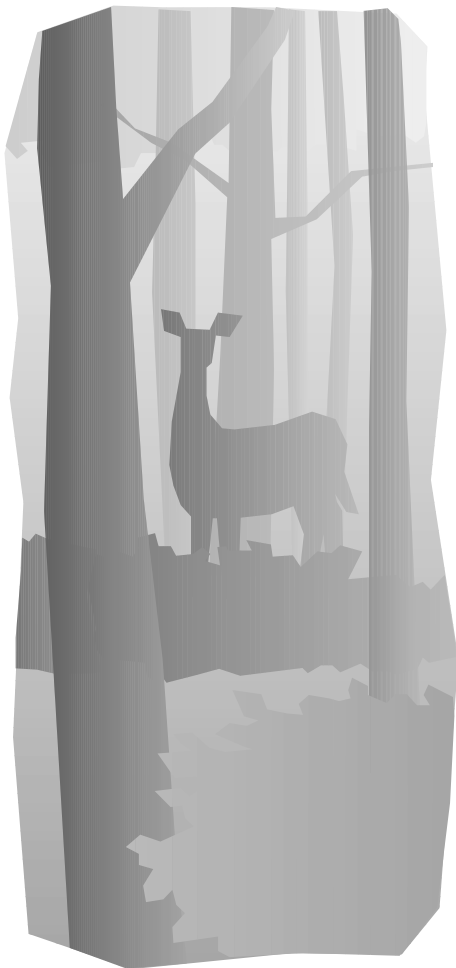




P R I N C I P L E S O F

Wildlife

Management in Alabama



Wildlife management and other natural resource fields are both arts and sciences that deal with complex interactions in the environment. Wildlife “science” is based on scientific principles, but wildlife “management” requires creative use of the scientific principles. This publication presents information on some of these important principles, including

- Wildlife management concepts and terms.
- Habitat needs and management recommendations for selected wildlife species.
- Wildlife management practices and their effects on habitat.

Some of the principles presented here have been simplified to make the materials more understandable. In addition, costs and budgets have not been considered when recommending practices. In actual situations, however, wildlife managers must consider economics when planning and recommending management practices. In real-life management cases, it is always wise to call upon trained, experienced professionals to assist you in making proper decisions to meet your goals and objectives.

Wildlife Management Concepts And Terms

Before you can evaluate wildlife habitat and make management recommendations, you need to understand some basic concepts about habitat and its relation to different wildlife species. This section presents some of the basic concepts. It is important that you study and understand them.

Concept 1 Habitat Requirements

The four basic habitat requirements of all living organisms are food, water, space, and cover. Each species has its own set of specific requirements. For example, gray squirrels use acorns for food, while woodpeckers eat 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 they eat in the summer. The cover they need for nesting may be much different than the cover needed to survive 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 specific featured wildlife species. The other, which is explained later in this publication 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, someone must first decide which species are to be favored. Landowners may

have certain objectives for specific species, or the general public may have concerns about 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, use management practices to improve the area's ability to supply needed requirements.

It is usually best to select management practices that provide the requirements that are in the shortest supply. 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, 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 Plant Succession

Vegetation and water are the basis of habitat management. Every acre of soil and water has a definite sequence of plant types that occurs over time. The different stages of this sequence are called successional stages.

We can usually 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 is stable and will remain the same for long periods of time. If humans or nature disturb the soil or water level, succession may be set back and the cycle will continue forward from the new starting point.

In wildlife management, 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 grasses.
3. Perennial forbs and grasses.
4. Shrubs.
5. Young woodland or trees.
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 Grassland Region, lack of precipitation often prevents succession from proceeding past stage 3. In this case, stage 3 would be considered the climax stage.

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 naturally occurring fires.

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

Nature never gives up. Even abandoned concrete parking lots are eventually taken over by

The Stages of Plant Succession (From Bare Ground To Woodland)



Stage 1
Bare ground



Stage 2
Annual forbs and grasses



Stage 3
Perennial forbs and grasses



Stage 4
Shrubs



Stage 5
Young woodland or trees



Stage 6
Mature woodland or trees

plants, which first grow in the cracks and around the edges. If left alone, concrete parking lots will eventually become “habitat” for some wildlife species.

Concept 4 **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 highest level is usually comprised 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 an important factor in managing 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 plant succession may have a variety of layers, comprised of grasses, forbs, shrubs, and trees. Another stage 6 woodland may have only one distinct layer of tall trees.

Concept 5 **Arrangement And** **Interspersion**

How different successional stages or vegetation types are situated in relation to each other 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, the different successional stages must be close to each other to allow safe travel for wildlife. Some species obtain all their habitat requirements from only one successional stage. Mixing plots of different successional stages within an

area is called interspersion. Usually, more interspersion supports a greater variety of wildlife.

Concept 6 **Edges And Contrast**

The boundary where two or more different 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. However, a change can be less distinct with a gradual transition from one stage to another. 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 food, cover, and other habitat requirements are arranged close together.

Edges produced when successional stages have extremely different types of vegetation are defined as having high contrast. There is high contrast where an area in stage 2 (grass and forbs) meets an area in stage 6 (tall trees) of plant succession. A boundary between stages 2 and 3 has low contrast. In general, edges with high contrast have more species of wildlife than edges with low contrast.



High-contrast edge



Low-contrast edge

Concept 7 **Amount of Edge And Size** **of Areas In One** **Successional Stage**

Edge is not beneficial for all wildlife. Some wildlife species need unbroken areas in a certain successional stage to provide some or all of their habitat requirements. A balance of edge with blocks of vegetation in one successional stage is desirable. Areas with unbroken blocks that are 10 to 40 acres in size are considered to have a good balance of edge and unbroken blocks. In large forests, blocks of up to 100 acres may be desirable.

Concept 8 **Corridors**

Corridors are areas of continuous habitat that permit animals to travel securely from one habitat to another. As environments become more broken up (fragmented) from construction of roads, parking lots, urban areas, harvesting of timber, clearing for agriculture, etc., small islands of vegetation remain.

Corridors allow animals to find and use the islands of suitable habitat. For example, in an urban area, relatively unbroken corridors found along *riparian* areas and ravines allow wildlife

to move into parks and other suitable habitats. Preservation, maintenance, and creation of unbroken corridors are very important in wildlife habitat management.

Concept 9 **Species Richness**

Species richness is defined as the number of different kinds of wildlife found in an area. As discussed earlier, one goal in wildlife habitat management may be to provide habitat for as many species as possible. Lands that are high in species richness usually have many of the following characteristics:

- A mixture of areas in different successional stages.
- A balance of edges with unbroken blocks of vegetation in one successional stage.
- Unbroken blocks of 10 to 40 acres.
- Edges with high contrast.
- A wide variety of vegetation layers present within each area containing only one successional stage.

These characteristics can be used to estimate the relative number of different wildlife species that may be present in separate areas. They also may be used to identify management practices that could increase species richness. For example, consider an area that is in stage 6 of plant succession. It has been proposed to harvest the trees by clear-cutting half of the area. Clear-cuts in 40-acre blocks that leave adjacent unharvested blocks 40 acres in size would be desirable. Strips or corridors of trees that link the larger unharvested blocks together could be left uncut (see Concept 8, Corridors).

Remember, when managing habitat for species richness, it is often not possible to provide the best habitat for featured species.

Instead of providing the best habitat possible for one species, the goal is to provide some habitat for as many species as possible.

Concept 10 **Carrying Capacity**

There is a limit (carrying capacity) to how many animals can live in a habitat. 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. When this happens, all extra or surplus animals will be lost in an existing habitat. Young wildlife and animals in poor health experience the highest death rates. 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, these efforts will fail. A long-term increase in population can only be accomplished by increasing the habitat's carrying capacity.

Concept 11 **Pond Dynamics**

No two ponds are ever exactly alike. Even ponds side-by-side and in the same watershed can look very distinctive from one another and each may respond somewhat differently to management efforts. These visual differences are usually associ-

ated with water quality and algal bloom differences. Management efforts are meant to control water quality, improve fishing, and attract wildlife.

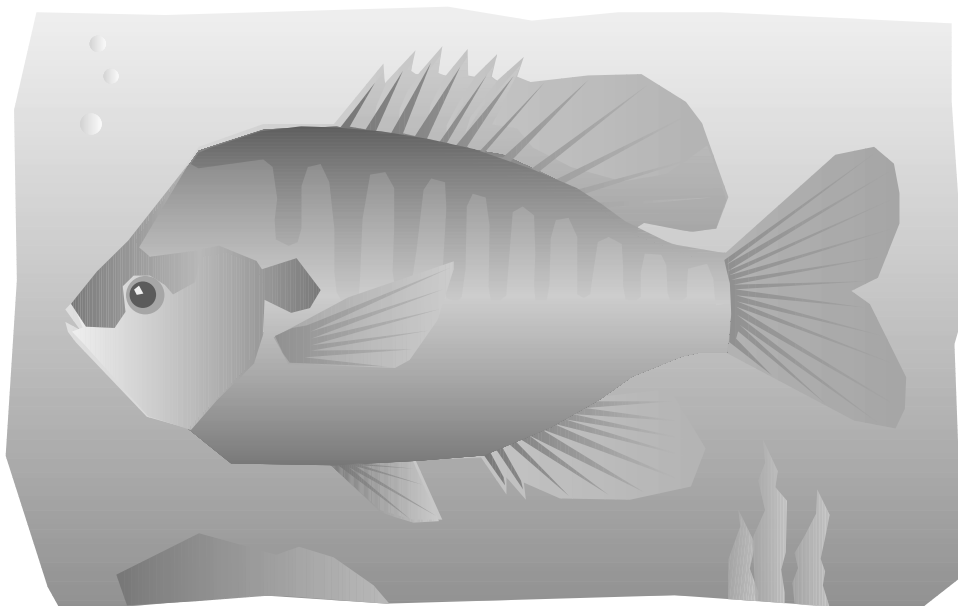
Dissolved oxygen, alkalinity, hardness, and pH are water quality factors that can be managed in ponds. Water quality affects the natural production of food in the pond and the health of the fish.

Oxygen dissolves in water from the atmosphere through the action of wind and waves or is produced by aquatic plants in the process of photosynthesis. Oxygen is only slightly soluble in water (measured in parts per million—ppm) and can drop to lethal concentrations in ponds. Ponds seldom have more than 10 or 12 ppm dissolved oxygen, even on sunny or windy days. However, dissolved oxygen below 4 ppm is stressful to most fish and below 2 ppm will kill many fish. Aquatic plants, particularly planktonic algae (or phytoplankton), produce most of the oxygen dissolved in 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.) consume oxygen and

the dissolved oxygen levels 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 in 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 growth of natural food organisms. Ponds should have a pH that fluctuates between 6.5 and 9, and 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 1 to 5 tons per acre.

Plankton is the term for all microscopic and near microscopic life that floats in the water. Plankton is divided into animal (zooplankton) and plant (phytoplankton) groups. Phytoplankton (microscopic algae) are the base of the pond food chain. Zooplankton and aquatic insects feed on phytoplankton, and they, in turn, are eaten by small fish (fry). 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.



Habitat Needs And Management Recommendations For Selected Wildlife Species

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 or selective cut small areas in large expanses of stage 5 and 6 woodlands.
- Manage livestock grazing to leave enough herbaceous canopy to support insects and small rodents.

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.

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.

Water: Robins require water daily in warm seasons. Obtain water from yard irrigation, rain filled gutters, low lying areas, ponds, etc.

- Provide birdbaths and pans of water. Do not place water in areas where cats and other pets can catch the birds.

Brown Thrasher

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

Habitat Requirements:

Food: Invertebrates and plant seeds are the principal foods. Forage primarily on the ground. 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. Will use areas that have shrubs only. Need a minimum of 2.5 acres of woody vegetation to support a breeding population.

- Selective-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 (shelter belts, hedgerows, field borders, clumps).
- Use brush chopping, chaining, roller beating, and controlled (prescribed) burning to rejuvenate and improve habitat in large areas of old stage 4 vegetation.
- Manage livestock grazing in riparian areas and other woody areas so shrubs and trees can regenerate and ground litter is present. Grazing in the winter usually does less damage to woody vegetation than at other times of year.

Water: Requirements unknown.

Eastern Bluebird

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. They also eat a limited amount of fruit. Bluebirds usually forage in open areas.

- Clear-cut or selective cut small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 5 and 6 woodland.
- Brush chop, chain, or roller beat, small areas (40 acres maximum, 10 to 20 acres preferred) in large expanses of stage 4 vegetation.

- Control burn small areas in large expanses of stage 4 and 5 vegetation.

- Use livestock grazing to keep some areas in stage 2 and 3 vegetation.

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

- Leave three to four 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. Space nest boxes more than 200 feet apart.

- Plant shrubs and trees along fencerows, field borders, etc.

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

Hairy Woodpecker

General Habitat Preference: Stages 4, 5, and 6 of plant succession are best habitat. Will use stage 3 of plant succession if areas with mature trees are nearby. 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 in 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 year.

Water: Hairy woodpeckers probably obtain necessary water from diet.

Hummingbird

General Habitat Preference: Found in or near mixed woodlands and forests rich in flowering plants. Prefers stages 5 and 6 of plant succession mixed with areas in stages 2, 3, and 4. In urban settings, prefers 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 the 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, lilac, salvia, trumpet vine, and various fruit trees.

- Use artificial feeders filled with sugar water as a substitute (1 part table sugar to 4 parts warm water). Never use honey rather than sugar as it cannot be digested by hummingbirds. Keep feeders clean.

- 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 build nests in secluded areas on houses and buildings. 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.

Mourning Dove

General Habitat Preference: Stages 2 and 3 of plant succession with some shrubs and trees nearby. Often use agriculture areas for feeding.

Habitat Requirements:

Food: Waste grain from cropland and a variety of grass and forb seeds.

- Do not till in fall after harvest of small grain crops. Leave waste grain available.

- 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 or selective 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 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.

- Use livestock grazing to keep some areas in stage 2 and 3 vegetation.

- Disk small areas in large expanses of stage 2 and 3 to encourage annual forbs and grasses.

- Lime fields as needed when determined necessary by soil tests.

Cover: Prefer tall shrubs and trees for nesting and loafing. Nest is made of twigs placed on branches of shrub or tree. Nests are also placed on 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 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: Require water daily. Prefer shorelines and banks without vegetation.

- Where water is limited or absent, develop water sources (such as catchment ponds, guzzlers, windmills, and spring developments).

- Remove trees near dam.
- Repair spillway.
- Stop pond leaks.

Northern Bobwhite

General Habitat Preference: Stages 2, 3, and 4 of plant succession interspersed. Ideally, habitat components are made up of one quarter grassland, one half cropland, one eighth shrub cover, and one eighth woodland.

Habitat Requirements:

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

- Plant $\frac{1}{8}$ to $\frac{1}{4}$ acre annual food plots in areas with too little cropland. One plot per 15 acres maximum.

- Leave some grain unharvested.

- Plant $\frac{1}{8}$ to $\frac{1}{4}$ acre perennial food plots in areas with too little permanent food and cover. Again, 1 plot per 15 acres maximum.

- Clear-cut small areas (small, 10-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 (10 acres or less) in large expanses of stage 4 vegetation.

- Control (prescribe) burn small areas (10 acres or less) in large expanses of stage 3 and 4 vegetation. Annual burning in stage 5 and 6 woodlands is also beneficial.

- Disk small areas in large expanses of stage 3 and 4 to en-

courage annual forbs and grasses used by bobwhite.

- Livestock grazing should avoid using planted food plots. Ample amount 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.

- Lime fields as needed when determined necessary by soil tests.

- Do not till in fall after harvest of small grain crops. Leave waste grain available.

Cover: Thick shrubs for hiding and roosting cover.

- 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: Require water regularly in warm seasons.

- In the Woodland and portions of the Prairie Brushland Regions where available water is limited or absent, development of water sources is desirable (such as ponds, dugouts, guzzlers, windmills, and spring developments).

Wild Turkey

General Habitat Preference: One-half to three-quarters of range in stages 5 and 6 of plant succession interspersed with areas in stages 3 and 4 of plant succession.

Habitat Requirements:

Food: Forage mostly on the ground for herbaceous plant seeds, nuts, acorns, and insects. 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 3 to 5 years in stage 4 and 5 vegetation in eastern and southern United States.

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

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

- Plant several perennial food plots and small (1 to 10 acre) fields to grasses and legumes in large expanses of stages 4, 5, or 6 vegetation and in any other areas where food is limited.

- Plant mast trees.

- 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.

- Lime fields as needed when determined necessary by soil tests.

Cover: Nest is shallow depression on ground lined with leaves and grass that is well concealed in thick shrubs or woodlands. Usually nest within ¼ mile of available water. Roost in trees or tall shrubs at night.

- In some areas will use artificial roost structures.

- Maintain a significant component of vegetation in stages 5 and 6 of succession, especially near streams.

- Plant trees and shrubs where cover is sparse.

- Livestock grazing management should leave thick herbaceous cover for nesting. Spring grazing can be detrimental to nesting habitat, especially in riparian areas.

Water: Require water frequently. In Alabama, the availability of water is usually not considered a limiting factor to wild turkey populations. Turkeys may acquire water from succulent vegetation, fruits, insects, or free-standing water.

Wood Duck

General Habitat Preference: Stage 5 woodlands flooded with water, open water adjacent to stage 5 and 6 woodlands, or wetlands dominated by trees.

Habitat Requirements:

Food: Fruits and nuts of woody plants, some grains, 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.

- 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 where aquatic emergent vegetation can grow.

- Manage livestock grazing to maintain thick herbaceous vegetation surrounding pond and in watershed that drains into

pond. Develop livestock watering facilities away from pond or allow access to only a small area of pond.

Cover: Nest in cavities in trees of flooded woodlands or adjacent to water. Use wetlands with an abundance of aquatic vegetation to raise young.

- Nest boxes can be provided 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 adjacent to areas dominated by emergent aquatic vegetation.

- Remove trees near dam.

- Repair spillway.

- Stop leaks in ponds.

Water: Require water as described above.

Eastern Cottontail

General Habitat Preference: Stages 3 and 4 of plant succession. Ideally, habitat components made up of one-third grassland, one-third cropland, and one-third shrub cover all interspersed together. Also use parks, golf courses, and stream corridors in urban areas.

Habitat Requirements:

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

- Plant ⅛ to ¼ acre annual food crops (grain sorghum is good) in areas with too little cropland. One plot per 15 acres maximum.

- Plant ⅛ to ¼ acre perennial food crops (grass and clover) in areas with too little grassland. Again, 1 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.

- Clear-cut or selective 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.

- Lime fields as needed when determined necessary by soil tests.

Cover: 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. In urban areas this practice may not be compatible with the landowners landscaping goals.

Water: Obtain necessary water from diet.

Eastern Gray Squirrel

General Habitat Preference: Deciduous woodlands in stages 5 and 6 of plant succession.

Habitat Requirements:

Food: Spend much time foraging on the ground. 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 management in large expanses 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.

- Plant trees and shrubs in ravines, along field borders, and in other idle land areas.

Cover: Nest in cavities in trees or build nests out of twigs and leaves. Usually place nest in the crotch of a tree over 30 feet above the ground. In areas where den sites are scarce, 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.

Water: In warm seasons require water daily.

White-tailed Deer

General Habitat Preference: Stages 3, 4, and 5 of plant succession all interspersed together.

Habitat Requirements:

Food: A variety of shrubs, forbs, grasses, and waste grain. Acorns and nuts are favorite foods.

- 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 1-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.

- Plant fields of grasses and legumes in large expanses of stage 4, 5, and 6 vegetation.

Controlled burn at three-year intervals in stage 5 pine woodlands or periodically in stage 3 and 4 vegetation.

- Brush chop small areas to maintain stage 3 and 4 vegetation.

- Manage livestock grazing to leave some forbs, grasses, shrubs, and trees available for food and cover. May include the development of livestock watering facilities in upland areas to discourage congregation of livestock and overuse in riparian areas.

- Lime fields as needed when determined necessary by soil tests.

Cover: Use woodlands and tall shrubs for hiding and travel cover.

- Plant trees and shrubs in ravines, along field borders, and in other idle land areas.

Water: Drink water when it is available, but can go for long periods without it.

Butterflies

General Habitat Preference: In urban areas are found in gardens, yards, and parks planted with shrubs and flowers that attract butterflies. Often lay eggs on a specific kind of plant.

Habitat Requirements:

Food: Usually drink 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 cinquefolia, and butterfly plant.

- Plant and maintain specific types of plants for butterflies to lay eggs on. Some examples are chokecherry and cottonwood for tiger swallowtails; dill, parsley, and carrot for black swallowtail; hollyhock and sunflower for painted lady; and clover for clouded sulfur butterflies.

Cover: Need shelter from wind. Plant the above areas sheltered from the wind.

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

- Provide an area with water puddles to 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.

Habitat Requirements:

Food: Insects.

Cover: Thick herbaceous vegetation on bank or shore adjacent to water. Also hide among floating vegetation in the water next to 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. Also useful for encouraging emergent aquatic vegetation.

Water: Need water to hide. Many kinds of frogs will dry up and die if their skin is not kept moist.

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. Bluegill eat a variety of insects, zooplankton (microscopic animal life), 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 phytoplankton. A bass-to-bluegill ratio of 3 to 6 pounds of bluegill to 1 pound of bass is considered a good fish population balance.

- Determine pond balance using a minnow seine.

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

- Harvest more or fewer bass.

- 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 pond and in watershed that drains into pond. Develop livestock watering facilities away from pond or allow access to only a small area of pond.

- Reseed watershed.

Cover: Are often found near submerged rocks, 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.

- Aquatic vegetation can become too abundant (more than 30 percent of water surface covered). Deepening the pond edges to 2 feet deep or more discourages rooted aquatic vegetation growth.

Water: Require an adequate quantity and quality of water. Basic requirements are (1) dissolved oxygen—minimum of 5 parts per million (ppm), (2) carbon dioxide—should not exceed 20 ppm, (3) pH should range between 7.0 and 9.0, and (4) water temperature should reach at least 70 degrees Fahrenheit sometime during the summer (1 foot below surface in shade).

- Test the water to see if it meets requirements.

- Aerate pond to increase oxygen and decrease carbon dioxide.

- Stop pond leaks if and when they occur.

- Repair spillway if needed.

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

- Remove trees from dike or dam portion of pond.

- Lime ponds (agricultural limestone) to increase pH if below 7.0.

- Install water control structures to allow manipulation of water level.

Wildlife Management Practices (WMPs) And Their Effects On Habitat

In this section, various practices used to manage habitat are described in further detail. The descriptions are brief and general and are not meant to be comprehensive. Additional reading, research, and guidance from wildlife management professionals is suggested.

Some of the practices may seem contradictory. For example, deepening edges of ponds discourages the growth of emergent aquatic vegetation while providing shallow water encourages growth. Landowner objectives will determine which practices you recommend.

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 which will help maintain the area in the desired condition.

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 prefer to eat on the ground rather than in a tree or on a balcony.

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.
- Helps keep vegetative succession in stage 3.

• 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.

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 3 to 5 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. Brush piles can be used in ponds to provide hiding places for small fish, and to give structure on which fish concentrate.

Effect On Habitat:

- Particularly useful for rabbits and quail in areas with little cover, especially in areas with plenty of food and little cover such as corn, soybean, grain sorghum, and small grain fields.
- Useful at the edge between fields and woodlands.

4. Controlled (Prescribed) Burning

General Description:

Burning should be done under cool, moist, 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. Do 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 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.

3- to 5-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 interspersed.

- 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.

5. 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 interspersed in wetlands (during dry periods).

6. Grain, Leave Unharvested

General Description: Strips or blocks of grain crops ($\frac{1}{8}$ to $\frac{1}{4}$ acre is usually sufficient) can be left unharvested. Especially valuable if left adjacent to herbaceous, shrub, or tree cover.

Effect On Habitat:

- Provides a food source for many species of wildlife.

7. Harvest Less

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

- No recent bluegill hatch.

- Many medium-sized bluegill in poor condition.

- Bass few, large, and in good condition.

Bluegill: Needed when seine sample 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.

- No young bass.

Game Birds And Mammals:

- Needed when there is a high proportion of young animals in the bag and hunting success is low.

8. Harvest More

Bass: Needed when seine sample 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.

- No young bass.

- Increase bass harvest cautiously. Spread the harvest over the entire summer.

Bluegill: Needed when seine sample and fishing records of pond reveal these situations:

- No recent bluegill hatch.

- Many medium-sized bluegill in poor condition.

- Bass few, large, and in good condition.

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).

9. Lime Ponds And Fields

General Description: When water quality tests show the pH is below 7.0 it should be adjusted to 7 and 8 by using agricultural lime. Lime can also be added to food plots when soil tests recommend.

10. 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 (i.e. maintain open areas in woodlands). This practice also includes livestock exclusion when necessary.

General Principles:

Proper Grazing Use: On native 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: 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, 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 deer. 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 (allows some wildlife to jump over) and the bottom wire should be smooth and a minimum of 16 inches above the ground (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 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 interspersions.

II. 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.

Boxes: Some specific 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: 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 already exist, such as hollow fence posts, isolated den or nesting trees, etc.
- In Wetlands: Provides secure nesting sites in areas lacking islands, peninsulas, or tall, dense vegetation.

12. 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. Should be planted prior to June 1 (except for grass-clover mixture) to ensure maturity.

Where possible plots should be square (1 acre minimum) located near cover on the downwind side. Plots should be located such that nearby shrub and tree cover does not encourage snow to drift into them. Must be protected from livestock.

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.

- Perennials—usually 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 succession.

- Provides both food and cover for many species of wildlife.

13. Plant Grass And Legumes

General Description: Plant large fields of grasses and legumes. Field size 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.

- To increase the value for wildlife, these plantings should be grazed, burned, or mowed occasionally (once every 3 to 5 years) to prevent deterioration of the vegetation.

14. Plant Mast Trees

General Description: Mast means seed or fruit which 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 such as sawtooth oak 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.

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.

15. 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 food for urban areas, fencerows, hedgerows, odd-areas, property boundary mark-

ers, 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.

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.

16. Ponds/Lakes—Artificial Reefs

General Description: Large rocks can be piled together; brush (used Christmas trees are good) or tires, weighted down and submerged can 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.

17. 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 1,000 pounds per surface acre.

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.

Broadcast agricultural gypsum on the pond surface at the rate of 12 to 25 pounds per 1000 cubic feet of water (500 to 1,000 pounds per acre-foot of water).

Effect On Habitat:

- Removes/settles silt in the water, allowing sunlight to produce phytoplankton.
- This activates 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 or drainage may be necessary for pond rehabilitation.

18. Pond Construction

General Description: This practice should be recommended for creating new ponds and wetlands with permanent water.

Dams and dikes or 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 it is

constructed. For example, steep sloping sides benefit fish and gentle sloping banks benefit waterfowl.

19. Small Dikes For Temporary Flooding

General Description: Only recommend this practice in existing wetlands or potential waterfowl feeding and nesting areas when appropriate.

Small dikes are used to temporarily flood (usually in the fall) feeding and nesting areas for waterfowl. Grain fields, Japanese millet fields, and stage 5 and 6 hardwood woodlands are examples of feeding areas flooded to attract waterfowl. When this practice is recommended it is implied that adequate water control structures will be included and should not be an additional recommendation.

20. 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 tractor with blade.

Edges should be deepened to a minimum of 2 to 3 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.

21. Ponds—Determine Balance

General Description: Population balance is first established in a farm fish pond by stocking the correct numbers of fish. After the first year, check fish pond

balance during the summer months 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 from the bank to its full length, and then sweeping in an arc back to the bank. Four to five 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. Recent reproduction of both bass and bluegill in the seine indicate that the fish population is balanced.

Unwanted species (bullheads, crappie, etc.) May also be caught in the seine indicated that the pond needs to be poisoned or drained.

22. 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 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.

23. Ponds—Fertilize

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 program.

Start fertilizing fish ponds in the spring when the water temperature is above 60 degrees Fahrenheit. Apply at the rate of 40 pounds of 20-20-5 (or its equivalent) granular, one gallon of 10-36-0 liquid fertilizer per acre, or eight pounds of water soluble powder per acre at two-week intervals, or until a good green color (phytoplankton bloom) develops in the pond. Place the granular fertilizer in an underwater platform in water less than 2 feet deep. Make additional applications of fertilizer (at the same rate per surface acre) every 3 to 4 weeks, or when the water clears (become 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. Lime based on soil tests on pond mud.

If a pond has been properly fertilized for the past 5 years and if there is no concentration of weeds, future fertilizations can be done using phosphate only. The rate is 10 pounds of superphosphate per acre per application. Make the first 3 applications 2 weeks apart, and at 3 to 4 week intervals thereafter. Granular fertilizer must be distributed from a fertilizer platform. Liquid fertilizer should be mixed with pond water and broadcast from a boat for large ponds or from the bank of small ponds. Water soluble powdered fertilizers can be broadcast from a boat or from the bank.

Effect On Habitat:

- 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 balanced fish pond.

24. Ponds—Remove Trees Near Dam

General Description: Roots of trees growing on the dam will loosen the compacted soil and cause leaks. This practice is needed anytime trees occur on the dam or when trees occur around more than one-third 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 will 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 one-third of the pond bank.

25. Ponds—Repair Spillway

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

26. 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.

27. 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 in the water. 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 acre if the pond will not be fertilized. As many as 50 channel catfish fingerlings per acre may also be stocked at the same time as the bluegill.

Effect On Habitat:

- The techniques of draining or rotenoning ponds allow unbalanced fish populations to be removed and new ones started with an balanced ratio of bass to bluegill.
- Needed in ponds with: extremely unbalanced fish populations, an overabundance of small, stunted bluegill, few of usable size, presence of wild fish such as carp, shad, goldfish, suckers, crappie, green sunfish, or bullhead catfish.

28. Ponds—Stop Leaks

General Description: Leaks in existing ponds may be stopped with:

Bentonite at 100 pounds per 100 square feet.

Tetrasodium pyrophosphate at 2 tons per acre.

Soda ash at 5 tons per acre.

In severe cases, plastic liners may be used (expensive).

Effect On Habitat:

- Necessary in leaking ponds with limited water supply.

29. Ponds/Wetlands— Provide Shallow Water/ Islands/Peninsulas

General Description: To increase emergent aquatic vegetation and/or provide islands and peninsulas for wildlife. This practice can only be recommended for existing ponds and wetlands. Not recommended for areas with moving water such as rivers and streams.

Draw the water down, let the area dry out, and use a tractor with a blade and front end loader. Soil can be gathered from nearby sources or pond/wetland bottom used to build islands, peninsulas, and the shallow water areas (less than 2 feet deep). Areas above the water line that are disturbed by this activity should be smoothed and planted to grass and legumes.

Effect On Habitat:

- Needed to increase nesting areas and emergent aquatic vegetation.

30. 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 the 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.

31. 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. Different tracts are cut each year and rotated over an area like a checkerboard.

In general, tracts should not be over 40 acres in size, and often tracts as small as 10 to 20 acres are preferred. They should be long and narrow with irregular shapes. The increased sprouting of shrubs, grasses, and forbs that result from sunlight reaching the forest floor benefits 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 that need woodlands to supply all of their welfare requirements such as gray squirrels, woodpeckers, etc. But again, if harvested tracts are not too large and there are sufficient amounts of surrounding forest, these species should remain.

Effect On Habitat:

- 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.
- At least 3 to 4 den and/or large mature trees per acre should be left in areas protected from wind which could topple trees.

32. 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 which 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, old mature, and large dead (snags) trees per acre should be maintained.

33. Water Control Structures

General Description:

Various structures made out of concrete, pipe, 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 structures are present on an existing dam or dike.

Effect On Habitat:

- Allows management of water levels to increase or decrease the amount of aquatic vegetation. Useful for creating a desirable mix (interspersed) of open water and aquatic vegetation.
- Can be used to manage the quality of water in the ponds or wetlands and for control of unwanted fish.

34. Water Developments For Wildlife

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

Guzzlers: Build 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) are designed to collect water for use by livestock and wildlife for drinking. They can collect run-off water from precipitation, or in areas with a high water table, can be filled by

ground water. Side slopes should be gentle to provide easy access to the water for wildlife. 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. 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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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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