquite, root plowing combined with the seeding of grasses and legumes may be the best way to maintain small areas in stage 3 vegetation.
- Clear-cut small areas (10 acres maximum) in large expanses of stage 5 and 6 woodlands.
- Livestock grazing management should avoid use of food and cover plots, and leave ample amounts of herbaceous vegetation in other areas used by cottontails for food and cover.

**Cover:**

- Cottontails use thick shrub or herbaceous vegetation for hiding and resting cover.
- Plant shrubs in large areas of stage 2 and 3 of plant succession, or in agricultural areas having few trees or shrubs. Plant along field borders, fence rows, or other idle land areas. This is also appropriate for open areas in urban settings.
- Provide brush piles where additional cover is needed.

**Water:** Necessary water is obtained from diet.

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**Eastern Fox Squirrel**

**General Habitat Preference:**

Stages 5 and 6 of plant succession with interspersed small openings (stages 2 and 3 of plant succession). Riparian areas are important in the Midwest. Squirrels also use urban areas with lots of trees.

Squirrels can be nuisances and cause property damage, thus requiring wildlife damage management techniques.

**Habitat Requirements:**

- Food: Squirrels spend much time foraging on the ground. They feed on a variety of nuts, acorns, seeds, mushrooms, bird eggs, and, in places, corn.
- Selective-cut timber in large areas of stage 5 and 6 woodlands. Leave three to four den trees and several other mature trees per acre.
- Clear-cut small patches (less than five acres) in large expanses of stage 6 woodland.
Brush chopping and controlled (prescribed) burns can be used to maintain small areas in stage 3 and 4 vegetation.

Plant mast-producing trees along fence rows, adjacent to streams, or in other idle land areas. When possible, locate plantings adjacent to existing croplands.

Leave some grain unharvested in croplands adjacent to trees.

Leave some crop residue untilled in the fall, especially near woodlands.

In urban areas, corn or sunflower seeds can be spread out on ground under trees used by squirrels. Artificial feeders can also be used.

**Cover:** Squirrels nest in cavities in trees or build a nest out of twigs and leaves. The nest is usually placed in the crotch of a tree over 30 feet above the ground. In areas where den sites are scarce, they will use nest boxes.

Need 3 to 4 den trees or suitable nest boxes per acre. Nest boxes are most beneficial in stage 5 woodlands and urban areas lacking den sites.

Leave hardwood corridors.

Plant trees in large areas of stages 2, 3, and 4 vegetation (irrigate if necessary).

Manage livestock grazing in riparian areas to maintain adequate forage on forest floor.

**Water:** Water requirements are generally met by the food consumed. However, in late summer this may not be adequate.

In urban areas provide a pool or pan of water if other sources are not available.

### Eastern Gray Squirrel

**General Habitat Preference:**

Deciduous woodland in stages 5 and 6 of plant succession.

*Squirrels can be nuisances and cause property damage, thus requiring wildlife damage management techniques.*

**Habitat Requirements:**

**Food:** Squirrels spend much time foraging on the ground. They feed on a variety of nuts, grains, acorns, seeds, mushrooms, and buds.

Leave some grain unharvested (corn preferred) and/or eliminate fall tillage of croplands adjacent to stage 5 and 6 vegetation.

**Selective-cut timber in large areas of stage 5 and 6 woodlands. Leave three to four den trees and several other mature trees per acre.**

**Plant mast-producing trees along fence rows, adjacent to streams, or in other idle land areas. When possible, locate plantings adjacent to existing croplands.**

**Livestock grazing should be managed to maintain adequate forage on forest floor. Maintain deciduous tree corridors along streams.**

**Cover:** Squirrels nest in cavities in trees or build nests out of twigs and leaves. The nest is usually placed in the crotch of a tree over 30 feet above the ground. In areas where den sites are scarce, they will use nest boxes.

Need three to four den trees or suitable nest boxes per acre. Nest boxes are most beneficial in stage 5 woodlands.

Leave hardwood corridors.

Plant trees and shrubs in open areas.

**Water:** Water requirements are generally met by the food consumed.

### Mink

**General Habitat Preference:**

Mink prefer habitat associated with stream and river banks and the shores of a variety of wetlands.

**Habitat Requirements:**

**Food:** Rabbits, mice, waterfowl, muskrats, fish, and crayfish are all used for food, depending on availability. Most food is found in close association with dense vegetation along the shores of wetlands.

Manage livestock grazing to maintain healthy vegetation along the banks and shores of streams, rivers, and other wetlands. In some regions this may include the development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas.

Controlled (prescribed) burns and brush chopping can be used to rejuvenate old decadent wetland vegetation that in turn can improve the habitat for the animals mink use for food.

Control water levels with water control structures to promote the growth of emergent aquatic vegetation adjacent to open water.
- Ponds and wetlands can be constructed with shallow water areas where emergent aquatic vegetation can grow.
- Provide shallow water areas in ponds and wetlands where emergent vegetation can grow.
- Small dikes can be used to temporarily flood areas which can improve habitat for animals mink use for food.

**Cover:** Mink use dens made in log jams, under tree roots, old muskrat burrows, and rock piles. The availability of den sites is considered to be a key factor in determining how many mink use an area. Areas with lots of trees and shrubs and limited livestock grazing near shorelines usually have more potential den sites.

The practices discussed under "Food" can also improve cover.

**Water:** Mink are found in association with water.

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**Mule Deer**

**General Habitat Preference:**

Stage 3 and 4 of plant succession in arid regions where stages 5 and 6 are limited or nonexistent. In Hot Desert Region, mule deer use riparian areas the most. In parts of the Intermountain Region, mule deer prefer 50 percent stages 5 and 6 interspersed with stages 3 and 4.

*Mule deer can be a nuisance when their habitat overlaps areas occupied by people. Therefore, wildlife damage management techniques apply in some cases.*

**Habitat Requirements:**

**Food:** Food requirements vary with season and availability. Mule deer often eat slightly more brush (browse) than grass or forbs. In the summer they eat grass, forbs, and brush. In the fall they eat grass and brush. In the winter they eat brush and grass; in deep snow brush is more available. In the spring they prefer grass and forbs.

- Control burn small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 4 and 5 vegetation.
- Brush chop, chain, or roller beat small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 4 vegetation. Do not do this in areas of deep snow if shrubs are the only available food in winter.
- Clear-cut small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 5 and 6 woodland. Clear-cuts should be narrow and irregularly shaped.
- Fertilize areas of stage 4 vegetation that are used heavily in the winter.
- Plant fields to grasses and forbs.
- Livestock grazing should be managed so that some herbaceous and shrub vegetation remains available for deer. This may include the development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas.

**Cover:** Mule deer will use tall thick shrubs, forests, and land features such as rock outcrops, cliffs, and ravines.

Manage for 50 percent stage 5 and 6 vegetation intermingled with stage 3 and 4 vegetation in parts of the Intermountain Region.

- Manage livestock grazing in riparian areas to maintain shrubs and trees. Grazing when woody vegetation is not growing rapidly (fall to late winter) usually does less damage than at other times of year.
- Plant willow trees or shrubs.

**Water:** Mule deer need water nearly daily in dry regions and during summer months. In winter they need it only if snow is absent. They will travel up to two miles for water, but prefer within one mile.

- Where water is limited or absent, development of water sources is desirable. Examples are guzzlers, catchment ponds, windmills, and spring developments.

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**Muskrat**

**General Habitat Preference:**

Stages 2 and 3 wetlands interspersed (mixed) together.

**Habitat Requirements:**

**Food:** Muskrat eat the roots, tubers, and green vegetation of emergent aquatic vegetation such as cattails and bulrushes.
 Manage livestock grazing to maintain healthy vegetation along the banks and shores of streams, rivers, and other wetlands. In some regions this may include the development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas.

- Controlled (prescribed) burns and brush chopping can be used to rejuvenate old, decadent wetland vegetation.
- Control water levels with water control structures. Provide areas in wetland with water less than two feet deep where cattails and bulrushes can grow. Up to 80 percent of the wetland should be able to grow such vegetation.
- Ponds and wetlands can be constructed with shallow water areas where emergent aquatic vegetation can grow.
- Provide shallow water areas in existing ponds and wetlands where emergent vegetation can grow.
- Small dikes can be used to temporarily flood areas to promote the growth of cattails and bulrushes.

**Cover:** Muskrat build lodges out of bulrushes and cattails, which are usually placed in dense growths of cattails and bulrushes. They rest on open shorelines, floating logs, or on tops of lodges. They also make dens in banks.

- Practices under "Food" can provide areas for lodges.
- Floating logs and rafts can be placed in open water areas. They should be anchored to the bottom.

**Water:** Muskrat need water of sufficient depth (4 feet) or flowing water that allows free movement under ice during the winter. During warm seasons, prefer water one to two feet deep, with around 20 percent of the wetland comprised of open water free of emergent aquatic vegetation. Again, controlling the water level when possible can be a beneficial management practice.

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**Raccoon**

**General Habitat Preference:**

Raccoon are most abundant near water, riparian areas and lands adjacent to wetlands. They are also found in urban areas. They prefer areas interspersed with different successional stages. Riparian areas in stages 5 and 6 of plant succession are ideal.

_ Raccoons can become pests in urban areas and in wetlands where waterfowl nesting is important._

In such instances, the management objectives may be to make the habitat less suitable for raccoons.

_They are also major predators of quail and turkey nests in the southeast._

**Wildlife damage management may be necessary.**

**Habitat Requirements:**

- **Food:** Raccoons eat a wide variety of foods consisting of garbage, birds, eggs, fish, small mammals, insects, crayfish, grains, seeds, fruits, and foods prepared for human and pet consumption.
- **Water:** Muskrat need water of sufficient depth (4 feet) or flowing water that allows free movement under ice during the winter. During warm seasons, prefer water one to two feet deep, with around 20 percent of the wetland comprised of open water free of emergent aquatic vegetation. Again, controlling the water level when possible can be a beneficial management practice.
- **Cover:** Raccoons nest and rest during the day in natural tree cavities, dens in the ground, under

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**Cover:** Raccoons nest and rest during the day in natural tree cavities, dens in the ground, under

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brush and junk piles, in old abandoned buildings, and rocky cliffs and ledges.

- Plant and maintain large deciduous trees especially in riparian areas and areas adjacent to wetlands.
- Maintain corridors and riparian buffers.

**Water:** Raccoons require water frequently during warm seasons.

- Build ponds or wetlands.
- Provide pools of water in urban areas.

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**White-tailed Deer**

**General Habitat Preference:**

Stages 3, 4, and 5 of plant succession, all interspersed together.

White-tailed deer can be a nuisance when their habitat and home range overlap areas occupied by people. Therefore, wildlife damage management techniques apply in some cases.

**Habitat Requirements:**

- **Food:** A variety of shrubs, forbs, grasses, and waste grain. Acorns and nuts are favorite foods. In the northern parts of the range for white-tailed deer, conifer trees are used in the winter.
- Clear-cut small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 5 and 6 woodlands.
- Selective-cut timber management of stage 5 and 6 woodlands.
- Plant several one acre perennial food plots of grass and clover in large expanses of stage 5 and 6 woodland.
- Plant annual food plots to grain.
- Plant mast trees.
- Leave small areas of cropland adjacent to woodlands unharvested.
- Eliminate fall tillage of grain crop residue adjacent to woodlands.
- Time harvest of crops and hay so that fawning sites are not disturbed.
- Plant fields to grasses and legumes in large expanses of stage 4, 5, and 6 vegetation.
- Use controlled burning at three-year intervals in stage 5 pine woodlands or periodically in stage 3 and 4 vegetation.

- Brush chop, chain, or roller beat small areas to maintain stage 3 and 4 vegetation.
- In areas dominated by mesquite, root plowing combined with the seeding of grasses and legumes may be the best way to maintain small areas in stage 3 vegetation.
- Manage livestock grazing to leave some forbs, grasses, shrubs, and trees available for food and cover. This is particularly important in riparian areas in the Great Plains Grassland Region. You may need to include the development of livestock watering facilities in upland areas to discourage congregation of livestock and overuse in riparian areas. **This is the only situation where you would construct ponds.**
- **Cover:** White-tailed deer use woodlands and tall shrubs for hiding and travel cover. They also use tall emergent aquatic vegetation in riparian areas and brushy upland drainages for cover in the Great Plains Grassland Region.
- Control water levels with water control structures, or use small dikes to temporarily flood areas to encourage the growth of tall emergent aquatic vegetation.
- Plant trees and shrubs in ravines, along field borders, and other idle land areas.
- Provide corridors for travel lanes in open areas.

- **Water:** White-tailed deer drink free water when it is available. They obtain most of their water from food items. Water developments are especially important in more arid regions.

  Special: Deer can seriously degrade habitat when overpopulated. Increasing or decreasing bag limits is essential for proper management.

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**Other Species**

**(Amphibians, Fish & Butterflies)**

**Bullfrog**

**General Habitat Preference:**

Bullfrogs inhabit permanent bodies of standing or slow-moving water. They prefer shorelines with dense vegetation (stages 3 and 4 of wetland succession), adjacent to shallow open water areas.
(stage 2) dominated by floating and submerged aquatic vegetation. All habitat requirements are often found in and around a single pond.

**Habitat Requirements:**

**Food:** Major components of the diet are snails, insects, crayfish, other frogs, fish, reptiles, and occasionally small mammals and birds.

**Cover:** Bullfrogs use dense emergent aquatic and upland herbaceous vegetation adjacent to water for hiding and foraging.

- Construct ponds and wetlands with shallow water areas.
- Control water levels with water control structures to encourage the growth of emergent aquatic vegetation adjacent to open water.
- Provide shallow water areas in existing ponds and wetlands.
- Manage livestock grazing to maintain dense vegetative cover on shores and banks adjacent to water. Limit livestock watering access to only a small area of the wetland.

**Water:** Bullfrogs need stable water levels for hibernation and egg development.

- Control the water level. When possible maintain a constant water level.

**Special:**

*Butterflies prefer a soft mud bottom under unfrozen water for hibernation.*

- Plant and maintain specific types of plants for butterflies to lay eggs on: dogbanes, milkweeds, asters, goldenrods, wintercress, vetches, blackberries, sunflowers, iron weed, and verbenas.
- Rooftop and balcony gardens planted with some of the plants mentioned above may attract butterflies.

**Cover:** Butterflies need shelter from wind.

- Plant the above in areas sheltered from the wind.
- Use pesticides carefully.

**Water:** Some butterflies can be seen collecting on moist sand or mud around water puddles.

- Providing an area with water puddles may attract groups of these butterflies.

**Frogs**

**General Habitat Preference:**

Weeds and aquatic vegetation on the edges of ponds, lakes, and slow moving streams. Mud bottoms are needed so frogs can bury themselves for hibernation during the winter.

*Frogs can become so numerous that they become a problem in some areas. Vegetation control and other wildlife damage management practices may be needed.*

**Habitat Requirements:**

**Food:** Insects.

- Use pesticides carefully.

**Cover:** Thick herbaceous vegetation on bank or shore adjacent to water. Frogs also hide among floating vegetation in the water next to the shore.

- Construct ponds and wetlands. Both shallow water to encourage emergent aquatic vegetation and deep water for hibernation are desired. Small backyard pools are often adequate.

- Control water levels with water control devices to insure adequate water depth for hibernation. This is also useful for encouraging emergent aquatic vegetation.

**Water:** Frogs need water to hide. Many kinds of frogs will dry up and die if their skin is not kept moist. (See discussion in "Cover" section.)

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**Butterflies**

**General Habitat Preference:**

In urban areas butterflies are found in gardens, yards, and parks planted with shrubs and flowers that attract butterflies. They often lay eggs on a specific kind of plant.

**Habitat Requirements:**

**Food:** Usually consists of sweet liquids such as nectar from flowers.

- Plant and maintain bushes and flowers that attract butterflies. Some examples are aster, verbena, zinnia, marigold, lilac, bush cinquefoil, and butterfly plant.
Largemouth Bass/Bluegill

**General Habitat Preference:**

Ponds, lakes, and slow moving rivers.

**Habitat Requirements:**

**Food:** Young bass eat insects and other invertebrates (worms, crayfish, and zooplankton). These invertebrates depend on phytoplankton for food. Adult bass eat other small fish such as bluegill and a variety of minnows, tadpoles, and crayfish, and even ducklings. Bluegill eat a variety of zooplankton (microscopic animal life), insects, tadpoles, small minnows, and crayfish.

- Construct ponds.
  
  Maintain a green color in pond water (green enough that a white disk cannot be seen 24 inches deep). The color is caused by phytoplankton (microscopic plant life-algae).

- In clear water, fertilizer may be added to increase or promote phytoplankton.

- Determine pond balance using a minnow seine and catch records. A bass to bluegill ratio of 3 to 6 pounds of bluegill to one pound of bass is considered a good fish population balance.

- Harvest more or fewer bluegill, depending on seine sample results.

- Harvest more or fewer bass, depending on seine sample results.

- Remove existing fish and restock pond.

- Prevent or clear up muddy water (brown or gray color). Muddy water blocks sunlight needed in producing phytoplankton.

- Manage livestock grazing to maintain thick herbaceous vegetation surrounding the pond and in the watershed that drains into the pond. Develop livestock watering facilities away from pond or allow access to only a small part of the pond.

- Reseed watershed.

**Cover:** Bass and bluegill are often found near submerged rocks, stumps, shrubs, and near aquatic vegetation where small fish (used for food) hide.

- Artificial reefs constructed of rock piles, sections of plastic or cement pipe (a minimum of 6 inches in diameter and 18 inches long), and brush piles and tires (sunk with weight) can be used for additional cover. These practices are recommended for ponds larger than 10 surface acres in size.

- Deepening the pond edges to 2 feet deep or more discourages rooted aquatic vegetation growth.

**Water:** These fish require an adequate quantity and quality of water.

- Stop pond leaks if and when they occur.

- Add water control structures if needed.

- Repair the spillway if needed and remove trees near the dam or dikes.

- Diversion ditches can be used to ensure an adequate water supply.

  Fish need water of a certain quality. Some of the basic requirements are: dissolved oxygen - minimum of 4 parts per million (ppm); carbon dioxide - should not exceed 20 ppm; pH should range between 6.5 and 9.0; and water temperature should reach at least 70 degrees Fahrenheit sometime during the summer (one foot below surface in shade).

  Test the water to see if it meets requirements.

  Aerate pond to increase oxygen and decrease carbon dioxide.

- Lime ponds (agricultural limestone) to increase soil pH if total alkalinity is below 20 ppm.

Rainbow Trout

**General Habitat Preference:**

Cold-water lakes, ponds and fast moving streams and rivers.

**Habitat Requirements:**

**Food:** Trout eat primarily insects; they also eat snails, crayfish, and smaller fish. The amount of available food is often related to the quality of water and available habitat for insects. In streams and rivers, many aquatic insects need fast moving water (riffles) that is high in dissolved oxygen and a gravel or cobble bottom. Ideally a stream should have 50 percent riffles and 50 percent pools (slow moving water).

It is difficult to make riffles. Maintenance of riffles is important in streams with small amounts of riffles.
Place gravel and cobble in stream to provide habitat for insects. Placement should be done with care to avoid changing currents, which could increase bank erosion.

Aquatic vegetation provides habitat for insects in ponds and lakes. Some aquatic vegetation should be maintained (not over 30 percent of surface area). Vegetation on banks and shores provides habitat for insects.

- Manage livestock grazing to maintain thick vegetation on banks and shores. Develop livestock watering facilities away from streams, rivers, lakes, or ponds. Or allow access in only small areas.
- Collect fish (seine, fishing rod, electroshock) and determine their health.
- Harvest more trout if lack of food is inhibiting growth.

**Cover:** In streams and rivers, trout need pools for cover.

- Construct small rock or log dams. Changing a stream’s flow can have bad side effects such as increased erosion. Design of such dams should be done by an expert who understands stream flows.
- Place large rocks in fast moving water. Again, locations should be selected with care.
- Riparian buffers may be needed to maintain water quality.

**Water:** Rainbow trout need high quality water. Some basic requirements are: dissolved oxygen - minimum of 6 parts per million (ppm); pH should range between 6.5 and 9.0; and water temperature should not exceed 70 degrees Fahrenheit at any time (one foot below surface in shade).

Test the water to see if it meets requirements. For ponds and lakes, these tests are important in the winter when ice prevents aquatic plants from receiving sunlight. Aerate to increase oxygen and decrease carbon dioxide.

- All practices related to ponds discussed under largemouth bass and bluegill may be applicable to ponds for trout.
Wildlife Management Practices (WMP)

In this section, various practices used to manage habitat are described in further detail. They are listed in alphabetical order. The descriptions are brief and general and are not meant to be comprehensive.

Identify and learn the practices that are recommended for the species listed in the Regions section. When preparing for a judging event, it is only necessary to learn the information recommended for the particular regions that will be used in the event. Many of these practices are commonly used in certain regions and not others. Study only the appropriate practices that are listed on the chart found in the particular description of the region that you are using. It is always wise to learn as much as possible about any practice before implementing it. Additional reading, research, and guidance from wildlife management professionals is suggested.

Some of the practices may seem contradictory. For example, Practice 28– Ponds, Deepen Edges discourages the growth of emergent aquatic vegetation, while Practice 44 – Water Control Structures encourages growth. Landowner objectives will determine which practices you recommend. Note that some practices may not be applied in all regions, even though you may be dealing with the same species. For example, timber harvest is not appropriate for white-tailed deer in the shortgrass prairie, but is in other regions.

At times, the best habitat management is maintaining an area in its current condition. This can include protecting the area from development and applying various management practices that will help maintain the area in the desired condition.

In this handbook, costs and budgets are not considered when recommending practices. However, in actual situations, wildlife managers must consider economics when planning and recommending management practices.
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1. Artificial Feeders

**General Description:**

Used primarily to feed wildlife in urban areas. A wide variety of feeder designs, methods, and different foods exist. Sunflower seeds and white proso millet are universal favorites. Some species prefer to eat fat rather than seeds. Some species prefer to eat on the ground rather than in a tree or on a balcony. For details on different designs and placement of artificial feeders contact a Cooperative Extension agent or state wildlife agency.

2. Brush Chopping (Mowing)

**General Description:**

Involves mowing dense vegetation (including fairly large shrubs) with a large rotary mower mounted behind a tractor.

**Effect on Habitat:**
- Helps keep vegetative succession in stage 2.
- Sometimes reverts succession from stage 4 to stage 3. Helps remove competition with some kinds of shrubs, allowing grasses and forbs to grow better.
- Sometimes helps keep vegetative succession in stage 4. Maintains low shrub growth with some kinds of shrubs by encouraging resprouting.
- In stages 2, 3, and 4, helps rejuvenate grasses, forbs, and shrubs, which improves quality of future nesting sites.
- In stages 5 and 6, maintains dense low understory in properly thinned woodlands.
- In grass-clover plots, helps keep vegetation low enough for use by some wildlife species such as doves and turkeys.
- In wetlands can be used to increase interspersion by reducing vegetative cover.

*This practice is used in stage 5 and 6 vegetation in the following regions: Eastern Deciduous Forest, Northeast Mixed Forest, Southeast Mixed and Outer Coastal Plain Forest, and Woodland areas found within the Great Plains Grasslands Region.*

3. Brush Piles

**General Description:**

Brush piles can be made from saplings or tree branches available from land clearing, timber harvest operations, tree pruning, etc. For best results, piles should be three to five feet high, 15 feet in diameter and very loose. This will allow grass and forbs to grow in them, creating more food and cover for wildlife.

**Effect on Habitat:**
- Particularly useful for rabbits and quail in areas with little cover, especially in areas with plenty of food such as corn, soybean, grain sorghum, and small grain fields and little cover.
4. Chaining/Roller Beating

General Description:

Chaining: A large chain is strung between two bulldozers that run parallel to each other (50 to 100 feet apart depending on length of chain). The chain knocks down shrubs and small trees.

Roller Beating: Large, sharp metal blades are welded lengthwise on a roller similar to those seen on steam rollers used to pave roads. The roller is pulled behind bulldozers to knock down and chop up large shrubs and small trees. Roller beating is an alternative to chaining and has almost the same effect on vegetation.

Both techniques are used where rugged terrain, rocks, or large shrubs prevent the use of a brush chopper. This practice is not used like brush chopping to manipulate understory vegetation in woodlands.

Effect on Habitat:

- Stage 4 sometimes reverts succession to stage 3. Helps remove competition of some kinds of shrubs, allowing grasses and forbs to grow better.
- Sometimes helps keep vegetative succession in stage 4.
- Maintains low shrub growth with some kinds of shrubs by encouraging resprouting.
- In stage 5 causes succession to revert back to stages 3 and 4.

Most often used in stages 4 and 5 of plant succession in the following regions: Mediterranean, Intermountain Foothills, Intermountain Montane, Intermountain Sagebrush, and Woodland.

5. Controlled (Prescribed) Burning

General Description:

Burning should be done under cool, low-wind conditions, when danger of wildfire is low. Burn as early in the spring (before April 1 if possible) as conditions permit, so ground nesting wildlife are not disturbed. Summer burning is common in the Southeast to control woody vegetation and promote herbaceous plants. Do burning only under close supervision of wildlife, forestry, and/or range professionals that have experience with controlled burns.
Results vary with the type of vegetation being burned, burning conditions, and the frequency and season of burning.

**Some General Effects of Fire Are:**
- Some understory shrubs sprout.
- Some shrubs are reduced, which improves the vigor and quality of forbs and grasses.
- Releases nutrients in soil.
- Reduces excessive dead vegetation (leaves, old grass, etc.) so seed can reach mineral soil.
- Scarifies (breaks down outside coating) some seeds so they can germinate.
- Rejuvenates grass and herbaceous vegetation, making area more productive.

**Effect on Habitat:**

**Annual Burning:**
- Stage 2, helps keep vegetative succession in stage 2.
- Stage 3, helps keep vegetative succession in stage 3.
- Stage 4, causes succession to revert to stage 3.
- Stage 5, in pines, keeps understory shrubs thinned out and stimulates grassy-weedy undergrowth if stands are properly thinned.
- Stage 6 is the same as stage 5.

*Annual burning in stage 5 and 6 vegetation is a practice used most often in the following regions: Eastern Deciduous Forest, Great Plains Grasslands, Northeast Mixed Forest, Southeast Mixed and Outer Coastal Plain Forest.*

**15- to 25-Year Interval Burning:**
- Maintains vegetative succession in stage 4 in areas dominated by fire-tolerant shrubs, such as Gambel oak, mesquite, manzanita, chamise, serviceberry, and mountain mahogany.
- Rejuvenates old, decadent shrubs, stimulating new growth.
- Reverts succession to stages 2 or 3 in areas dominated by fire-intolerant shrubs, such as sagebrush.

*Used primarily in stage 4 of plant succession in the following regions: Mediterranean, Woodland, Intermountain Foothills, Intermountain Montane, and Intermountain Sagebrush.*

**Three- to Five-Year Interval Burning:**
- Stage 2, allows succession to progress, but more slowly than if left alone.
- Stage 3, usually keeps vegetative succession in stage 3.
- Rejuvenates grass and grass-like vegetation in stage 3 and 4 wetlands.
- Periodic burning of vegetation-choked wetlands can improve the water and cover interspersion.
- Stage 4, makes shrub growth more dense due to abundant sprouting of shrubs.
- Stage 5, in pines, stimulates thicker understory shrubs if stands are properly thinned.
- Stage 6 is the same as stage 5.

*Three to five-year interval burning in stage 5 and 6 vegetation is a practice used most often in the following regions: Eastern Deciduous Forest, Great Plains Grasslands, Northeast Mixed Forest, Southeast Mixed and Outer Coastal Plain Forest.*

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**6. Corridors**

**General Description:**

“Corridors” are areas of continuous habitat that permit animals to travel securely from one habitat to another. As the landscape becomes more broken up (fragmented) from construction of roads, parking lots, urban areas, certain methods of timber harvesting, clearing for agriculture, hurricanes, and/or wild fires, etc., only small islands of suitable vegetation might remain.
**Effect on Habitat:**
- Corridors allow animals to meet and mate with other animals of the same species but from different populations, thus maintaining genetic diversity.
- Corridors also allow animals to find and use islands of suitable habitat for feeding. In an urban area, relatively unbroken corridors found along streamside (riparian) areas and ravines allow wildlife to move into parks, and other suitable habitats. Preservation, maintenance, and creation of uninterrupted corridors are very important in wildlife habitat management.

  - Corridors can be harmful if they are too small, i.e., less than 100 meters wide. Predators may be attracted to edge, and corridors then become unknowing traps for some animals. For example, the probability of predation by raccoons, skunks, bobcats, coyotes, and nest parasitism (laying eggs in another bird's nest) by brown-headed cowbirds, increases in narrow corridors.

*Note: Riparian buffers may act as corridors, but are not recommended for the same reasons. Corridors often may be needed in upland areas.*

7. Dams, Rock or Log

**General Description:**
Small (less than 1.5 feet high) dams are built across streams to raise the water level and create pools. Any structures put in a stream have potential to alter stream currents in an undesirable manner. The placement and design of such dams should be done by people who have experience with this practice.

**Effect on Habitat:**
- Used to create pools for fish to hide and rest. If designed properly, can be used to reduce some kinds of stream erosion.
- Used in areas with considerably more riffles than pools.

8. Decrease Bag/Creel/Season Limit

**Bass:**

9. Disking

**General Description:**
Areas in successional stages 2, 3, and 4 can be disked to promote the growth of annual and perennial forbs and grasses.

**Effect on Habitat:**
- Keeps vegetative succession in stage 2.
- Promotes the growth of annual forbs that some wildlife prefer for food and cover.
- In stage 3, causes succession to revert to stage 2.
- In stage 4, causes succession to revert to stages 2 or 3.
- Can be used to decrease vegetative cover and
increase interspersion in wetlands (during dry periods).

10. Fertilize Ponds

This practice is not needed often in areas where the soil is derived from limestone or other materials (as in much of the western United States) that have a high pH.

General Description:

Well-fertilized ponds can produce up to three times as many pounds of fish as unfertilized ponds. Ponds should not be fertilized if they have an aquatic weed problem.

Start fertilizing fish ponds in the spring when the water temperature reaches 60 degrees Fahrenheit. Apply at the rate of 40 pounds of 20-20-5 (or its equivalent) granular, one gallon of 1-36-0 liquid fertilizer per acre, or 8 pounds of soluble powder per acre at two-week intervals, or until a good green color (phytoplankton bloom) develops in the pond. Place the granular fertilizer on an underwater platform in water less than two feet deep. Make additional applications of fertilizer (at the same rate per surface acre) every three to four weeks, or when the water clears (becomes less green) so that you can see deeper than 24 inches into the water. Continue this program until water temperatures drop below 60 degrees Fahrenheit in the fall.

If a pond does not develop a green bloom after several fertilizations, then it probably is acidic and needs to be limed or has an aquatic weed problem. Lime is based on soil tests of pond mud. When water quality tests show the total alkalinity is below 20 ppm it should be adjusted by using agricultural lime.

Effect on Habitat:

- Needed in fish ponds with water clear enough so that a white object can be seen at 24 inches deep.
- Fertilizer in ponds stimulates phytoplankton production, which is the first step in the food chain of a fish pond.

11. Fertilize Vegetation

General Description:

A practice generally recommended for mule deer in the western regions of the United States, it improves the nutritional quality of vegetation used for forage, especially in areas heavily used during the winter. Broadcast 100 pounds of actual nitrogen per acre every three to four years.

12. Fish (pond) or Wildlife Survey

General Description:

Fish Surveys

Population balance is first established in a farm fish pond by stocking the correct number of fish. After the first year, check fish pond balance during early summer by using a 1/8-inch mesh minnow seine 15 feet long and 3 feet deep. Seine at intervals around the pond by anchoring one end at the bank, pulling the seine straight out from the bank to its full length, and then sweeping in an arc back to the
bank. Four to five seine sweeps in an average pond is usually enough.

Balance is determined by comparing age groups, condition, and numbers of bass and bluegill caught in the seine and from fishing records. Recent reproduction of both bass and bluegill in the seine indicate that the fish population is balanced. Fish caught by hook-and-line can be evaluated on body condition (fat, skinny, size of head in relation to body, etc.). Evidence of disease is a good indicator of pond imbalance.

Unwanted species (bullheads, crappie, etc.) may also be caught in the seine or when fishing, indicating that the pond needs to be poisoned or drained.

Trout do not often reproduce in ponds, so overall health of the fish is used as an indicator of pond balance. Growth rate, body condition (fat, skinny, size of head in relation to body, etc.), and evidence of disease are good indicators of pond balance.

Wildlife Surveys

Monitoring of wildlife for trends of increasing or decreasing populations or body weights of animals is important for land managers. Data on quail, white-tailed deer, breeding birds, turkey, and many other species are routinely collected by wildlife biologists using methods such as roadside counts, call counts, check stations, transects, and questionnaires. These data are then used to prescribe future harvesting or land management strategies.

13. Fish Rocks

General Description:

Large boulders are placed in streams (with hard bottoms) to improve fish habitat. The rocks need to be large enough so that small floods will not move them. This practice may cause undesirable changes in the stream flow. Location and placement of the rocks should be done under the guidance of someone with experience.

Effect on Habitat:

- Creates pools of deep and slow-flowing water used by trout for resting and hiding.
- Used in areas with considerably more riffles than pools.

14. Grain, Leave Unharvested

General Description:

Strips or blocks of grain crops (1/8 to 1/4 acre is usually sufficient) can be left unharvested. This is especially valuable if the strips are left adjacent to herbaceous, shrub, or tree cover.

Effect on Habitat:

- Provides a food source for many species of wildlife.

15. Harvest Timing (Crops/Hay)

General Description:

When possible, avoid harvesting crops or hay during nesting and fawning seasons to reduce nest destruction and mortality. Use flushing bars when possible.

In most situations it is not possible to avoid harvesting during the entire nesting season, but any significant delay can be a benefit.

16. Increase Bag/Creel/Season Limit

Bass:

Needed when seine samples and fishing records of pond reveal these situations:
Many recently hatched bluegill.
Very few medium-sized bluegill.
Bass less than one pound in poor condition.
Few or no young bass.

Increase bass harvest cautiously. Target the bass less than one pound. Spread the harvest over the entire summer.

**Bluegill:**

Needed when seine samples and fishing records of pond reveals these situations:

- No recent bluegill hatch.
- Many medium-sized bluegill in poor condition.
- Bass few, large, and in good condition.
- Target medium-sized bluegill, using seine harvest or shoreline rotenone.

**Trout:**

Needed when seine and fish records of pond reveal these situations:

- Many fish, small and in poor condition. In many areas extremely cold water reduces trout growth. In these situations harvesting more may not help much.

**Game Birds and Mammals:**

Needed when animals show signs of overpopulation such as:

- Disease.
- Destruction of habitat by crowded animals.
- Poor body condition.

- Excessive fighting.
- Few young animals in bag.
- Higher percentage of older animals than young in fall population (indicates poor reproduction due to inadequate nutrition); thinning population will leave more food to go around.

### 17. Livestock Grazing Management

**General Description:**

A practice for managing the use of vegetation by livestock. Can be used to manipulate successional stages to benefit wildlife (e.g. maintain open areas in woodlands). This practice also includes livestock exclusion when necessary.

**Some General Principles Are:**

- **Proper Grazing Use:** On native, perennial rangelands and riparian areas, do not graze more than 50 percent of the yearly growth of vegetation preferred by livestock.

- **Timing:** Avoid grazing areas during periods when wildlife and/or vegetation is vulnerable to damage. *Examples* — Grazing riparian areas in the summer can damage young shrubs and trees; grazing in spring can reduce cover needed by ground-nesting wildlife.

- **Intensity:** Relates to how many livestock are on a given area at any one time. Many livestock on an area is high intensity, few livestock is low intensity.

  High intensity grazing should be for shorter periods of time or all the vegetation will be used.

  High intensity grazing increases the chance that ground nests will be trampled, and should not be used in important nesting areas during the nesting season.

- **Rotation:** Livestock should be moved from an area before vegetation is over-used. The vegetation is allowed to recuperate (rest) before it is grazed again.

**Tools:**

- **Rotation:** Livestock should be moved from an area before vegetation is over-used. The vegetation is allowed to recuperate (rest) before it is grazed again.
Fencing, water developments, salting, and herding are the most common methods used to control livestock grazing. Whenever livestock grazing management is recommended, it is implied that the necessary tools will be available. Some information on these tools follows.

**Fencing:** Useful to protect food plots, ponds, streams, wetlands, woodlands, or other natural vegetation areas from livestock. Often necessary for managing livestock grazing (such as rotating areas being grazed, controlling access to water, etc.).

Fences interfere with movement of wildlife, especially large animals such as pronghorn, deer, and elk. They should be recommended only when necessary and designed to allow movement of wildlife.

The top wire should be a maximum of 42 inches above the ground (this allows some wildlife to jump over) and the bottom wire should be smooth and a minimum of 16 inches above the ground (this allows some wildlife to go under).

**Water Developments:** Can be used to distribute livestock grazing in semi-arid and arid regions of the United States. The more watering places available, the less likely livestock will concentrate in one area, and the more flexibility one has in managing livestock. Alternative water sources are often essential when developing grazing systems that permit occasional rest of important areas (i.e. riparian areas) during critical growing seasons.

Catchment ponds, dugouts, windmills, and spring developments discussed under Practice 42-Water Developments for Wildlife are also used to develop water for livestock.

**Salting:** Locating salting areas away from watering places and occasionally moving locations can be used to encourage uniform distribution of livestock.

**Herding:** Using horseback or other means to move animals is useful for achieving proper distribution of grazing animals. Used to discourage congregation of animals in attractive areas for long periods of time.

**Effect on Habitat:**
- Used to insure livestock grazing does not over-utilize vegetation which is also used by wildlife.
- If properly managed, livestock grazing is usually not harmful to wildlife habitat and in some instances, is used to improve wildlife habitat.
- Changes in grazing management are recommended only when it is evident that livestock use is damaging wildlife habitat or is needed to improve the habitat for selected wildlife species.
- Periodic grazing of vegetation (cattail) choked wetlands can improve water and vegetation interspersion.
- Reduces siltation, turbidity, and stream bank erosion.
- Reduces stream and pond pollution from livestock waste.

**18. Nesting Boxes Structures/Platforms**

**General Description:**

The particular design and placement of nesting structures and boxes often determines which wildlife species will use the structure. Contact a Cooperative Extension agent or wildlife specialist for specific designs of nest boxes and other artificial nesting structures.
**Boxes:** Some species have to nest in cavities that they don’t excavate themselves. If natural cavities are not available, artificial cavities (nest boxes) can be used.

Each species needs a certain kind of cavity (diameter of hole, depth, area, etc.) in a certain location (field, woods, water, etc.) and at a certain height (4 feet to 20 feet high).

**Platform:** Species such as the red-tailed hawk build nests in large trees or other structures above the ground. If nesting sites are scarce, artificial platforms placed on poles above the ground may be used.

**Structures:** Canada geese and mallards will also use platforms if they are placed near water. In wetlands dominated by open water and lacking islands or peninsulas, floating nest structures are often used by Canada geese and mallards.

**Effect on Habitat:**

- **In Wooded Areas:** Boxes are especially useful in woodlands in stage 5 succession or where trees are not old enough to provide cavities.
- **In Open Areas (Stages 2, 3, and 4):** Always useful unless an abundance of nesting cavities or locations, such as hollow fence posts, isolated den or nesting trees, etc., already exist.
- **In Wetlands:** Provides secure nesting sites in areas lacking islands, peninsulas, or tall, dense vegetation.

**19. Plant Food Plots (1/8 to 2 Acres)**

**General Description:**

Strips can be long and narrow (300 to 400 feet long and 15 to 20 feet wide) or square blocks and preferably located at the edge between two or more kinds of habitat (such as between woodland and hayfield). Best if located next to natural cover such as shrubs, etc. Food plots should be planted prior to June 1 (except for cool season annual grasses-clover mixture) to ensure maturity.

Where possible and in regions with heavy and drifting snow, plots should be square (one acre minimum) and located near cover on the downwind side. Plots should be located so that nearby shrub and tree cover does not encourage snow to drift into them. Plots must be protected from livestock.

Food plots include the planting and temporary flooding of Japanese millet in wetlands to provide food for waterfowl. Japanese millet plantings are often larger than two acres and used most often in the warmer regions of the United States.

**Effect on Habitat:**

- **Annual Food Plots - Usually Grains:** Useful in areas of natural plant succession where row-cropping (corn, soybeans, grain sorghum, small grains, etc.) is scarce. One small (1/8 to 1/4) acre plot per 15 acres or large (1 to 2 acres) plot per 60 acres.
- Provides food for many species of wildlife.
- **Perennial Food Plots - Usually Introduced Grasses and Clover or Other Forbs:** Useful in areas of row-crop farming (corn, soybeans, grain sorghum, small grains, etc.) especially where shrub field borders are scarce. Useful in most areas with absence of stage 3 succession.
- Provides both food and cover for many species of wildlife.

**20. Plant Grass and Forbs**

**General Description:**

Plant large fields of native grasses and forbs. Introduced grasses and forbs are not recommended because they do not provide suitable habitat structure. Native legumes may be used when suitable. Field size should be between 2 and 40 acres.

**Effect on Habitat:**

- Smaller fields are useful for wildlife in wooded areas with little acreage in stages 2 and 3.
- Larger fields are useful in areas with little acreage in hayfields, pastures, or small grains that are used by some wildlife species for winter survival, nesting, or roosting cover.
These fields will be used for food as well as cover by many species.

These plantings should be native plants and they should be grazed, burned, or mowed occasionally (once every 3 to 5 years) to prevent deterioration of the vegetation through litter buildup.

Contact a Cooperative Extension agent for planting recommendations.

21. Plant Mast Trees

General Description:
Mast means seed or fruit that provides food for wildlife. For the purpose of this handbook, mast trees are defined as those trees which produce an annual crop of acorns or other nuts. Mast trees produce an abundance of mast and they may be a desirable supplement to plant for wildlife. Plant mast trees in early spring when they are still dormant.

For specifics about what, when, and how to plant, contact your local Cooperative Extension agent or Natural Resource Conservation Service office.

Effect on Habitat:
- Especially useful for deer, squirrels, turkeys, and wood ducks in areas with little available mast, such as large expanses of farmland, pine woodland, field borders, urban areas, etc.

22. Plant Trees or Shrubs

General Description:
When properly located, shrubs and trees can benefit many species of wildlife.

Fruiting shrubs and small evergreen trees are especially good for urban areas, fencerows, hedgerows, odd-areas, property boundary markers, and other idle land plantings. It may also be desirable to plant large trees and willows in some areas.

In dry regions, irrigation or water harvesting is often needed to grow shrubs and trees.

In large open areas, multi-row plantings of at least 15 rows of trees and shrubs are beneficial, especially if planted adjacent to tall herbaceous cover or a good food source. It is best to plant shrubs and trees in the early spring when they are still dormant.

For specifics about what, when, and how to plant, contact your local Cooperative Extension agent or Natural Resource Conservation Service office.

Effect on Habitat:
- Useful along fences in areas where field borders (such as fencerows) are scarce.
- They are especially useful to make travel lanes for wildlife to move safely across open fields between two areas of cover.
- Also useful along the edges between fields and woodlands, around farm homesteads, and urban areas.
- Can be a valuable practice used to restore and improve riparian areas.

23. Ponds/Lakes, Artificial Reefs

General Description:
Large rocks can be piled together, or brush (used Christmas trees are good) weighted down and submerged to provide cover for fish.

This practice is recommended for ponds or lakes that are larger than 10 acres. In smaller bodies of water, artificial reefs may allow prey fish (bluegill, etc.) to be overly successful at avoiding predators. This can lead to an overabundance of prey fish that are in poor condition. Structures are usually placed on the ice during winter and allowed to sink. Be cautious about thickness of the ice.

24. Ponds, Clear Muddy Water

General Description:
You can clear muddy water in any of these ways:
Broadcast agricultural limestone on the pond surface at the rate of 500 to 1000 pounds per surface acre or at the rate recommended based on a pond mud soil test.

Broadcast agricultural gypsum on the pond surface at 12 to 25 pounds per 1000 cubic feet of water (500-1000 pounds per acre-foot of water).

Dissolve aluminum potassium sulfate (commercial alum crystals) in water and spread on the entire surface at the rate of 5 to 15 pounds per acre-foot of water.

Broadcast cottonseed meal on the pond surface at the rate of 100 pounds per acre.

**Effect on Habitat:**
- Removes/settles silt in the water, allowing sunlight to stimulate phytoplankton.
- This stimulates the first step in the pond food chain.
- At the same time, any erosion of the watershed (which may have caused the muddy water) must be stopped.
- Common carp may also be the cause of muddy water. Poisoning (see Practice 33) or draining the pond may be necessary for pond renovation.

## 25. Pond Construction

**General Description:**
This practice should be recommended for creating new ponds and wetlands with permanent water. There is no need to mark additional pond maintenance practices.

Dams, dikes, and levees can be used in natural drainages to create ponds and wetlands with permanent water for use by fish and wildlife.

The design varies, depending on the purpose for constructing the pond and the region where it is constructed. For example, steep sloping sides benefit fish and gentle sloping banks benefit waterfowl.

*Contact your local Cooperative Extension Service or Natural Resource Conservation Service office for design details.*

## 26. Ponds, Diversion Ditches

**General Description:**
Diversion ditches should be constructed so that a small amount of water enters the pond and exits the spillway. The bulk of water is diverted around the pond through the diversion ditch. In extremely dry regions, diversion ditches can be used to bring extra water to the pond from surrounding watersheds during rains.

**Effect on Habitat:**
- Needed for ponds with too much water flowing through them. Too much water dilutes and wastes fertilizer and requires expensive water control structures for managing the water flow.
- Used to protect ponds from flood waters.
- In dry regions these are used to fill ponds that have inadequate watersheds.

## 27. Ponds, Deepen Edges

**General Description:**
Usually used to improve ponds for fish. To deepen pond edges, draw the water down, let banks dry out, and use a bulldozer or tractor with blade.

Edges should be deepened to a minimum of two to three feet with steep side slopes.
Soil removed from the edge can be piled around the bank and then smoothed out and planted to grass and legumes.

**Effect on Habitat:**
- Needed to reduce rooted aquatic vegetation around the edge of a pond.

### 28. Ponds, Remove Trees Near Dike

**General Description:**
Roots of trees growing on the dam will loosen the compacted soil and cause leaks. This practice is needed any time trees occur on the dam or when trees occur around more than 1/3 of the remaining pond bank. It also improves the pond’s capability to hold water, and cleans pond banks for use by doves.

**Effect on Habitat:**
- Trees growing around the pond can reduce the water level.
- Some species (such as doves) prefer clean banks for watering.
- Some nearby trees are desirable for many wildlife species, but need not occupy more than 1/3 of the pond bank.

### 29. Ponds, Repair Spillway

**General Description:**
Needed if the spillway in existing dam or dike is eroding or otherwise damaged, keeping the pond level too low and increasing the chance of the dam washing away during heavy rains.

### 30. Ponds, Reseed Watershed/Filter Strips

**Effect on Habitat:**
- One method of reducing erosion in the watershed.
- Reduces silt entering the pond water and allows sunlight to promote phytoplankton.
- Improves water quality and provides nesting, brooding and winter cover for some wildlife.

### 31. Ponds, Restock

**General Description:**
Restock only after all fish in pond are removed, either by draining pond or applying rotenone.

Rotenone kills fish by interfering with the fish’s ability to use oxygen or respire. It is applied as a liquid or powder during early fall. Bluegill fingerlings are then stocked in the late fall, and bass fingerlings are stocked the following June.

Present stocking rates are 1000 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. Each state has its own stocking recommendations.

As many as 50 channel catfish fingerlings per acre may also be stocked at the same time as the bluegill.

Trout are not often stocked with bluegill and bass.

**Effect on Habitat:**
- The techniques of draining or rotenoning ponds allow unbalanced fish populations to be removed and new ones started with a balanced ratio of bass to bluegill.
- Needed in ponds with:
  - Extremely unbalanced fish populations
  - An overabundance of small, stunted bluegill
  - Few fish of usable size
Presence of wild fish species such as carp, shad, gold fish, suckers, crappie, green sunfish, or bullhead catfish

32. Ponds, Stop Leaks

General Description:
Leaks in existing ponds may be stopped with:
- Bentonite at 100 pounds per 100 square feet.
- Tetrasodium pyrophosphate at two tons per acre.
- Soda ash at five tons per acre.
- In severe cases, plastic liners may be used (this is expensive).

Effect on Habitat:
- Necessary in leaking ponds with limited water supply.

33. Riparian Buffers

General Description:
A riparian buffer is an area of trees, shrubs, forbs, and grasses located adjacent to streams, lakes, ponds, and wetlands. Riparian buffers are important for providing habitat and protecting water quality in streams and wetlands. Recommended minimum width — 100’.

Effect on Habitat:
- Provide shade for summer cooling and cover in the stream or wetland.
- Provide corridors for wildlife to move from one habitat to another.
- Slows overland flow of water and helps maintain water quality.
- Provide structural diversity both adjacent to and within the stream. As trees die then fall into the stream, the large woody debris helps create pools and riffles and provides cover for fish and other aquatic life.
- Leaves, stems, branches, and large woody debris fall into streams providing nutrition and habitat for aquatic insects, a major food source for fish and amphibians.

Note that this is a distinctly different practice than corridors. If an area needs corridors, that will need to be checked in addition to this practice.

34. Roosting Platforms/Perching Poles

General Description:
Some wildlife species perch or roost on fence posts, in trees, or in tall shrubs to avoid danger from predators and/or to search for food on the ground below. If sufficient trees or tall shrubs are not available, artificial platforms covered with brush or perch poles can be useful. The particular design and placement of roosting platforms and perch poles often determines which wildlife species will use the structure.

Contact your Cooperative Extension agent or wildlife specialist for details on specific designs and placement of these structures.

Effect on Habitat:
- Useful in open areas that lack roost or perch sites.

35. Root Plowing

General Description:
A large winged plow is pulled under the ground by bulldozers to cut the roots of shrubs. It is usually used in combination with herbicide treatments and grass plantings to convert (usually temporarily) mesquite shrublands into grasslands. Although this tool has many uses, for the purposes of this handbook it will be used only in the Prairie Brushland and Woodland Regions found in Texas to manipulate mesquite shrublands.

Effect on Habitat:

- Stage 4, when combined with other treatments, reverts succession to stages 2 or 3. Removes competition of some kinds of shrubs, allowing grasses and forbs to grow better.
- Sometimes keeps vegetative succession in stage 4. Maintains low dense shrub growth by encouraging resprouting.

36. Small Dikes, for Temporary Flooding

General Description:

Small dikes are used to temporarily flood (usually in the fall or winter) feeding and nesting areas for waterfowl. Grain fields, Japanese millet plantings, and stage 5 and 6 hardwood woodlands are examples of feeding areas flooded to attract waterfowl. Temporary flooding is also used to improve existing wetlands as nesting habitat for some wildlife such as the redhead duck, and to control the growth of aquatic vegetation.

This practice is only recommended in existing wetlands or potential waterfowl feeding and nesting areas when appropriate.

When this practice is recommended it is implied that adequate water control structures will be included and should not be an additional recommendation.

37. Snags, Dead and Down Woody Material

General Description:

In forested habitat, leave or provide a minimum of seven snags, 10-20+ inches in diameter, and four down logs per acre. Large down logs 24 inches in diameter, 50 feet long are optimal. In intensively managed forests of smaller material, leave logs of 12+ inches in diameter and 20 feet long — minimum. Conifer logs usually decay slower and provide habitat over a longer period of time. Logs of different species with remaining limbs, bark, and stumps should be retained for habitat diversity.

Snags should be retained as an eventual source of dead and down woody material in forested habitats.

In streams, woody material creates stream diversity. It creates structure that may be used as cover.

Effect on Habitat:

- Dead and down wood is important to numerous species of terrestrial wildlife as sites for feeding, reproducing, hiding, and resting. The use of dead and down material varies as the log decomposes.
- Down logs in various stages of decay provide denning sites and a rich food source for insect- and fungi-eating animals.
- Down logs provide drumming sites that are important for mating rituals for ruffed grouse.
- As logs decompose, they can hold more moisture and provide an essential cool, moist microhabitat for many species of reptiles, amphibians, and small mammals.
Dead and down material provides sites for regeneration of some tree and shrub species.

Dead and decaying logs serve as sites for nitrogen fixation by some bacteria.

Large logs create in-stream pools and riffles (see Rainbow Trout and Pacific Salmon).

Logs, large limbs, and smaller branches provide shade, cover, and food for aquatic organisms, some of which are food for younger salmon or trout.

Snags provide roosting and perching sites for many birds.

Snags provide sites for cavity construction.

Snags provide foraging sites for many species.

38. Streams, Determine Balance

General Description:
Seining is usually not effective for collecting fish in streams. Fish in streams are usually collected using a fishing rod or are electroshocked.

Electroshocking involves running a small electrical current between two rods. The rods are moved up and down the stream and fish that are between the rods are stunned and float to the surface.

The fish are collected in a net and the age, condition, and numbers are recorded to determine the stream balance. The fish are then revived and returned to the stream.

39. Streams, Remove Fish Barriers

General Description:
Remove or replace culverts that prevent fish passage to upstream habitat areas. Culverts with great drops below them or with too fast of water flowing through them, can block fish from upstream habitats. These culverts can be replace with arched or bottomless culverts or with bridges. Dams can prevent fish from migrating either upstream or downstream. Removal of dams will allow fish to use habitats upstream of the barrier. In some cases, fish passage around barriers can be provided using a “fish ladder” or steplog structures.

Effect on Habitat:
- Provides more habitat for fish to spawn and rear.
- Allows fish to migrate within the stream system and between the stream and ocean to complete their life cycles.

40. Tillage, Delay in Spring

General Description:
Stubble of small grain (wheat, barley, and oats) can be left standing until after nesting season on fallow ground. Fallow ground is ground that is left to rest (no crop planted) for a growing season.

Effect on Habitat:
- Provides undisturbed nesting cover for many species of birds.
- Provides some grain for wildlife food.

41. Tillage, Eliminate in Fall

General Description:
When tillage is necessary, inversion tillage (soil is turned over and covers up crop residue) such as mold board or disc plowing should be avoided. Tillage implements such as chisel plows and rod weeders can be used to do tillage operations without turning the soil over.

**Effect on Habitat:**
- Provides waste grain as a food source used by many species of wildlife.

### 42. Timber Harvest, Clear-cut

**General Description:**
A type of timber management where all trees are harvested at the same time on a tract of land, usually for the purpose of regenerating a shade intolerant timber species. Often prescribed burning is used to prepare the site to plant trees. It is assumed this will be done if appropriate and should not be recommended in addition to this practice.

**Effect on Habitat:**
- Clear-cuts can be long and narrow with irregular shapes to increase habitat for wildlife species that are attracted to edge, or they can be circular to minimize edge for those species that do not benefit from the consequences of edge (i.e., predators, brown-headed cowbirds). The increased sprouting of shrubs, grasses, and forbs that result from sunlight reaching the forest floor following a clear-cut is beneficial to several wildlife species. Many wildlife species also prefer the edge between forest and openings created by such cuts.
- This practice can be harmful to wildlife species such as red squirrels, woodpeckers, etc. that need woodlands to supply all of their welfare requirements. But again, if harvested tracts are not too large and there are sufficient amounts of surrounding forest, these species should remain.
- Clear-cuts are useful in large forested areas with very little acreage in stages 2, 3, and 4, of succession. Reverts stages 5 and 6 to 2, 3, and 4, with more emphasis on stage 4. If controlled burning is used to prepare the site, then stages 2 and 3 will predominate over stage 4 in the short term.
- When recommending clear-cuts, take into consideration the availability of snag and cavity trees in the immediate vicinity and leave them when possible. At least three to four snags and den trees per acre should be left in clear-cut areas.

### 43. Timber Harvest, Selective Cut

**General Description:**
Also called “all-aged management.” Only selected trees are cut, a few at a time. Stands managed this way have trees of all ages.

This benefits many different species of wildlife. Animals preferring stages 2, 3, and 4 of succession benefit from the sprouting of shrubs, grasses, and forbs where individual trees were cut, yet mature trees are also present for species that prefer stages 5 and 6.

**Effect on Habitat:**
- Stimulates shrub, grass, and forb understory production in woodlands due to removal of large tree crowns which would otherwise cause shading.
- Also stimulates growth of mast-producing and other surrounding trees.
- At least 3 to 4 den trees and 3 to 4 old mature and large dead (snags) trees per acre should be maintained.

### 44. Water Control Structures

**General Description:**

Various structures made out of concrete, pipes, wood, etc., are useful to control the water level in wetlands and ponds.

They usually are combined with dams and shallow dikes for water control.

*Recommend only when inadequate or no structures are present on an existing dam or dike.*
*For specific designs of such structures see the local Natural Resources Conservation Service office.*

**Effect on Habitat:**
- Allows management of water levels to increase or decrease the amount and type of aquatic vegetation. Useful for creating a desirable mix (interspersion) of open water and emergent aquatic vegetation.
- Can be used to create shallow water areas.
- Can be used to manage the quality of water in the pond or wetland and for control of unwanted fish.
- Can be used to control water levels in flooded timber, drawing water down to prevent tree mortality.

### 45. Water Developments for Wildlife

**General Description:**

You can provide drinking water for wildlife and livestock in these ways:

- **Guzzlers:** Built by covering an area with an apron of fiberglass or some other material that sheds rain. The water is collected in a storage tank and slowly released into a trough from which wildlife can drink.

- **Dugouts:** Large, earthen catchment basins (built with bulldozers, backhoes, or draglines) designed to collect water for use by livestock and wildlife for drinking. They can be designed to collect run-off water from precipitation, or in areas with a high water table, they can be filled by ground water. Side slopes should be gentle to provide easy access to the water for wildlife. They are also often used by waterfowl for resting and brood habitat.

- **Catchment Ponds:** Earthen dikes are constructed to retain water (usually run-off water from precipitation) in natural drainage areas. Placement of the dike is critical to avoid damage by floods and also have the ability to collect sufficient water. They are also used by waterfowl for resting and brood habitat.

- **Windmills:** A well is drilled in the ground and the windmill is used to pump water out of the ground and into a watering trough. The trough should be designed so wildlife can use it without danger of drowning.
**Spring Developments:** Water seeping out of the ground or near the ground surface is collected in perforated pipe and put in a watering trough. This practice is feasible only in areas that have springs.

**Birdbaths and Backyard Ponds:** Small ponds can be constructed in backyards and other urban areas to provide water for a variety of wildlife. Birdbaths are also useful for providing water in urban settings.

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**46. Wildlife Damage Management**

**General Description:**

Professional wildlife biologists often have to exclude, trap, relocate, euthanize (humanely put to death), repel, poison, shoot, or frighten individual animals in order to reduce or eliminate damaging behaviors or health hazards. Examples of wildlife damage are coyotes that prey on sheep or pets, raccoons or bats in the attic, deer eating ornamental plants in the yard, skunks under the house, snakes in the house, bird strikes at airports, cormorants eating catfish fingerlings at an aquaculture facility, or starlings roosting in urban trees and defecating on sidewalks, creating a health hazard.

Wildlife damage management may be recommended in addition to the practice of increasing bag/creel limits if individual animals are nuisances.

- Direct control techniques like relocation, trapping, toxicants on livestock collars, and selectively shooting only problem animals are commonly used and effective.
- Nonlethal methods of predator control include sheep confinement and herding, use of guard dogs, and the use of exclusion fences. Nonlethal control techniques like repellents (also used on collars mounted on livestock prey-at-risk) and chemical sterilization are currently extremely limited in their usefulness.
- Methods of controlling herbivores (deer, rabbits, etc.) include exclusion fences, taste and area repellants, scare tactics (such as propane cannons), decoys (of predators), and others. Trapping and relocating large animals like deer and elk is not cost effective.
- Methods of bird control include scary balloons, exclusion devices, live trap and relocation, and others.

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**47. Tall Fescue Conversion (Missouri Only)**

**General Description:**

Tall fescue (Kentucky 31) is an introduced, cool season, perennial bunchgrass with short rhizomes that has been planted for livestock forage, erosion control and conservation plantings throughout Missouri. Tall fescue does not provide adequate nesting, brood-rearing or winter habitat for many grassland wildlife species, particularly northern bobwhite quail, tall fescue should be controlled and replaced with mixtures of native warm-season grasses and legumes. Tall fescue can eventually be eliminated through such management practices as prescribed burning, disking and use of recommended herbicide.