Wildlife Management

for Missouri Landowners

Second Edition

Missouri Department of Conservation

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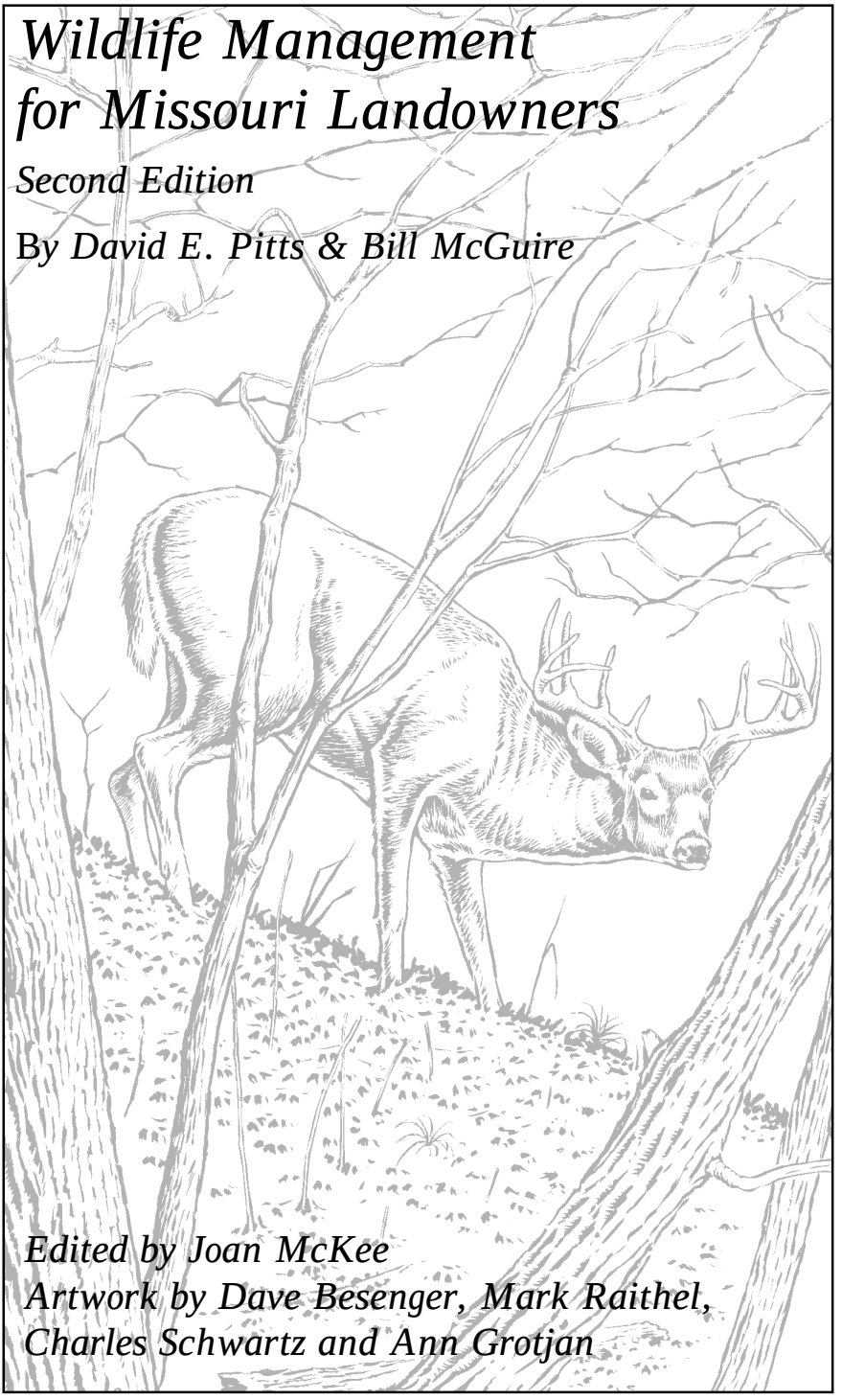
By David E. Pitts & Bill McGuire



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Private landowners are the key to conservation

Private landowners hold the future of Missouri's forest, fish and wildlife resources in their hands. Since more than 93 percent of this diverse state is in private ownership, we must depend upon these individuals to be good stewards of the land and to protect and conserve the land for future generations. Ultimately it is the private landowner who decides exactly how to manage soils, forests, fish and wildlife resources on their land.

We are fortunate to live in a country where private landowners have the freedom to do with their land whatever they wish to do, within bounds set by our society. Landowners can elect to bulldoze the trees from the hillsides of their land, or they can choose to seek advice concerning forestry management. Likewise, owners of rare pieces of remnant prairie have the right to plow under the variety of native grasses and forbs and to plant a row crop or pasture in its place, but they may choose to learn how to increase both the prairie hay quality and its production through proper management. Experience has shown that all things are connected in the environment. For example, the bulldozing of a hillside will not only impact the wildlife that used the area, but also the streams where the top soil ends up. The effects of a land-use change can often be seen immediately, or the impact may be very slow and felt only by the next generation of landowners. One thing is certain: There always is an impact. Everything is connected.

It is my hope that this booklet will encourage you, the private landowner, to look for current information as you are faced with land management choices and decisions that will impact forest, fish and wildlife resources on your lands. Not all decisions will be easy, and some probably will be simply trade offs among the best of several unpopular choices. Those of us who are charged with the responsibility of making similar decisions on a larger scale refer to this process as "resource management." These decisions must often be based upon the best information available at the time and may change as information and technology changes. Such decisions rarely please everyone who is affected by the results.

I appreciate your stewardship of the land and wish you the best as you manage your own private property. The Conservation Department stands ready to assist your efforts to enhance the forest, fish and wildlife resources of Missouri in any way we can.

Jerry M. Conley, Director
Missouri Department of Conservation

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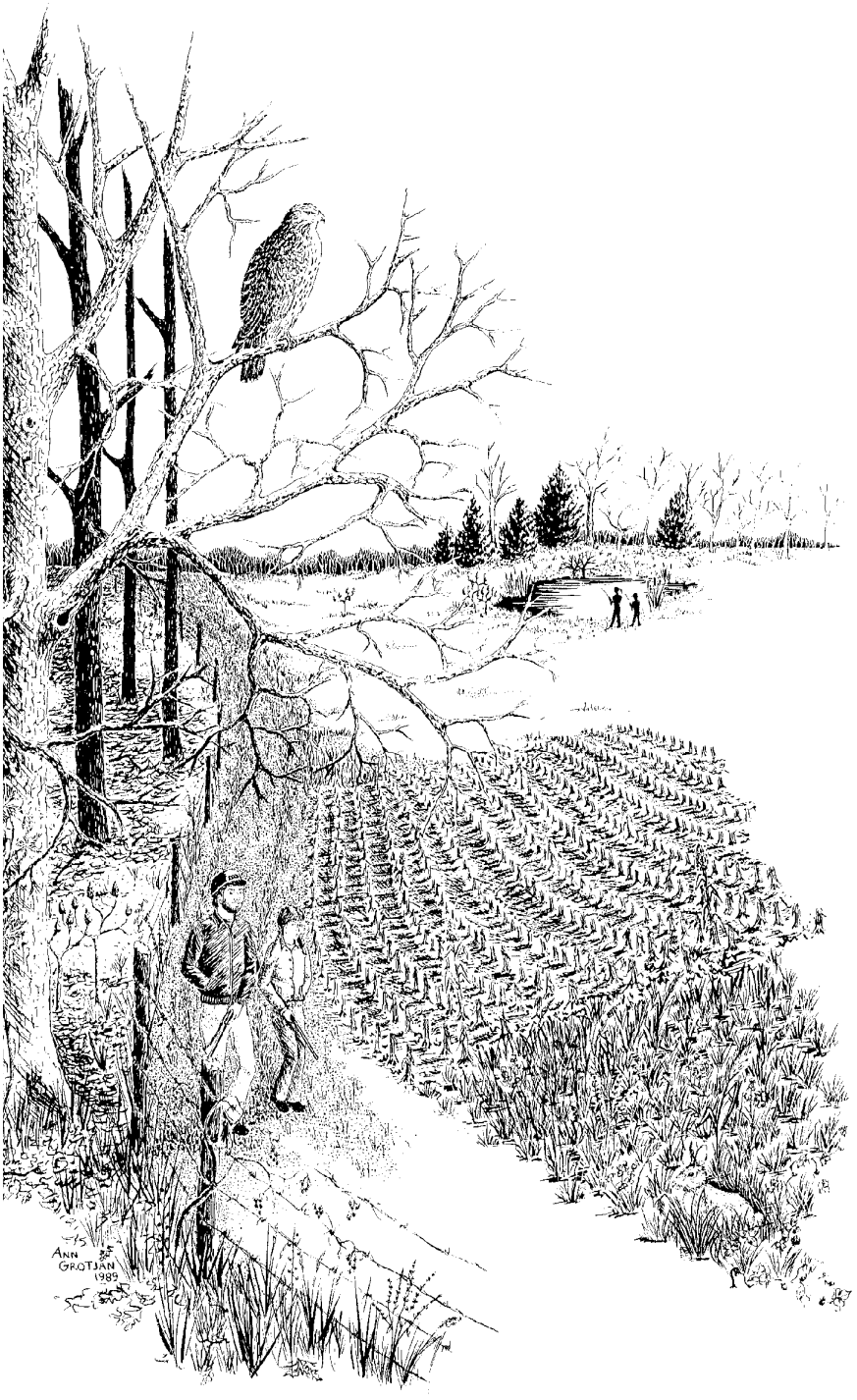
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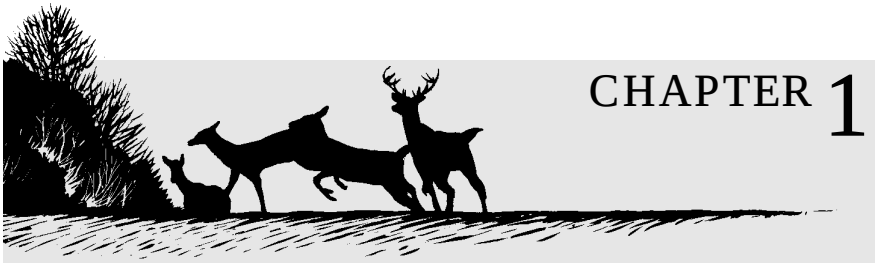


CHAPTER 1

Wildlife and the Land

■ Perhaps you enjoy hunting or take pleasure in the fruits of the hunt, such as a well-spiced venison stew on a frigid winter's day. Maybe you enjoy the call of a quail on a spring morning or the hooting of barred owls under a harvest moon. If so, you no doubt appreciate the value of Missouri's rich wildlife heritage.

If you are a landowner, you may want to maintain that heritage on your own land. The purpose of this booklet is to help you with this important and enjoyable task.

■ Wildlife has taken a roller coaster ride since pioneers settled the Missouri wilderness. Wildlife was once abundant and often taken for granted. A Montgomery County report from about 1830 says that "turkeys were so numerous and so easily obtained as scarcely to be worthy of consideration."

By the mid- to late 1800s things had changed. The ax, plow and wildfire were destroying the forests and prairies. Market hunting for meat and fur exacted a heavy toll on wildlife populations. Deer and turkey dwindled, and elk and antelope were driven from Missouri. The passenger pigeon disappeared entirely.

On the other hand, the many small, private farms that had been carved out of the wilderness proved to be good habitat for smaller wildlife, such as quail, rabbit, skunk and dove. Islands of grain and grass were planted by farmers, creating a healthy mix of woods, brush, brushy fencerows, crops and grasses.

■ The wildlife "roller coaster" has continued through the years. Many species that were reduced in numbers have been restored to abundance in Missouri, thanks to public support for wildlife research and controlled harvest. Recently, however, some of these restored populations have suffered as financial pressures forced farmers to focus on short-term profits to pay the bills. In the name of efficiency and economic survival, fields have been enlarged, fencerows removed, woodlands grazed or cleared, and neglected areas put into production. Because of a loss of food and cover, wildlife have either moved to more favorable areas or died from exposure and starvation; and, once again, farm game numbers have declined.

Increased soil erosion also has hurt wildlife populations. The top few inches of soil are essential to wildlife survival: They sustain the plants that provide living areas, food and shelter for wildlife. For example, a covey of bobwhite

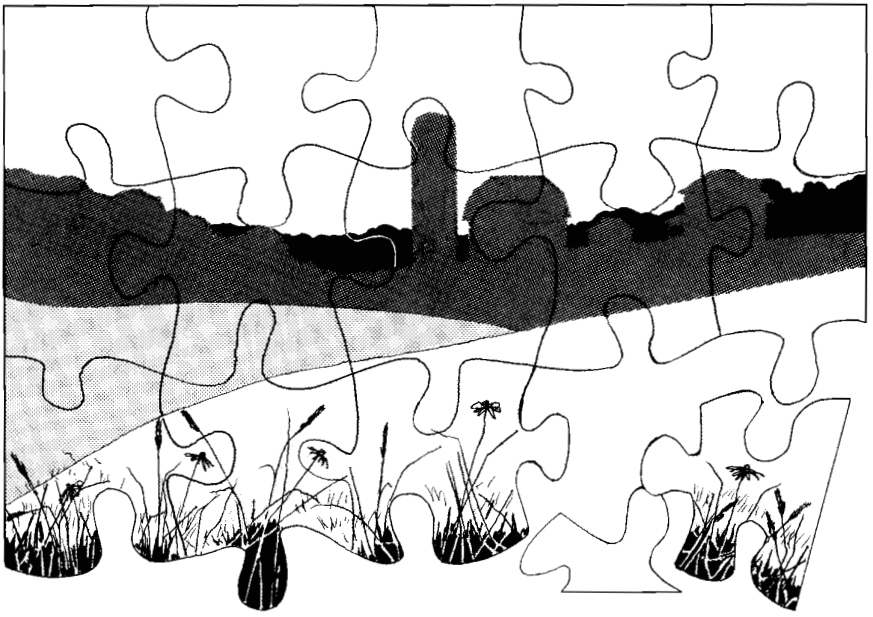
quail can live on about 20 acres under ideal conditions. Their spring and summer foods are green plants and insects; in fall and winter, they eat weed seed and grain residues. They receive most of the moisture they need from these foods. In summer they can find shelter in grassy and weedy areas, but need dense brush during the cold months. Many of these things depend upon rich topsoil. Erosion removes vital soil and lowers the basic productivity of the land. Quail will not do well if any of the above elements are missing. Like other animals, they are vulnerable to prey and weather if the necessities for survival are separated by more than 1/8 mile.

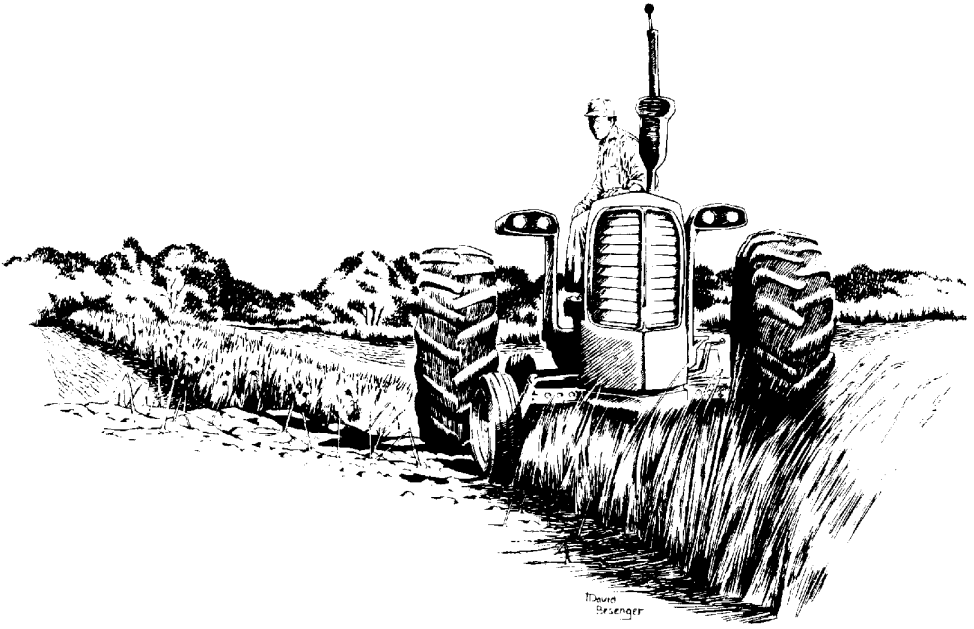
■ These trends—declining wildlife and increasing soil erosion—are disturbing, but by no means irreversible. Missouri landowners can make great inroads into these problems simply by improving conditions for wildlife on their own land. This booklet describes a number of techniques—many of them quite simple—that can be used to increase wildlife diversity and abundance on private land.

Many soil-saving practices recommended by the Natural Resources Conservation Service also are included in this booklet. As many landowners have discovered, practices that save soil often can be beneficial to wildlife.

The benefits of managing land for wildlife are many, but there are costs. Fortunately, many state and federal agencies offer partial reimbursement for landowners unable to absorb the expense. Some management practices have economic benefits of their own. For example, fencing a woodlot from livestock will improve both timber value and production, while increasing long-term profits.

■ Think of Missouri as a giant puzzle with tens of thousands of pieces, each of which represents a tract of land. More than 90 percent of these puzzle pieces would be private land.

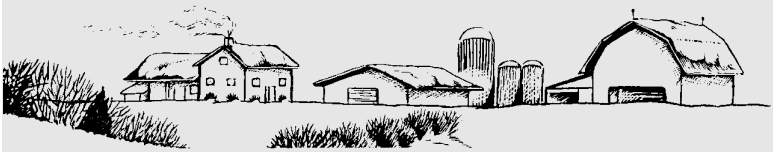




Landowners have played a leading role in wildlife production through the years. This handbook will help you get started improving wildlife habitat on your piece of the puzzle. REMEMBER: EACH LANDOWNER CAN MAKE A DIFFERENCE.

If you do not own land, this handbook will increase your knowledge of the balance between wildlife and the land, and provide valuable information to pass along to a landowner friend.

CHAPTER 2



Land Planning for Wildlife

■ Successful habitat improvement begins with a thorough evaluation of your farm for its wildlife potential. After you have made this "wildlife habitat inventory," you can draw up a management plan that will not only increase the number and diversity of wildlife on your land, but also increase its overall productivity and value.

Evaluating Your Land

Food, water and cover are the three essential ingredients of good wildlife habitat. When evaluating your land, keep them always in mind.

Look first at the plants on your property—the amount and distribution of trees, crops, brush and grass. Vegetation largely determines the types of animals that can live on a plot of land. Plants are the basis of nature's "food web," of which every animal is part. Plant-eating animals—such as deer, rabbits and insects—convert plant energy to protein and fats. Carnivores—hawks, owls, bobcats, predatory insects and insect-eating birds—feed on the plant eaters. This complex food web will collapse without plants.

Also note the sources of water. Wildlife in Missouri has varied water requirements. Salamanders need a fish-free pond for spawning. Bobwhite quail need surface water only during long, extremely dry periods. Water may become the focal point of a wildlife plan because it is a limiting factor for some animals.

Cover is essential and will be discussed throughout this booklet. Both natural and manmade cover provide resting, roosting, nesting, protection and foraging areas. Natural cover is managed by planting, pruning, thinning or clearing. Manmade cover includes brush piles, nesting boxes, rock piles, birdhouses, log piles and similar structures.

Familiarizing yourself with your land will help you know what animals live there and what others you would be able to attract. Walk your land and take notes often and during all seasons. Land and animals change through the year, and you will see new signs during each trip. Look for scratch marks, tracks, burrows, nests and other signs. Note the kinds of animals on your land, the areas they are using and the times you observe them.

In your evaluation, it may help to divide your farm into wildlife habitat types. The four main types of farm habitat are cropland, grassland (including pasture), woodland and idle areas.

The following questions will help you evaluate your current management of these habitat types in terms of benefits to wildlife. Ideally, you should answer “Yes” to every question.

CROPLAND

■ Do you avoid fall plowing? The fall plowing of sloping cropland will increase erosion and eliminate crop residues that feed wildlife during the winter.

■ At harvest, do you leave a row or two of grain at the field edge? This standing grain provides food and cover for wildlife during winter months.

■ Do you avoid heavy herbicide and insecticide applications? When applied in excess of label instructions, herbicides and insecticides eliminate important wildlife food sources by destroying weed seeds and insects in non-crop areas.

GRASSLAND

■ Do you graze livestock on a rotation among several pastures? Rotating cattle through different pastures can improve both beef production and wildlife habitat.

■ Do you top-dress pastures? Improved soil fertility will contribute to both wildlife and domestic livestock productivity.

■ Are warm-season grasses included in your grazing system? Grasses that grow during the hot summer months, such as warm-season grasses, provide summer livestock grazing and wildlife food and cover.

■ Are there legumes in your pastures? Legumes add nitrogen to the soil, help improve forage for cattle and attract insects on which wildlife feed.

WOODLOTS

■ Do you prevent cattle from grazing your woodlot? Woodlots and woodlot edges are prime wildlife habitat in Missouri. Woodlots should be protected from the competition of grazing cattle.

■ When you harvest timber or cut firewood, do you build brush piles from the trimmings rather than burning them? Brush piles around a woodlot leave an uneven, brushy edge that provides food and cover for wildlife.

■ Have you maintained a border or edge between the woodlot and other habitat types? Fields that adjoin a wooded area are more attractive to wildlife when a grassy or shrubby border is established and maintained.

FENCEROWS AND OTHER IDLE AREAS

■ Have you allowed fencerows to grow up in shrubs, vines and small trees? Fencerows provide travel lanes between different habitat types if woody plants are present.

■ Do you avoid applying pesticides to fencerows? Destroying fencerow vegetation reduces both the food supply and the cover that these areas provide.

■ Are brushy or grassy strips present between crops, pastures and woodlands? These buffer strips provide necessary cover, nesting and feeding areas for wildlife.

If you answered "No" to one or more of these questions, you might consider adding these practices to your management plan.

Making a Wildlife Management Plan

Begin the farm plan by obtaining a drawing, map or aerial photo of your land. Aerial photographs are available at no charge to the landowner from the Farm Service Agency office in each county. Enlarged copies are available for a small fee.

On the map or photo, mark different habitat types with colored pens. Each type of habitat meets different wildlife needs, so for best results they should be intermixed on your property. Note areas that are isolated from other habitat types. Some animals, such as quail and rabbits, require that

the habitat types be close together; others, like deer and turkey, can easily travel several hundred yards to find food, cover or water.

Next, mark areas that might be improved for wildlife. Land can be improved in a general way—for instance, by letting field areas grow up—or it can be improved to attract, maintain or increase certain species of animals. In the latter case, you'll need to learn the animals' habitat requirements: how much territory they need, what they eat and where they find cover. The requirements of some common wildlife species are given in Chapter 8.

Usually your habitat improvement will involve adding or removing vegetation. In fact, wildlife management is basically plant management. Landowners can change wildlife numbers on their property by changing the supply of plants that attract, feed and shelter them.

You can add plants that provide food for rabbits and other ground feeders, if that's what you are interested in. Or, you may want to cater to deer or other animals that eat higher on brush and trees. Your wildlife plan should ensure an all-season variety of seeds, berries and plants. This sometimes means controlling the growth of some trees and bushes.

A soils map can help you find the best locations for plantings and will indicate the suitability of sites for pond construction. A detailed soils map of your area is available from the Natural Resources Conservation Service. See page 58 to find the office near you.

Keep a notebook of your progress, including when, where and how the plantings and other improvements were carried out. This record will help you think ahead and avoid mistakes, such as placing plants in an area where they will become problem weeds. Take photos of habitat changes. Before-and-after pictures of the land show whether or not you are getting results. You also can talk to neighbors and representatives from service agencies who can offer insights on the long-term soundness of your plan.

Often, landowners wrongly assume that large numbers of wildlife will remain permanently on their property if they improve food and cover areas. Usually, the improvements are less dramatic. Your acreage may not gain a permanent flock of turkeys or a herd of deer, but it may become an important part of their range. Your efforts make a difference, even if wildlife use your land only seasonally or temporarily.

The following chapters describe a large number of management practices you can include in your habitat improvement plan. Wildlife responds slowly to changes in habitat, so the main thing is to get started NOW.

CHAPTER 3

Cropland Management

■ Minor changes in an area's crops can have a major effect on wildlife numbers. This chapter discusses management practices for cropfields and adjacent areas that are practical, profitable and beneficial to wildlife.

Crop Fields

Conservation tillage

Many land managers consider conservation tillage to be the most promising single practice for reducing soil erosion. It also is very beneficial for wildlife, especially quail, pheasants and songbirds.

Conservation tillage is a broad term that refers to several tillage methods that maintain crop residue—stubble, grain and other plant seeds—on the field surface. These tillage methods control erosion, conserve soil moisture and increase organic matter, resulting in better field soil conditions. Studies have shown that conservation tillage fields can have yields that equal or exceed conventional tillage fields. In addition, production costs are less for conservation tillage systems.

Residues from conservation tillage provide both food and cover for wildlife. In particular, waste grain and weed seeds left after harvesting are staple foods for wildlife in winter. If you must plow in the fall, plow only a portion of the field and leave the field borders for spring tillage.

Currently, conservation tillage methods dictate an increase in pesticide use. Proper application of these pesticides will reduce both production costs and hazards to the environment.

Crop rotation

Crop rotation is simply the planting of different crops in the same field from year to year. Long-term rotation means planting three or even four different crops before returning to the original crop. These practices increase the health of the cropping system and add plant diversity to the land.

Continuous cropping means that the crops in a field do not change each year. Crop-disease experts report that the highest risk for crop diseases results from continuous cropping. Insect problems also are more prevalent under this system, so more pesticides are needed. Most corn and soybean diseases and associated pests can be controlled by a simple crop rotation.

Legumes always are a good choice—and often a necessity—for rotation because they add nitrogen to the soil and reduce fertilizer requirements for next season's crop. Sweet clover, for example, can produce up to 174 pounds of plant nitrogen per acre. Legumes also make ideal wildlife nesting cover and food if mowing is delayed until after July 15. Clovers can be seeded into row crops after the last cultivation to reduce erosion, add nitrogen and provide wildlife cover during the winter. See pages 66 and 67 for seeding charts.

Small-grain crops, such as wheat and oats, provide nesting cover throughout the spring and summer. The stubble of these crops, cut high and left undisturbed, makes excellent brood-rearing habitat for quail and pheasants. The seeds of annual plants associated with small-grain stubble provide food for wildlife.

Legumes and small grains help prevent soil erosion. Good rotation crops for sloping fields include corn or milo, soybeans, wheat or oats, and clover.

Contour strip cropping

The practice in which row crops are planted in strips along the natural contour of the slope and next to a grass strip is referred to as contour strip cropping. It provides erosion control and plant diversity.

The strips of grass, legumes or small grains act as a filter that traps sediment and slows water runoff. The strip width is dictated by the severity of the erosion problem and the slope of the field. Where erosion is severe, permanent grass

strips should be maintained between strips of crops. These strips should be seeded to a grass/legume mixture that is beneficial to wildlife. See chart on page 66. All of the listed grass/legume mixtures produce high-quality hay. In some years, the seed and hay harvested from these strips can produce more income per acre than the adjacent row crops.

Strips seeded to grass/legume mixtures serve as travel lanes and cover for wildlife. These strips also provide nesting and roosting cover and, if possible, should not be mowed until mid-July.

Field Borders, Fencerows & Turn-Rows

Field borders can be seeded to grass/legume mixtures that are attractive to wildlife. See chart on page 66.

When planted around cropfields, native warm-season grasses and other grasses, such as redtop and timothy, serve as valuable nesting, brood-rearing and concealment cover for wildlife. These grasses may be hayed in July when adjacent crops provide cover.

Field borders next to woodlots, wooded fencerows, hedgerows and other brushy areas offer more opportunities for wildlife. Shading and root competition from trees and shrubs in these areas can be minimized with the use of a tractor-drawn root plow, which prunes the roots of woody plants. Root plows are available on loan from many Soil and Water Conservation districts in Missouri.

Turn-rows planted to a grass/legume mixture will help control soil erosion, provide space to turn equipment and serve as a roadway along the edge of the field. Grass/legume borders also provide cover for ground-nesting birds, such as meadowlarks, pheasants and quail. These areas should be clipped at two-year intervals to prevent woody sprout invasion. Clipping should be done in mid-July, after the peak of the nesting season.

Fallow Fields & Set-Aside Acres

Fallow fields are cropfields that lie idle during part or all of the growing season.

The acreage of fallow fields in Missouri has increased in recent years due to government set-aside programs. These programs help provide wildlife with the old-field weeds and grasses they need for food and cover.

Rules for managing set-aside acres under federal cost-share programs are written in each Conservation Farm Plan. Each plan is written by the Natural Resources Conservation Service using input from the landowner. At the landowner's request, land improvements for wildlife can be included in the plan.

Some plantings that benefit wildlife on set-aside acres are:

- Native warm-season grasses, such as big bluestem, Indian grass and switch grass
- Trees
- Annual grain food plots
- Cool-season grass/legume plantings, such as orchard grass and red clover, timothy and Korean lespedeza, or a similar mix.

Chapter 10 gives suggestions on seeding rates and mixtures.

Grassed or Wooded Waterways

Waterways may be used as outlets for water collected by terrace systems on crop fields. These waterways vary in size according to the size of the drainage area and are seeded to perennial grasses, legumes or both.

A grassed waterway is not needed in all terraced areas.

Wooded waterway. Conservation Department photo

In many cases a wooded draw may function as an excellent water outlet for terraces if it is not actively eroding. In addition, wooded draws can provide critical woody cover for wildlife.

Most of the native warm-season grasses can be planted on grassed waterways to help control erosion, provide wildlife cover and produce high-quality hay. They should be mowed after the peak of quail and pheasant nesting in mid-July.

Terraces

A terrace is an earthen embankment built across the slope of a field to intercept runoff water. Terraces, by design, divide long, steep hillsides into a series of shorter slopes to reduce erosion. The terrace channel is sloped toward a grassed waterway, a stable wooded draw or an underground outlet so the water runs off without creating a gully.

The three types of terraces used in Missouri are broad

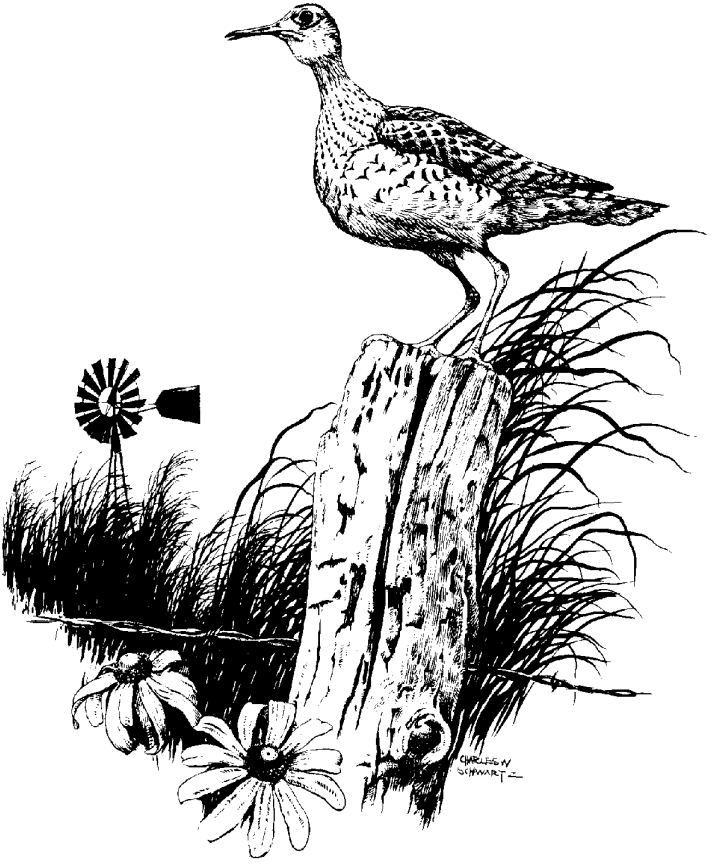
Broad-based terrace. Natural Resources Conservation Service photo

base, steep backslope and narrow base. All three terrace types are effective in reducing erosion; however, only steep backsloped and narrow-based terraces provide grassy cover for wildlife.

Most grass/legume mixtures are suited for seeding these terraced slopes. Switch grass works particularly well and develops into travel lanes, nesting areas and cover areas for wildlife. Woody shrubs that invade the switch-grass strip can be controlled with periodic burning.

Steep-backed terrace. Natural Resources Conservation Service photo

Narrow-based terrace. Natural Resources Conservation Service photo



Field Shelterbelts, Windbreaks & Fencerows

Trees planted as windbreaks can reduce wind velocities on their downwind side for distances up to 10 to 20 times the height of the trees, depending upon the species and density.

Hardwood or deciduous trees, which shed their leaves in the fall, are not as effective as evergreens for winter protection. Their bare limbs do reduce wind velocities and offer some amount of protection, however. The advantages of hardwood trees are that they are hardier, grow faster and are taller at maturity than evergreens. Field windbreaks reduce soil erosion, conserve soil moisture and provide food and cover for wildlife. See pages 88-90 for information on designing windbreaks.

Woody fencerows next to cropfields provide many of the same benefits as windbreaks. Natural woody fencerows

can be encouraged by not spraying or mowing next to the fence. When protected from grazing and clipping, fencerows can develop into natural travel lanes for wildlife. Planting clumps of trees and shrubs or spreading seeds of vines and shrubs along the fencerow also helps.

Cropland Management Tips:

- ✔ Establish conservation tillage systems.
- ✔ Avoid fall plowing unless absolutely necessary. If you fall plow, leave unplowed borders or strips for spring plowing.
- ✔ Minimize pesticide and herbicide applications.
- ✔ Rotate crops to include forage and small-grain crops.
- ✔ Use winter cover crops for green browse, erosion control and wildlife cover.
- ✔ Plant grass/legume border strips around all or a portion of crop fields. Mow or disk these strips at two-year intervals to control woody vegetation.
- ✔ Allow shallow draws to revegetate naturally, or plant to warm-season grasses or a grass/legume mixture. Delay mowing until after July 15 to avoid nesting losses.
- ✔ Seed waterways to grass/legume mixtures that are beneficial to wildlife. Delay mowing until after July 15, which is the end of the peak nesting season.
- ✔ Establish grass filter strips around crop-field ponds to reduce sedimentation and to add wildlife cover.
- ✔ Protect woody draws and fencerows.
- ✔ Leave a minimum of 1/4 acre of grain crops unharvested for each 40 acres of crop field. Leave crops in patches or strips near cover.

CHAPTER 4

Grassland Management

■ Grasslands provide many kinds of wildlife with food and cover. The greater prairie chicken, upland sandpiper and meadowlark are open grassland nesters. Rabbits, bobwhite quail, turkeys and pheasants also nest in grasslands, but prefer areas near woods or brush. Grasslands also help wildlife by controlling soil erosion.

Grasslands can be divided into three categories:

1) Cool-season grasslands containing grasses, such as orchard grass, timothy, tall fescue and Kentucky bluegrass, which grow best in cool weather;
2) Warm-season grasslands containing native grasses, such as Indian grass, big and little bluestem and switch grass, which grow best in warm weather);
3) Native grasslands, unplowed prairie remnants dominated by native warm-season grasses.

This chapter deals with the management opportunities on the nearly 13 million acres of grasslands in Missouri. The first section describes some general management techniques for pastures or grasslands. Not all of these techniques are suitable for every grassland. Specific management techniques for each of the three types of grasslands are given in the following sections.

■ A word of caution concerning tall fescue and its negative impact on wildlife habitat in Missouri: Since the late 1950s, more than 35 million acres have been planted to tall fescue in the United States. In many areas, the more aggressive fescue has replaced diverse native plant communities. When this happens, wildlife populations that depend upon a variety of plants can no longer thrive.

Livestock producers use fescue extensively because it is a hardy cool-season forage that is tolerant of a wide variety of management conditions and soil types. Fescue has become a vital forage for the livestock producers in Missouri. Cattleman also have recognized several diseases in cattle that can be attributed to continuous grazing on fescue with seed heads that are infected with an endophyte fungus.

Fescue is well suited for planting along highways, roadsides and idle areas for erosion control. As a result, however, most native wildflowers and grasses valuable to songbirds, mammals and insects in these areas have been replaced by fescue that is of little value to them. The dense, grassy sod that prevents soil

erosion, however, inhibits the movement of some songbirds and quail that must be able to move freely through the vegetation to forage for seeds and insects. Fescue also covers any bare-ground areas that are important as dusting sites for rabbits, songbirds and quail.

Studies in Kentucky, Missouri and elsewhere show that fescue can cause nutritional problems for a wide variety of species, including cottontail rabbits, black-tailed jackrabbits, quail, prairie voles and white-footed mice. In fact, a Tennessee study concluded that endophyte-infected fescue had promise in reducing or eliminating burrowing mammals from orchards, tree farms and golf courses.

Fescue also is allelopathic, which means it has the capacity to exude toxins into the soil that kill or restrict the growth of competing plants. This allows it to invade prairies, old fields and sparse woodlands, thus eliminating the native plants that are more attractive to Missouri wildlife. Small shrubs or seeds planted in fescue sod have little or no chance at survival, due to its aggressive, toxic nature.

Grasslands in General

Management is usually necessary to keep grasslands productive. When grasslands are left idle, forage production is reduced as ground litter builds up. This buildup also harbors rodents and restricts the movement of wildlife, such as bobwhite quail and rabbits. Five methods commonly used in grassland management are grazing, haying, fertilizing, overseeding with legumes and prescribed burning.

Note: Remnant prairies may require special management practices. See pages 23 and 24.

Grazing

Grazing can be continuous or rotational. Continuous grazing is where all animals are placed in one pasture and allowed to selectively graze. Rotational grazing may be as simple as switching livestock between two pastures; or, if practical, livestock may frequently be moved among several pastures.

Grazing affects both the plants and the soil in pastures. Livestock are selective about the plants they eat. They tend to repeatedly graze some plants and ignore others. This weakens the more desirable plants and allows unwanted plants to thrive and multiply. Nearly all pastures have areas where livestock concentrate, such as around water, bedding grounds and feeding areas. If the pasture is

continuously grazed, these areas become overused, resulting in pasture deterioration.

Continuous grazing reduces forage production and eliminates wildlife cover and food. Cattle trampling also destroys wildlife nests. Years of continuous overgrazing can change a grassland to a brushy area with undesirable plants. Grasses that are continually overgrazed will produce less and less forage in each successive year. Under certain management objectives and pasture conditions, however, continuous heavy grazing may be used as part of an over-all program to improve grazing distribution.

When land is rested—left idle between grazing periods—the vigor of the choice plants increases, giving them a chance to grow and multiply. This gradually increases the number of high-quality plants per acre. Improved forage increases livestock production, improves wildlife food and cover, reduces soil erosion and conserves water.

Rotational grazing allows you to pasture more cattle together and also allows wildlife to use the rested pastures and areas adjacent to the fenced pasture. Rotational grazing permits the use of forages when they are at peak production, protein content and palatability. It also helps the growth of legumes, such as clovers, and allows wildlife nests to survive, if the rest period is not too short. Rotating between pastures with native warm-season forages and those with cool-season forages increases productivity, but requires careful management.

A grazing system will work well only if the grass or forage is adequate to support the livestock numbers, so keep stocking rates in mind. If your main objective is to produce the maximum amount of forage from your grasslands, you may want to investigate the use of a management intensive grazing program. Here, the livestock is rotated among smaller paddocks at very short intervals. Contact your University Outreach and Extension or Natural Resources Conservation Service office for details.

Haying

One of the most important landowner-controlled factors in managing grasslands is the timing of hay cutting. Cutting too early may reduce production, but cutting too late will not allow grasses to replenish their root reserves before winter. This weakens a stand of grass. Wildlife cover also is reduced due to the lack of regrowth. Haying should be

timed so that yields and quality are optimum. If wildlife considerations can become a part of the haying operation, cutting part of the hay field at different times of the year will increase habitat diversity.

Cutting height also has an impact on grasses. Clipping grasses too low will remove the point, or node, on the grass stem where new growth occurs. Regrowth of the grass will be slower because the “growth point” has been removed and the new leaves must now grow from the dormant buds located lower on the stem.

Haying has a dramatic impact on both the landscape and wildlife. With the ground bared, wildlife is vulnerable to predation, and the animals must move to adjacent areas for cover. If there is no room for these new animals, some will starve or be killed by predators.

Fertilizing

Both haying and grazing will remove nutrients from the soil. Fertilizer and agricultural limestone should be added to a pasture or hayland only after the soil is tested. See pages 72-77. If you are unfamiliar with soil tests, the results can be interpreted by your local University Outreach and Extension agronomist.

Remnant native prairies may or may not require that fertilizer or limestone be added. See page 23 and 24 for more details.

Overseeding with legumes

Legumes, such as clovers and lespedezas, remove nitrogen from the air and add it to the soil, where it is then available for other plants. Improved livestock performance has been shown with the addition of a legume to a cool-season grass diet.

The success of overseeding an established pasture with legumes will vary. Consult the agricultural agencies in your area for the current recommendations on legume varieties, seeding dates and methods. Some grass/legume seeding mixtures that are beneficial to both livestock and wildlife are shown on pages 66 and 67. Remnant prairies usually will have native legumes present and will not require over-seeding under a good grazing, burning and haying program.

Cool-Season Grasslands

Cool-season grasses, such as tall fescue, smooth bromegrass, Kentucky bluegrass, orchard grass and timothy, begin growth early in the spring when the soil reaches 40 degrees F. Their growth slows during the warmest part of summer when the soil reaches 78 degrees F and resumes as the soil cools in the fall. Timothy and smooth bromegrass mature later than tall fescue or orchard grass. These grasses allow a later haying date of high-quality forage, while avoiding nest destruction that occurs with earlier haying dates.

Cool-season grasses have been popular with farmers because they are easy to establish, withstand heavy grazing and respond to heavy fertilization. Most of these grasses continue to be productive, but tall fescue can cause health problems in livestock. The problems associated with endophyte-infected fescue are still being studied.

Cool-season grasses are usually grazed to within 2-4 inches tall. Grazing below this height will result in lower production, increased soil erosion and less wildlife use.

These grasses are normally at peak quality and ready for cutting during the nesting season. If the usual cutting height of 1-2 inches is raised to around 4 inches, the disturbance to ground-nesting wildlife is reduced.

Cool-season grasses usually do better in higher pH soils. Soil pH can be raised by adding agricultural limestone.

Warm-Season Grasslands

Many landowners are rediscovering our native warm-season grasses and their value to forage systems. These grasses, such as native bluestems, switch grass, eastern gamma grass and Indian grass, also are good for wildlife. The growth pattern of these grasses is compatible with legumes and other broad-leaf plants that are important to both wildlife and livestock. See “Establishing Native Warm-Season Grasses” on page 77.

When the soil reaches about 60 degrees F in the spring, the warm-season grasses begin growing. They grow best during the warmest months of the year, when the soil is about 90 degrees F. Although warm-season grasses have a shorter growing season, they make more efficient use of water and soil nutrients—nitrogen, phosphorus and potassium—than do other grasses.

Grazing

Native warm-season grasses should not be grazed closer than 8 inches high. Since warm-season grasses begin growth later in the year, they are usually not ready to be grazed until mid summer, when most of the ground-nesting wildlife have hatched their broods. Under a good management program (burning, rotation, etc.), however, native grasslands can be grazed earlier in the summer.

Haying

Native warm-season grasses are usually hayed in late June and July—after most of the broods have hatched. These grasses should not be cut closer than 5-6 inches to allow for rapid regrowth. The regrowth should not be grazed nor should a second cutting be taken. A second cutting will reduce the vigor of the plants, weaken the stand, and eliminate important winter cover and spring nesting cover.

Overseeding with legumes

Legumes may be overseeded on new warm-season grass plantings during the second year or after the grasses have become established.

Fertilizing

While studies have shown that native warm-season grasses are very efficient at removing nutrients from the soil, they do use large amounts of phosphorus (P) and potash (K). These elements should be replaced when hay is removed. These grasses usually do not require that as much fertility be added to the soil, as do the cool-season grasses. Studies also have shown that yields, crude protein, estimated net energy, digestibility and relative feeding values were increased in big-bluestem/Indian-grass hay when the grasses were fertilized with nitrogen. The major increases occurred at rates of 50 or 100 pounds of nitrogen per acre, with 50 pounds per acre giving the greatest return on the dollar. Nitrogen should be applied only in combination with prescribed burning to avoid problems with cool-season grasses and weeds.

Note: Fertilization of remnant native prairies is recommended only under certain conditions.

Prescribed burning

Burning is an important native-grass and remnant-prairie management practice when used under the right conditions at the right time. Fire releases nutrients, controls ground litter and some unwanted plants, stimulates seed production and helps improve plant diversity within the native grassland, which helps distribute grazing pressure.

Remnant Native Grasslands

Missouri's native grasslands, or prairies, once covered nearly one-third of our state. These prairies were dominated by warm-season grasses and supported several hundred species of plants. Today, less than one percent of our original prairie remains. Most have been replaced by cropland or introduced warm-season or cool-season grasses. The small remaining tracts are referred to as remnant prairies and are vital to the survival of prairie chickens and other grassland wildlife.

Historically, these prairies supported some fire-tolerant shrubs and a few scattered trees. Currently, the trees that surround the remaining smaller remnant prairies can provide high launch points for avian predators, which may pose a problem for many grassland wildlife species.

Proper management will make your native prairie more productive and protect a valuable, dwindling resource. Experienced personnel can provide information about the special management needed on native prairies. If you have a tract of native prairie, contact the Wildlife Division of the Conservation Department for a management plan. The address is on page 55.

Prairie remnants, when grazed moderately, will provide excellent summer pasture. Start grazing these tracts about May 15, when the vegetation is 8-10 inches tall. Native prairie should be grazed no later than Aug. 15, and no lower than 8 inches high.

Native prairie remnants provide quality hay. Haying dates are more critical in prairies, as they affect not only the yield and quality of the forage, but also the types of

plants that will persist.

Prairie remnants should not be fertilized or limed unless they are in excellent condition because the fertilizer may be used by undesirable weedy plants. Native prairies already contain several beneficial legumes and should never be overseeded in an attempt to increase productivity.

Prescribed burning

Studies show that prescribed burns in March and early April will favor forbs (broad-leaf plants), while late April or May burns will favor the production of grasses. A fire at the wrong time can be costly to both wildlife and forage production, but burning time should be varied to maintain plant diversity. *Caution: Use fire with great care. Experienced personnel are available to assist in the planning of prescribed burns. Contact the Wildlife Division of the Conservation Department or your local NRCS office.*

Grassland Management Tips:

- ✔ Use both native warm-season and cool-season grasses in a rotation grazing system.
- ✔ Investigate the possible use of a “management intensive” rotation grazing system.
- ✔ Avoid hayfields and pastures with only a single species of grass.
- ✔ Leave an unmown strip, 20-25 feet wide, around the edge of hayfields.
- ✔ Protect shrubby vegetation in drainages and along the field edges with permanent fences.
- ✔ Establish legumes in cool-season pastures and hayfields.
- ✔ Allow warm-season grasses to regrow to 12-15 inches before the fall dormancy period.
- ✔ Consult a professional for details concerning the management of native remnant prairies.
- ✔ Establish grass/legume fire lines around all warm-season pastures and hay fields.

CHAPTER 5

Woodland Management

■ The wooded areas on Missouri farms have great potential as habitat for a variety of wildlife species. When protected, the forest interior provides food and cover for deer and turkey, den trees for squirrels and furbearers, and snags for nesting woodpeckers. The forest edge produces browse for deer and nesting areas for songbirds.

The difference between a good wildlife woodland and a poor one may be nothing more than a fence or proper management of the trees. This chapter offers ideas for managing your woodland for both wildlife and timber production.

Woodland Interiors

Protection from grazing

Grazing livestock do serious damage to woodlands. Much of this damage is not immediately visible and shows up only as long-term effects, such as tree decline and loss, soil erosion and compaction, and wildlife habitat destruction.

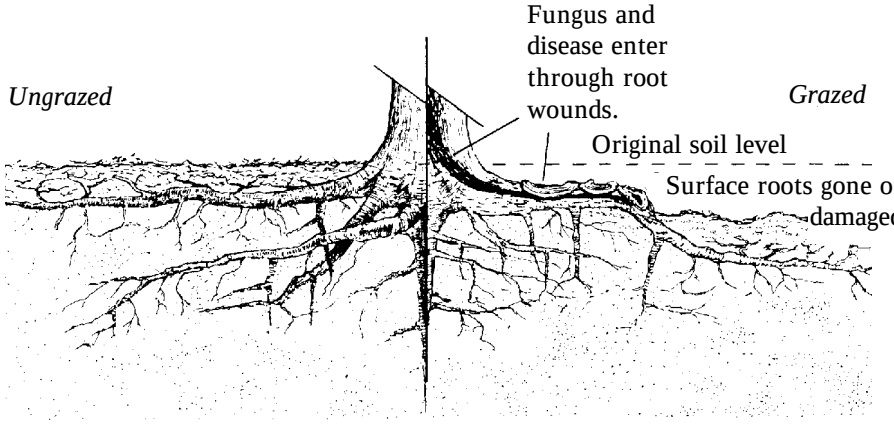
Tree seedlings and saplings are the first to be eaten or destroyed. Saplings are broken, stripped of bark and trampled. Even large trees suffer wounds from rubbing and the chipping of hooves at the base of the tree.

Livestock hooves mix the leaf litter into the soil, speeding decomposition and exposing bare soil to erosion. The pores in the soil that allow air and water to move down to tree roots are sealed off. Rainwater that should infiltrate into the soil runs off the surface. The fine, hairlike feeder roots located several inches under the ground are exposed and damaged. Trees become weakened and growth rate is slowed. Damaged and exposed tree roots are excellent entry points for insect and disease pests.

The appearance of a grazed woodland changes as trees are harvested or die of old age, and there are no young trees

An obvious "browse line" forms in grazed forests, destroying layers of wildlife habitat.

Livestock grazing tramples the soil, exposing tree roots to a variety of damage.



to take their place. Often, trees that are more resistant to grazing increase in number as the less resistant, but more valuable, trees are eliminated. Hickories, with their tap root, can tolerate more soil compaction than oaks and will increase in number. Honey locust seedlings are thorny and seldom eaten by livestock and, therefore, thrive in grazed woodlots.

Since there is little else for cattle to eat in the woods, plants are consumed from the ground up to as high as the cattle can reach, creating a browse line. Wildlife needing dense brush and low-growing plants have difficulty surviving in a grazed woodland.

The ability of trees to produce fruit depends on their vigor and health. Grazed woodlands are less vigorous and the trees produce fewer seeds—including acorns, which are a staple food for woodland wildlife. Cattle grazing in a woodlot may eat the entire acorn crop, leaving nothing for wildlife.

Ungrazed forest land provides excellent protection for the soil. In contrast, the soil erosion on a grazed woodland can be as much as 110 times greater than on an ungrazed woodland.

Influence of Grazing on Erosion Potential in Forest Land

	% Ground Cover	Erosion Potential
Non-grazed	95+	Minimal
Lightly grazed	85-95%	8 times
Moderately grazed	50-85%	30 times
Heavily grazed	0-50%	110 times

Hardwood forests produce poor-quality forage for livestock. One acre of a managed pasture is worth from 20 to 40 acres of woodlands in grazing value. The best investment is to manage existing pasture land and allow the woodlands to grow trees and wildlife.

To return a grazed woodland to good wildlife habitat, fence out livestock. Check with local Natural Resources Conservation Service and Farm Service Agency offices for possible cost-share programs to help offset fencing costs.

Timber stand improvement

Timber stand improvement, or TSI, is the removal of selected trees from a timber stand to improve the health and growth of the remaining trees. Most unmanaged timber stands become overcrowded, causing a shortage of water, nutrients and sunlight for all trees. TSI reduces competition in a stand and allows the landowner to decide which trees to keep.

Proper spacing of trees is the key to any TSI operation. Trees too closely spaced will soon become crowded, slowing their growth. Trees spaced too far apart waste growing space and encourage larger crowns at the expense of taller, straighter trunks. To estimate the best distance between trees in a stand, measure one or several trees at a height of 4 1/2 feet above the ground—a measurement known as "diameter at breast height," or DBH. Multiply the average DBH (in inches) by two and use that number as the distance in feet to leave between trees. For example, if a tree is 11 inches in diameter, multiply by two for an answer of 22. Twenty-two feet is the proper spacing to leave between that tree and the trunk of its nearest competitor tree.

When you are thinning a timber stand, the most important trees to leave uncut are the final harvest trees or crop. These trees will have the highest value as wood products.

Other trees to leave standing are those that will be removed in future thinnings, but are needed in the meantime to fill growing space.

This leaves the least desirable, surplus trees, which can be cut for firewood or other purposes. Characteristics of surplus trees include:

- poor-quality wood
- multiple sprouts from one stump
- swellings or bumps on the trunk—indicating internal damage
- fire scars or other damage to the trunk
- many wide-spreading branches.

These TSI practices are used mostly to improve timber values. When you are improving a timber stand for wildlife habitat, it is often necessary to leave some of the surplus trees and, occasionally, even cut a good crop tree.

Trees to leave for wildlife habitat are:

Den trees—those with an opening leading into a hollow interior.

Wolf trees—those with a short trunk but wide, spreading crown. These are especially important if they produce large amounts of mast (acorns and nuts) and are in an area dominated primarily by small trees that have not reached mast-producing age. Leave at least one for every two acres.

Tall, fruiting trees—including hackberry, black cherry, mulberry, black gum and persimmon.

Protecting snags and den trees

A snag is a standing dead tree. Den trees are live trees with a natural hollow in the trunk or limbs. Both are essential habitat for many kinds of woodland wildlife.

Once a tree dies, the slow process of decay begins. As the heartwood in a snag softens, woodpeckers excavate nest holes, which are later used by other wildlife.

Many birds, mammals and reptiles use tree cavities throughout the year for nesting, feeding, perching, escape cover and protection from the weather. Fewer or no den trees usually means less wildlife in an area.

In a typical woodlot, trees with cavities are often in short supply, so it is important to protect both existing and potential den trees. Old, open-grown, large-crowned trees should be protected because they are likely to become good den trees. They also produce nuts, seeds and fruits, making them doubly valuable for wildlife.

White oak, post oak and other members of the long-lived white oak group make the best den trees, but black or red oak, hickory, American elm, sugar maple, American sycamore, eastern cottonwood, black gum, ash and basswood also are excellent.

As a general rule, seven snags or living den trees per acre provide an adequate number of cavities. Live den trees will last longer and are often fruit or nut producers. Standing dead trees attract insects and do not compete with other trees for water, nutrients and sunlight. Consider the option of deadening undesirable trees but not removing them.

A woodland management plan for wildlife should include the following practices for protecting snags and den trees within a woodlot:

- Leave at least one snag and one den tree larger than 20 inches at DBH for every acre of woodlot.
- Leave at least four snags ranging between 10 and 20 inches at DBH per acre.
- Leave at least two snags and two den trees ranging between 6 and 10 inches at DBH.

Preserving existing snags and den trees, as well as protecting potential den trees, helps the woodlot become a productive wildlife area for many years to come.

Den trees and snags can be created by wounding selected trees. Open wounds allow fungi to enter the tree and begin the decay process. It may take several years for trees to develop cavities. This process can be hastened through the following techniques:

- Cut a limb (the larger the better) about 6 inches from the trunk of the tree. Ash, elm, cottonwood, sycamore, silver maple and basswood are especially prone to develop natural cavities from cuts.
- Chop a section of bark from the trunk of a suitable tree, preferably one that already shows signs of damage or decay. Select trees at about 100-foot intervals.
- Drill a hole, at least 2 inches in diameter and 3 inches deep, into the trunk of a tree. If possible, make the hole under a limb that is 3 inches or more in diameter.

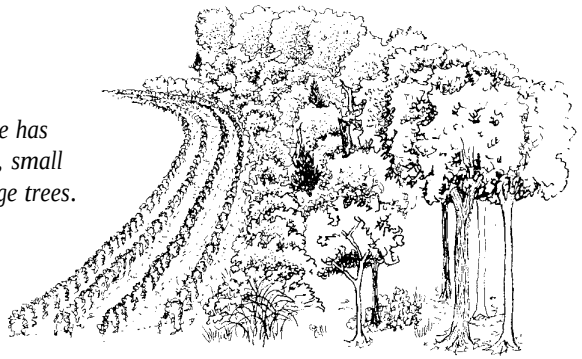
For more immediate results, put up bird houses and den boxes. See building plans in Chapter 10.

Woodland Edges & Openings

Edge is the transition zone between habitat types. This zone offers critical wildlife food and cover. The amount, diversity and quality of the edge directly affects wildlife populations.

High-quality edge is a wide band of plants that gradually changes from one cover type to another. It has grasses, weeds, shrubs, vines and small trees that provide wildlife foods, such as berries, seeds, browses and insects. It also offers cover for nesting and protection from weather and predators.

Good edges usually require deliberate action on the part of the landowner. High-quality woodland edge can be created by planting shrubs or small trees in a 30-foot or wider strip at the edge of the field. Another option is to



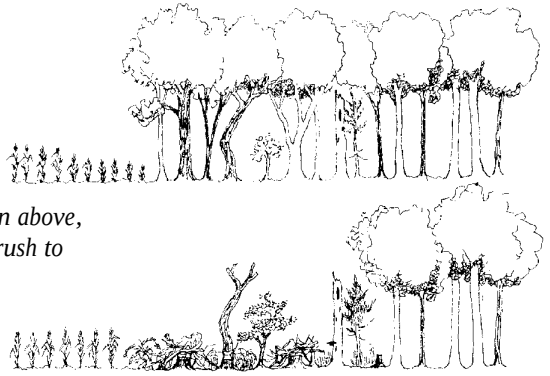
An ideal edge has crops, brush, small trees and large trees.

allow the border to naturally revert to native plants and supplement with plantings if necessary. The natural process usually is rapid and reliable after the elimination of grazing, plowing and mowing. Conversion of heavy sod, such as fescue, to edge habitat can be hastened by plowing, disking or applying herbicide to the border strip, which allows native species to invade.

Some crop-field acreage is considered too valuable to remove from production. An alternative in such areas is to create edge in the woodlot by removing some trees.

If a field is bordered by trees that affect the growth of crops along the edge, it actually may be cost efficient to let an edge develop between the trees and the field. This is true because the return from low-yield field edges may not offset the cost of seed, fertilizer and site preparation.

Large trees of low commercial value within 30 feet of the crop field should be removed for firewood or deadened to allow sunlight to reach the smaller shrubs. Within 15 feet of the crop field, small trees, such as dogwoods, hawthorns, plums and red cedars, also should be cut. Some trees should be cut low so that sprouting will occur at ground level. Vines attached to trees should not be cut when felling the tree.



Large trees, such as those shown above, should be deadened, allowing brush to come up in their place.

Large woodland tracts can lack the variety of plants necessary to support diverse wildlife populations. A 1-acre opening in a forest often provides as much as 10 times the amount of plants used by wildlife as 1 acre of mature timber. Annual weeds, grasses and seedlings found in these openings produce food, nesting sites and escape cover for wildlife.

Five to 10 acres of small clearings per 100 acres of woods is desirable. These openings should range from 1 to 3 acres in size. Smaller woodlots surrounded by pastures and farm fields will reduce the need for forest openings. On larger woodlands, open space is provided by roads, utility rights-of-way, log landings or small clearcuts.

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Woodland Management Tips:

- ✔ Protect woodlands from grazing.
- ✔ Deaden large trees along woodlot edge.
- ✔ Plant 30-foot wide strip of shrubs along mature woodland edge.
- ✔ Use root plow to reduce competition along woodlands next to crop fields.
- ✔ Create small openings within large timber blocks.
- ✔ Encourage vines and fruiting shrubs.
- ✔ Apply timber stand improvement practices.
- ✔ Don’t cut den trees and snags.
- ✔ Leave brush piles from firewood cutting.
- ✔ Install squirrel den boxes.
- ✔ Fence a 100-foot wide zone along all wooded streambanks to exclude livestock. Stop all cutting and mechanical activities in this area.

CHAPTER 6

Idle Area Management

■ Nearly every farm has some land that is unsuitable for cultivation, grazing or haying due to its steepness of slope, soil type, wetness or small size. These idle areas—old fields, abandoned house sites, pond edges, wetlands, stream banks or corridors, bushy draws, ditch banks, erosive areas and even your lawn—can be useful to wildlife. With a little management, they can provide wildlife food, sites for nesting and brood rearing, and protection.

This chapter contains information on developing idle land or "odd areas" for wildlife.

Old Fields

Abandoned pastures and crop fields can provide excellent wildlife habitat, but you may feel inclined or pressured to "clean these areas up to make them look better." While a few trails will make them more accessible for you, "brush hogging" large areas will simply destroy the seed and fruit producing plants that several animals depend upon for food and cover. These areas naturally produce plants, such as goldenrod, wild aster, strawberry, ragweed, blackberry, sumac, coral berry (buckbrush), wild plum and red cedar. All of these plants provide some food and protection during the year for several species of wildlife. Many songbirds use wild plum and other low-growing shrubs for nesting, quail use them for escape cover and deer browse on their twigs.

Old fields are usually in the early stages of plant succession, the natural process by which an area passes from bare ground to the most complex or "climax" stage of vegetation. The earlier stages are more productive for wildlife, such as quail and rabbit. Soil disturbance is good in these areas, otherwise, the "old field" tends to stagnate in one of the plant succession stages. Disking and fire will help start the process all over again, making the area more

productive. These stages can be encouraged in an old field by using some of the following techniques:

- Use a herbicide to kill any tall fescue in old fields. Fescue can inhibit the growth of other plants, and it produces little food or cover for wildlife.
- Some bare ground is important. Studies show that most quail nests are located within a few feet of bare ground. The hen quail will move her chicks immediately after hatching to bare ground in search of grit and insects.
- Disk strips through the field on the contour to expose 75 to 80 percent of the soil. Allow weeds to grow. You may want to seed some of the strips at the rate of 5 pounds of Korean lespedeza and 1/2 pound of ladino clover per acre.
- Burn areas between the disked strips. Burned areas produce more kinds of seeds and insects that are important to quail chicks and songbirds.
- Burn at different intervals and at different times of the year. Burning the ground litter aids in quail chick movement and exposes seeds.
- Mow 30-foot strips and leave 30-foot strips in late fall to stimulate new growth. After three years, mow the uncut strips again to generate new growth.
- Leave clumps of woody growth about 50 feet in diameter to provide wildlife cover.
- Construct brush piles. Discarded Christmas trees and limbs from tree trimming make ideal brush piles. Protect these from burning.
- Hinge cut large cedars by cutting two-thirds of the way through the trunk and bending the tree parallel to the ground. Many cedars will continue to live in this position, creating a living brush pile.
- Plant a green browse plot, a grain food plot or plant native warm-season grass strips. See Chapter 10.

Landscaping for Wildlife

Landscaping your homesite with native wildflowers and shrubs will make it attractive to many species of butterflies and hummingbirds that call Missouri home during the summer. Hummingbirds are particularly attracted to red or orange tubular flowers, such as trumpet creeper,

honeysuckle, cardinal flower, columbine, bergamot and red buckeye. Butterflies are attracted to flowers such as milkweeds, coneflowers, phlox, mints, blazing stars and asters. Monarch butterflies use milkweed both as a nectar source and as a food source for the caterpillars. More detailed information concerning the planting of “butterfly gardens” is available from the Missouri Department of Conservation.

Abandoned House Sites

The shrubs, lawn grasses, fruit trees and weeds found around old home sites are beneficial to wildlife. The stately old trees, with their many cavities and high production of nuts, fruits and seeds, are attractive to squirrels, rabbits, quail, deer and songbirds. Old concrete and rock foundations attract groundhogs, whose burrows provide homes and cover for rabbits, raccoons and red foxes. Lawn grasses and shrubs are eaten by deer. Grasshoppers and other insects found around these sites are food for quail and turkey broods.

Old house sites can be improved by placing tree limbs and old lumber on the foundations for wildlife cover. Fruit bearing shrubs and trees, such as walnuts, nanking cherry, hawthorn and wild plum, can be planted. Mow strips around and through the lot to stimulate new growth of grasses and legumes. Early spring or early fall is the best time for mowing. Be careful not to mow too much of the area.

Glades & Balds

Glades and balds are rocky openings of various sizes in forested areas. Glade features include exposed bedrock, native prairie grasses and wildflowers. They are more common in the southern half of Missouri and usually are found on the south or west sides of slopes, but can occur on any aspect. Glades occur on almost any type of bedrock, including limestone, sandstone, igneous and dolomite. They can be as small as 1/4 acre or cover hundreds of acres in some instances.

Glades are home to many uncommon animals, such as collared lizards, eastern narrowmouth toads and

roadrunners. Some of the more common glade animals are speckled king snakes, fence lizards and six-lined race runners. In southwest Missouri, glades are home to endangered plants, such as Missouri bladderpod and geocarpon. Glades in the St. Louis area harbor the beautiful Fremont's leather flower, which is only known from Missouri and Kansas. A healthy glade will frequently have more than 100 species of plants, including pale purple coneflower, Missouri black-eyed Susan and Missouri evening primrose.

Many glades under private ownership are covered with eastern red cedar trees, as a result of continuous grazing by livestock and the lack of fires that controlled the invasion of cedar. With a little work, a landowner can restore a glade to its relatively open condition, making it more valuable to the wildlife that call it home. A glade with no or few cedars and a good variety of plants should be protected from extensive grazing. The glade will remain in good condition with nothing more than an occasional prescribed burn. Areas with extensive cedar growth will require the use of a chain saw. The cedars can be dropped, allowed to cure for about a year, then burned. The burning of several cedars can produce an impressive fire. Extreme care and extensive planning should be done before undertaking this activity. Contact the local Conservation Department forester or wildlife biologist for guidance concerning the use of prescribed fire and to see if the cedar logs might have market value.

Pond Areas

You should develop the area around your pond according to what you and your family enjoy. A pond site can be developed for wildlife habitat, fishing or other types of recreation.

Trees and shrubs may be planted around the pond for protection and cover. Windbreaks help check wave erosion and provide food and nesting areas for wildlife. To avoid damage to the dam by root penetration, do not plant trees on the dam. They also should be planted far enough from the shore so that they do not interfere with fishing. Trees and wildlife bundles may be purchased at low cost from the Missouri Department of Conservation.

All ponds are used at times by wildlife. By locating the

pond near good wildlife cover or by developing good cover around the pond, a landowner can increase this use. If the watershed is grazed, fencing off an area around the pond that is 1 to 1 1/2 times the water acreage permits the development of ideal wildlife cover. The larger the area, the more attractive it will be to songbirds, furbearers, deer and wild turkeys.

Stream Banks or Riparian Corridors

Trees and shrubs that grow along streams (the riparian corridor) provide an important wildlife habitat component. Several wildlife species depend on riparian woodlands for all or part of their habitat needs. Some species spend their entire lives within this zone.

In the crop farming regions of Missouri, a strip of riparian woodland may be the only woody cover to be found on the farm. In heavily forested portions of Missouri, the forest cover could include the stream bottom. The kinds of trees that grow along the stream on bottomland soils, however, are different from those on the adjoining slopes. This makes riparian woodlands unique. The water and the variety of trees, shrubs and other plants make riparian woodlands important to wildlife.

The riparian woodland should be at least 100 feet wide on each side of the stream. Where the riparian strip is very narrow or nonexistent, you can improve it by spreading seeds from nearby trees and shrubs. Cottonwoods, green ash, silver maple, willows, sycamore, elm, sweetgum and yellow poplar have light, windborne seeds that germinate if they land on bare soil. A herbicide can be used to kill the tall fescue within these areas. Trees, such as pin oak, pecan, black walnut, silver maple, cottonwood, sycamore, yellow poplar, river birch and sweetgum, can be successfully grown from seedlings. Many of these trees make excellent cavity trees at maturity. A mixture of these trees is ideal because some grow fast, such as cottonwood and sycamore, and provide cavities earlier. Slower-growing, long-lived trees, such as sugar maple and swamp white oak, will replace the faster growing trees in later years. Tree seedlings must be mulched with straw or sawdust to conserve moisture and reduce grass competition.

Don't remove trees that have fallen into the stream or appear ready to do so. The tree and shrub roots are keeping

the bank from eroding. When a tree eventually falls, it creates important instream habitat for fish and other aquatic life. Trees that are causing problems in the stream can be removed, but never use heavy equipment to dredge the stream channel.

Livestock that graze along stream banks destroy trees and shrubs and cause stream bank erosion. Fence cattle away from stream banks. Where access to water is needed, cattle can be restricted to one watering area to reduce potential erosion.

Brushy Draws

Brushy draws that extend well into crop or hay fields can provide quality habitat for wildlife and help control soil erosion. A brushy draw should contain vines, brush, grasses and only an occasional large tree. These areas are even more attractive to wildlife when planted in bluegrass, Korean lespedeza and ladino clover.

Livestock should be fenced out or excluded from these draws. Cattle can quickly destroy the low-growing shrubs important to wildlife as sources of food and cover.

Brush piles can be constructed along the edges and at the head of the draws. To avoid clogging the drainage, don't place a brush pile in the bottom of the draw.

Springs, Seeps & Fens

Springs, seeps and fens (upland marshes) are found throughout Missouri, but are more common in the Ozarks. These are valuable watering areas for wildlife. Many rare and endangered plants, including orchids, are associated with these unique sites. They are fragile and subject to erosion when livestock are allowed access. If water for wildlife or livestock is a limiting factor on the farm, water holes should be constructed on other, more suitable sites.

Erosive Areas

Certain field areas will erode more than others, depending on the soil type, steepness of slope and land use. Erosion-prone land can be seeded to various plants that will

benefit wildlife and help save the soil.

Select a good seed mixture appropriate to the soil type and location. See Chapter 10 for seeding mixtures. Wildlife prefer a legume and grass mixture to a single seeding of fescue. Lightly disk or rake the area to expose some bare soil for a seed bed. Broadcast the seed mixture, and then spread three bales of wheat-straw mulch for each 1,000 square feet of area.

A cutting of hay may be possible after a few years. Cut hay only once a year, leaving about 6 inches of stubble. Cut hay in alternating strips every other year to keep the plants growing vigorously. This will provide nesting sites, as well as food and cover for wildlife.

Fencerows

A brushy fencerow, which can provide an important connecting link between different habitat types on the farm, is an ideal place to start habitat improvement work. The simplest way to make or improve a travel lane is to stop mowing, grazing or cultivating the strip next to the fence. On farms with heavy grazing, install a double fence to protect a travel lane. An electric fence is effective and inexpensive for this purpose, but it must be maintained in good repair. Also, protect the fencerow from wild fire.

If some of the larger trees in a fencerow are cut for firewood, the tops can be used to make brush piles. See pages 68-70 for construction tips. If the fencerow is bare or less than 20 feet wide, plant shrubs, such as dogwood, wild plum, grape, cedar and blackberries, to improve the cover. Plowing and heavy disking will reduce grass competition and create a seedbed where seeds of these shrubs (such as persimmon, redbud, aromatic sumac, hazelnut and ninebark) and trees (such as oaks, mulberry, cherry, pin oak and dogwood) could be planted. If tall fescue is growing in this area, a herbicide will have to be applied to reduce the competition of this aggressive grass. Tree seedlings must be mulched with sawdust or straw to conserve moisture and reduce grass competition. Other native plants will be added through bird droppings.

Idle Area Management Tips:

- ✔ Disk strips on the contour to encourage weed-seed production.
- ✔ Mow alternate strips, but protect woody vegetation. Hinge cut cedars and cull trees, such as locust and elm, for quick cover.
- ✔ Plant annual grain food plots.
- ✔ Plant grasses and legumes around brush piles and in brushy draws.
- ✔ Fence to protect pond areas.
- ✔ Fence to protect stream banks.
- ✔ Fence to protect woody, brushy draws.
- ✔ Develop wildlife watering holes.
- ✔ Protect springs, seeps and fens from livestock.
- ✔ Plant grasses and legumes on eroding area.
- ✔ Protect fencerows for cover and travel lanes.
- ✔ Use herbicide to kill tall fescue, allowing seed producing weeds and legumes to grow.
- ✔ Burn small grassy-weedy areas at different times and intervals to create plant diversity.

CHAPTER 7

Wetland Management

■ Wetlands mean different things to different individuals. Some people envision a dark, dreary swamp; others find a place to enjoy an early morning duck hunt or an afternoon of wildlife watching.

By definition, a wetland is a tract of land containing much soil moisture that supports certain types of water-tolerant vegetation. Lands that fit this description can vary from permanently flooded sloughs to areas that have only saturated soil during part of the year.

Wetlands function as biological filters that remove sediments and pollutants from surface waters. They also act as natural sponges, reducing flood severity by slowly discharging excess water back into the stream or groundwater table.

Wetlands are biologically rich, with a greater diversity of plants and animals than is found in drier habitats. They are excellent habitat for all kinds of waterfowl, shorebirds and songbirds. Natural wetlands along streams and rivers are important as fish spawning and rearing areas.

Historically, natural wetlands dominated the floodplains and river deltas in Missouri. During the past few decades, many were converted to agricultural land, and their benefits lost. As we look toward the future, we realize how important it is to preserve our few remaining natural wetlands and to develop new wetlands wherever possible.

Many of the wetlands in Missouri today are "developed"—that is, they were constructed on previously dry or seasonally flooded land and are maintained by levees and water-control devices. For information on construction and development of private wetlands, see pages 82-84.

■ Most wetland management today is directed toward creating good waterfowl habitat. In this type of management, production of food for waterfowl is a primary concern.

Diverse groups of plants grow naturally on moist or wet soil. These plants produce seeds that contain essential nutrients for waterfowl. They also provide excellent growing conditions for invertebrates, such as small snails, clams and insects, which are good waterfowl foods. Wetland management techniques encourage the growth of these moist-soil plants. In many cases, domestic grains are planted and then flooded for supplemental food.

Following are some procedures that produce many kinds of waterfowl foods, both natural and cultivated, under a variety of wetland conditions.

Flooded Fields

On developed wetlands, moist-soil plants are encouraged in flooded fields by drawing the water from the fields during the growing season. This allows germination of the seeds that are naturally present.

The timing and rate of the drawdown are important for good plant growth. Although there is no set method for determining the best time to draw down a wetland, a general recommendation is that the water be held on the wetland until early summer (May through June). The drawdown is then begun by opening the water control structure. The rate of the drawdown should be slow enough to prevent rapid drying of the soil. This will discourage undesirable species while stimulating desirable moist-soil plants. The wetland is then reflooded to make these foods available for waterfowl. A slow, progressive reflooding of the marsh is best, starting around the first of September for teal or the first of October for many other wetland species.

Flooded Cropland

Flooded grain crops can be very beneficial for waterfowl, especially late in the winter when the weather is extremely cold. Corn or grain sorghum should be flooded from Oct. 15 to March 30. Crops planted specifically for waterfowl need not be clean-tilled because the weeds will provide additional food. Japanese millet also can be sown (15 pounds per acre) to supplement the cultivated crops.

Flooded Timber

Bottomland forests are an important wetland habitat type. The management plan for a bottomland forest should protect the health of the trees; therefore, no flooding should occur during the growing season. Flooding dates, depths and duration should vary from year to year to maintain the productivity of the forest. In Missouri, a forested wetland usually can be flooded from Oct. 15 to Feb. 15. The water should be drained before the trees leaf out. A slow drawdown is better than a rapid one because

more preferred plants will be produced. Open areas in the forest can be planted in Japanese millet or managed for natural foods.

Temporary Wetland Pools

Temporary or ephemeral pools are important breeding sites for various frogs and salamanders. These pools also are used by reptiles, migrating shorebirds, waterfowl and insects—all of which are important to the local ecosystem. Many temporary wetlands have become permanent pools of water that people have stocked with fish. This destroys their usefulness for frogs and salamanders because fish prey upon the eggs and the young of amphibians. It's no coincidence that most of the rare amphibians in Missouri use temporary pools for breeding.

While most of Missouri's amphibians are spring breeders, there are a few salamanders that breed in the fall. Some of the common species that use these areas are western chorus frogs, spring peepers, southern leopard frogs and tiger salamanders. In prairie areas, the northern crawfish frog and the Great Plains narrowmouth toad will use these pools.

To select a site for your pool, you should look for natural low spots or dips in the landscape that may hold water for short periods of time, particularly during the spring. These sites can occur almost anywhere—on flood plains, uplands, forests, fields or pastures. These areas may already have wetland plants, such as smartweed and sedges. If the site holds water for two or three months, there is a good chance it is already being used and shouldn't be disturbed. Areas on flood plains are especially attractive because they fill up during floods.

A small pool can be constructed in less than a day using a small bulldozer or a tractor and blade. A depth of 1-2 feet is ideal, and the pool should have sloping sides. Pools can be of almost any size or shape, depending on the site. Trees around the site should be left in place.

Once the pool is constructed, there is usually no need to introduce aquatic plants or animals. The soil in a seasonally wet area will frequently have a seed bank of wetland plants, and animals are good at finding wetlands on their own. If plants are introduced, care should be taken not to use aggressive species, such as cattails or

purple loosestrife.

If done correctly, your pool will dry up during the hottest part of the summer and fill up again in the fall or spring, just in time for the next breeding season.

Natural Sloughs & Small Ponds

If draining the pond or lake is possible, it should be drawn down 1-2 feet in early June to encourage beneficial plants, then allowed to refill with rainfall and runoff. Mudflats around ponds can be seeded to Japanese millet.

If water control is possible, sloughs can be managed as described above. If not, the following techniques can be used where feasible:

- Plant food and cover strips, and encourage native plants along edges of wetland.
- Plant bottom-rooted plants, such as duck potato, in shallow-water areas.
- Plant pin oaks or other beneficial trees along the water's edge.
- Control bottom-feeding fish to allow aquatic plants and insects to thrive.

Wetland Management Tips:

✔ Nesting structures for wood ducks can be constructed from the plans shown on page 84. These nest boxes can be installed in wetlands and along streams.

✔ The Department's field staff can furnish technical assistance with private wetland development and management. The booklet, "Missouri Wetlands and Their Management," is available at no charge from the Missouri Department of Conservation.

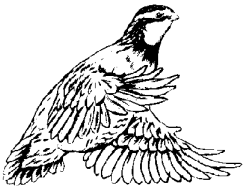
CHAPTER 8

Species Management

■ This chapter describes habitat management techniques for five species—quail, rabbit, turkey, deer and squirrel.

Most of the management practices recommended for these species also will benefit songbirds, frogs, toads, salamanders, turtles and other species that are essential to the balance of nature. These animals feed on rodents, weeds and insects, which will overpopulate if not kept in check. They, in turn, are eaten by other wild animals, such as mink, raccoons, skunks, owls, hawks and fish.

Bobwhite Quail



Bobwhite quail are best managed on a 20- to 40-acre basis. This area is small enough to work with and large enough for a covey of quail.

Food management

Bobwhite quail are primarily seed eaters, although they do eat some insects. Their diet varies over the state. In grain-producing areas, soybeans are the most popular quail food, followed by corn, weed seeds and milo. In other areas, quail rely heavily on weed seeds, but will eat small-grain crop residues when available. For this reason, fall plowing eliminates an important food source if crop residues are turned under.

A quail management plan should provide these three primary sources of food: 1) crop residues, such as waste grain and legumes; 2) native weed and grass seeds, and shrub and tree fruits; and 3) special plantings of grain. See "Annual Grain Food Plots" on page 63.

It is essential that food be available close to escape cover. Quail should be able to walk through good cover to their feeding grounds.

Important food plants for quail:

Acorns	Crotons
Asters	Dandelion
Bedstraws	Foxtails
Beggar ticks	Goldenrods
Blackberry	Grapes
Cinquefoil	Korean lespedeza
Clovers	Poison ivy
Crop residue of: corn, milo, sunflower, soybean	Ragweeds
	Sedges
	Smartweeds

Cover management

The most obvious cover management for quail is *to protect what is already there*—the shrubby and woody edges, draws and "waste areas" that usually occur around a farm. Cover often can be improved simply by fencing livestock out to allow natural plant growth. Scattered patches and travel lanes of dense, brushy cover should be maintained throughout each 40 acres.

Escape cover—This important element can be provided by brush piles made from branches left over after firewood cutting, brush thinning or tree trimming. Several loose piles located next to food production areas are best. Consider an area to be suitable escape cover if you can't walk through it.

Nesting cover—Good nesting cover is most often located in unmowed or ungrazed areas, or in field borders with redtop, timothy, orchard grass, perennial rye grass or mixtures of native warm-season grasses.

Roosting cover—Quail roost in vegetation that is not too dense, but still provides concealment from above. The roost is usually in open, "clumpy" vegetation away from thick or tangled escape cover. Fields of ragweed, croton, big bluestem or Indian grass are good roosting areas.

Disturbing the soil

Disking is used to change the composition of plants within the bobwhite quail range. The removal of strips of sod-forming grasses, such as bluegrass, broomsedge and fescue, will make room for the seed producing plants that are important to quail. This technique can be applied to old fields, where the vegetation has grown into a stagnated condition that provides less diversity of plants. However, if fescue is the major component of the grass composition, disking may only enhance the fescue production. In this situation, a herbicide must be used to kill the tall fescue in addition to disking.

Fallow crop fields that have produced tall weeds for a couple of years can be made more accessible for quail broods by disking from December to April. The shorter vegetation that is produced after disking will produce insects that also are important for quail chicks. Disking strips in alternate years will add to the field's diversity and prolong its usefulness for quail and other wildlife that use this habitat component.

Studies have shown that disking in winter (December) produces heavy-seeded quail foods, such as ragweed and partridge pea, while the peak production of important grass seed results from disking later in spring (April). June disking produces more of the plants that attract insects, plus a number of major seed plants, such as beggerweed, that are important seed producers for quail. An area managed for quail should have a mixture of these treatments to produce the variety of plants that are used for cover and food. The disked strips in an old or fallow field must be redisked every few years to keep the food plants from being crowded out by the less-desirable vegetation.

Prescribed burning

The most economical, useful tool for anyone wishing to raise quail in the wild is prescribed burning. The removal of litter makes quail food easier to find. Important plant seeds scarified by the heat will germinate much better on the burned-over range, while the new sprouts will furnish insects in spring and summer. The kinds of invertebrates that parasitize quail are actually decreased by fire. Furthermore, careful burning releases the ash and minerals

tied up in vegetation and stimulates the building of nitrogen in the soil. The result is a fertilizer effect for plants that are beneficial for quail.

Fire is a management tool that either can be used to an advantage or abused to become a negative factor in habitat management. Before fire is used, the manager must become aware of both the negative and positive aspects of fire within the habitats that are being managed. Factors that must be considered are:

- the time of the burn—early spring, late spring, summer, fall, etc.
- the type of burn—head fire, backing fire, etc.
- conditions of the burn—wind, moisture, etc.
- type of fuel—grassy, shrubby, etc.
- fire control methods—green lines, plowed lines, mowed lines, etc.

Valuable information concerning the use of fire and the methods through which it can be applied to a particular habitat situation can be obtained by contacting the Missouri Department of Conservation or the Natural Resource Conservation Service representative assigned to your county.

Cottontail Rabbit

The average-size Missouri farm of 290 acres has plenty of room for rabbit management. Under good conditions, the home range of a cottontail is often less than 5 acres.

Rabbits need well-distributed escape cover, such as brush piles, an ample year-round food supply, and safe places for nesting and raising their young.

Food management

Rabbits eat plant foods. Bluegrass is nearly a year-round food, although not heavily used during the summer. Sprouting wheat, corn kernels and milo seeds are important during fall and winter.

Cheat, an annual grass, is an important food during early spring. Good summer foods are white clover, Korean lespedeza and crabgrass. These foods must be of high quality and next to good rabbit cover. For planting details, see “Green Browse Plots” on page 61.

Important food plants for rabbits:

Asters	Korean lespedeza
Bluegrass	Nodding foxtail
Cheat (chess)	Plantains
Cinquefoil	Poison ivy
Clovers	Ragweeds
Crabgrass	Sedges
Crop residues	Smartweeds
Dandelion	Strawberry
Fall panic grass	Sumacs
Fleabanes	Tall thistle
Horse nettle	Tick trefoils
Knotweed	Timothy

Water management

Although rabbits drink from surface water during hot, dry spells, they obtain most of the water they need from the succulent plants they eat.

Cover management

Dense, well-distributed protective cover is the most critical element in good rabbit habitat. Brush piles located in the right places bring the quickest response of all the management tools. Rabbits often take over a brush pile the night after construction. Place brush piles close to other permanent cover, such as briars, fencerows or woods. Don't burn brush piles left from clearing; instead, push them to the edges of the field for cover. For more information, see "Brush-Pile Construction for Escape Cover" on page 68.

Discarded Christmas trees make ideal brush piles for rabbits. To make them even more effective, place an old skid or some other similar material on the ground and then pile enough Christmas trees on top to make a pile about the size of a car.

Some trees, such as locust, will remain alive for several years when "lopped over" or "hinged." If the top is allowed to remain attached to the stump, the twigs and limbs will provide both food and cover.

Odd or non-agricultural areas—such as woodlots, gullies and pond sites—that are allowed to grow briars, brush and tree sprouts will provide excellent nesting sites for rabbits

and other wildlife. Fencing these areas to exclude cattle improves existing cover and allows grass and shrubs to thrive. When fencerows are protected from grazing and the larger trees along the row are topped, the resulting low, dense growth also will provide good rabbit cover.

Wild Turkey

Food management

The number one food of wild turkeys throughout the year is acorns, but they also eat the seeds, buds, leaves and tubers of many other plants. Their principal natural plant foods fit into a few general categories: mast (acorns and pine nuts); fruits (dogwood, grapes, cherry, gum, persimmon, juniper); seeds (native grasses and sedges, weeds); and greens (grasses and grass-like plants, selected annual and perennial broad-leaved plants).

These birds also eat insects, and a management plan for year-round food must include clearings where they can forage for them. At least 10 percent of the forest area should be in scattered openings.

Seasonal fluctuations in one type of natural food will usually create few problems for wild turkeys. Low production of one food usually coincides with high production of another.

Domestic crops, such as soybeans, cowpeas, buckwheat, sorghum grain, corn, oats and millet, also are desirable foods for turkeys.

Grain food plots—Annual grain food plots for turkeys, as well as deer, not only supplement natural foods, but also help in extremely bad weather or during drastic natural food shortages. See “Annual Grain Food Plots” on page 63.

Green browse plots—Permanent 1-acre food plots can be established in forest clearings. Apply recommended amounts of limestone and fertilizer to a good, clean-tilled seed bed, then seed to wheat and clovers. See “Green Browse Plots” on page 61.

Crop residues—Corn fields attract turkeys during severe weather in late winter and early spring when other food is in short supply. A few rows of corn left standing next to timber will ensure a food supply in case of deep snow.

Idle fields—Abandoned fields surrounded by timber are an essential part of the annual range of wild turkeys. Try to keep old fields open and in a grass-legume mixture. Mowing or moderate grazing helps because turkeys tend to avoid fields grown up in dense vegetation.

Important food plants for turkey:

- Acorns
- Bedstraw
- Blackberries
- Buttercups
- Cherries
- Clovers
- Crotons
- Crop residues corn, milo, soybeans, etc.
- Dandelion
- Dogwoods
- Goldenrods
- Grapes
- Hackberry
- Hawthorns
- Insects
- Korean lespedeza
- Native warm-season grasses
- Poison ivy
- Ragweeds
- Roses
- Sedges
- Smartweeds
- Sorrels
- Strawberry
- Sumacs
- Sunflowers
- Tick trefoils
- Wild beans

Water management

Wild turkeys require surface water and ordinarily are not found where it is lacking. One pond, stream or other water source per quarter section of land is usually adequate for good turkey habitat.

Cover management

Turkeys prefer open, mature woods. Studies show that stands of large trees will support twice as many turkeys as other woodland types. Turkeys also use stands of smaller trees if the understory is not too dense.

Food management

White-tailed deer are browsing animals. They eat the succulent tips of many different shrubs, vines and trees, along with a variety of other foods. No one food predominates throughout the year. What deer eat depends on the availability of the food, its abundance and the season. A deer management plan should include adequate food supplies for all times of the year.

Spring and summer browse—Summer foods consist mainly of the leaves of annual and perennial plants and shrubs. Deer prefer summer grape, red clover, Virginia creeper and Korean lespedeza during this period.

Fall and winter foods—If plentiful, acorns are the primary food. Lacking acorns, deer feed on corn, lespedeza, wheat, other crops and native plants, such as sumac and buckbrush. Twigs of sapling trees and various shrubs also are important winter foods.

Woodlots can be managed for deer food production by maintaining acorn-producing trees, creating brush and protecting the woodlot from grazing cattle. About 54 percent of the deer's year-round diet is acorns. For a good supply of acorns, maintain mature oak trees of several species, such as post, black, white, northern red, chinquapin, blackjack and scarlet. About 20 acorn-producing oaks per acre are required to support deer.

Important food plants for deer

Acorns	Crotons	Maples
Crop residues	Dogwoods	Persimmon
Asters	Elms	Poison ivy
Blackberries	Fleabanes	Pokeweed
Black haw	Goldenrods	Roses
Bluegrass	Grapes	Sumacs
Cherries	Greenbriers	Spurge
Cinquefoil	Hazelnut	Tick trefoils
Clovers	Korean lespedeza	Violets
Coralberry (buck brush)	Lettuces	Virginia creeper

These trees should average at least 14 inches in diameter at breast height (DBH). The number of acorns produced by each tree will depend on its crown size, age and health, and on the weather.

Creating "brush" is the most commonly used technique for improving white-tailed deer habitat. The brush stage, or seedling/sapling forest, has nearly three times the amount of twig production, or browse, per acre than a saw-timber stand. Timber harvest is a good way to create brush, but be sure to leave enough mature oak trees for a satisfactory acorn crop.

Shrubs and vines are another type of brush. Some common shrubs browsed by deer are: blueberry, flowering dogwood, witch-hazel, serviceberry and viburnum.

The woodlot should be fenced to exclude livestock because they compete directly with deer for food.

Water management

Deer require water from a surface source daily. Their water needs are partially met by the succulent plants they eat, but the lack of water may keep deer from using areas that otherwise have good habitat. A management plan for deer should include at least one water source per square mile.

Cover management

Evergreen stands are important deer habitat. They provide shelter from the weather, escape cover and food during winter. Cedar and pine groves as small as 5 acres are excellent shelter once the trees are 10-15 feet high.

Squirrel

You can increase the number of squirrels on most farms that have some woods. Certain practices, such as installing den boxes, give prompt results. Others require several years to take effect.

Food management

Woodlands of around 40 acres or larger with at least 50-75 trees that produce nuts, seeds or fruits—such as oak,

hickory, walnut, elm, maple and mulberry—are usually good squirrel habitat. Mature trees will increase the volume of food produced.

Timber stand improvement, or TSI, which reduces competition among trees, will increase the production of acorns and other squirrel foods. Any practice that increases the diversity of plants within a woodlot will usually benefit squirrels.

In years when natural foods, especially acorns and nuts, are in short supply, squirrel feeding stations stocked with corn, nuts and other foods can be beneficial.

Important food plants for squirrels

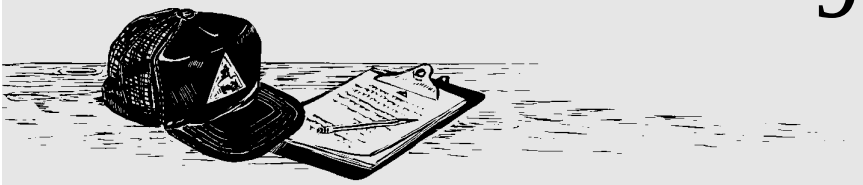
American elm	Fungi	Shagbark hickory
American plum	Honey locust	Shellbark hickory
Apple	Mockernut hickory	Shumard oak
Bitternut hickory	Osage orange	Silver maple
Black oak	Pecan	Wheat
Black walnut	Pin oak	White oak
Chestnut oak	Post oak	Wild grape
Chinquapin oak	Red mulberry	
Corn	Red oak	

Management for den sites

The supply of den trees—those with cavities for shelter and nesting—is a major factor limiting squirrel populations. A mature forest usually has more cavities for squirrels than a younger woodland. See page 29 for details on managing a woodland for den trees.

In woodlots with fewer than four natural dens per acre, artificial dens will be of value. A pair of squirrels usually requires two to three dens—one each for the male and female, and one for raising the young. Competition for dens among squirrels, owls, bees, snakes and other cavity users is intense. When artificial dens are supplied, some of this competition is reduced. Dens can be built from auto tires, rough lumber, sawmill slabs, nail kegs or hollow logs cut in sections. See pages 70-72 for details on how to build and install a squirrel den box.

CHAPTER 9



Wildlife Management Services

■ Technical help with wildlife and fisheries habitat improvement, as well as woodland resource management on your farm, is available from several agencies. This assistance is free of charge, and some financial help may be available if certain requirements are met.

These agencies, their field representatives and the services they provide are described below.

Missouri Department of Conservation

The Missouri Department of Conservation is responsible for managing the forest, fishery and wildlife resources of the state. All of the field personnel serve multi-county areas, with the exception of the conservation agents. Field personnel may be contacted locally or by writing to the Missouri Department of Conservation, Box 180, Jefferson City, Mo. 65102-0180.

Conservation agents

A conservation agent is assigned to each county. If you do not know your conservation agent, contact the sheriff's office or University Outreach and Extension office, or write to the above address.

Conservation agents enforce the rules and regulations of the *Wildlife Code*, including Missouri's trespass laws.

Conservation agents also assist private landowners with wildlife, fisheries and forest management. For example, they give on-the-farm habitat recommendations, provide application forms for fish stocking of private lakes and distribute seeds for wildlife food plots. Agents also are the contact persons for assistance with wildlife damage. If a

request for assistance is outside the agents' expertise, they will refer the interested person to the appropriate Department specialist.

Educating the public about Missouri's wildlife and fisheries resources and their regulation is a major part of conservation agents' job. Agents frequently give presentations to groups and appear on radio and television programs. They focus much of their effort on hunter education classes.

Wildlife management & urban biologists

These biologists are wildlife management specialists. At a landowner's request, they will make recommendations for improving wildlife habitat to meet the owner's conservation goals. They are particularly knowledgeable about the ways that farming systems, wildlife management and government agricultural programs can blend together productively.

Wildlife management biologists hold workshops for landowners and give presentations to farmers' organizations, civic clubs, and hunting and wildlife-oriented groups. They work closely with agricultural agencies, such as the Natural Resources Conservation Service, University Outreach and Extension, and Farm Service Agency. They also provide technical support to agricultural education instructors on wildlife projects.

Wildlife damage biologists

These specialists can help you deal with problem wildlife. Due to multi-county assignments, they are available by appointment only. They teach wildlife-control techniques to landowners who are experiencing significant wildlife damage. Arrangements for this service can be made by contacting your local conservation agent.

Fisheries management biologists

These biologists provide technical help in management of private impoundments and streams. They give advice and assistance to landowners with regard to pond stocking, aquatic weed control, water-quality improvement, fish-

population management, streambank stabilization and revegetation, and other aspects of fisheries management.

District & urban foresters

These foresters, who have multi-county assignments, can help you manage your valuable forest land.

Services include: tree planting and harvesting information, woodland wildlife management, timber stand improvement, timber sales advice, information on tree insect and disease control, and other related assistance.

University Outreach & Extension

OUTREACH & EXTENSION
UNIVERSITY OF MISSOURI
LINCOLN UNIVERSITY

University Outreach and Extension, formerly called Missouri Cooperative Extension Service, provides technical assistance on a broad range of agricultural projects. These offices have a wide selection of printed material available on various aspects of agriculture, forestry, horticulture, home economics, wildlife conservation and wildlife damage to property and crops. Your University Outreach and Extension office also will do soil testing and help you interpret the results.

University Outreach and Extension has agricultural advisors stationed at many locations throughout the state. They work individually with farmers or give presentations to groups on agricultural topics.

Your county office is listed in the yellow pages under "Government Offices—County." It often is listed as "University Outreach and Extension, University of Missouri."

Farm Service Agency

USDA

The Farm Service Agency, or FSA, is a unit of the U.S. Department of Agriculture. FSA works closely with the Natural Resources Conservation Service in the administration of USDA programs that provide loans, price support, cost sharing and other ways to assist landowners financially with approved conservation practices. On the local level, FSA is assisted by a committee of landowners to ensure programs meet both federal policy and local needs.

This agency may offer several types of programs that can assist landowners in providing food, cover, tree plantings and water for wildlife through cost-sharing and incentive programs.

Note: Cost-share or incentive programs vary from year to year, depending upon available federal revenues. Landowners should check with the various agencies concerning available programs and their individual sign-up dates.

Your local FSA office is normally listed in the white pages of your telephone directory under "United States Government—Agriculture, Department of—Farm Service Agency." Usually, this office is located in the same building with the local office of the Natural Resources Conservation Service.

Natural Resources Conservation Service

The Natural Resources Conservation Service, or NRCS, is a unit of the U.S. Department of Agriculture. NRCS is responsible for the technical aspects of USDA programs, and works closely with the Farm Service Agency in the administration of these programs.

Local NRCS personnel can assist in developing conservation plans that detail the practices necessary to protect your land from erosion, improve water quality and create better fish and wildlife habitat. They also make forage and crop management recommendations, help with the design of terraces, waterways and ponds, and suggest plant species that best meet your resource needs.

Your local NRCS office is listed in the telephone book white pages under "United States Government—Agriculture, Department of—Natural Resources Conservation Service."

Soil & Water Conservation District

The Soil and Water Conservation District, or SWCD, is a local organization under the Soil and Water District Commission of the Missouri Department of Natural Resources. Each district is guided by an elected volunteer board of directors, made up of local landowners. Local district boards usually employ a manager and one or more technicians who assist the Natural Resources

Conservation Service field staff.

The districts administer state cost-share conservation programs with assistance from the Department of Natural Resources and NRCS. In conjunction with NRCS, SWCD supports various resource conservation activities; and in many districts, the agency provides conservation education to local schools. Many SWCD offices also participate in cooperative cost-share programs with the Missouri Department of Conservation. Your local SWCD office will usually have the same telephone number as the NRCS office.

Missouri Department of Natural Resources

The Missouri Department of Natural Resources, or DNR, is involved in environmental and resource-related issues. This state department deals with energy, mineral resources, soil and water conservation, and the state's historic heritage.

DNR administers any funds appropriated by the legislature for the use or benefit of the Soil and Water Conservation Districts. This agency also runs soil surveys, administers a soil and water conservation cost-share program, and manages grants-to-districts programs. Some of this grant and cost-share money is made available by the Missouri Department of Conservation to encourage wildlife habitat improvement practices. For information on these practices, contact your local Soil and Water Conservation District office.

CHAPTER 10

Wildlife Management Practices

■ This chapter describes many habitat management practices that have proved to be effective. If you are interested in more practices of this type, help is available from professionals in this field. Refer to Chapter 9 for a list of the agencies specializing in this type of resource management.

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Green Browse Plots

A green browse plot of legumes with a thin stand of grass will provide green forage for turkeys, deer and rabbits. It also will attract an abundance of insects for turkey poults and quail chicks.

Size & location

Green browse plots should be at least 1 acre in size. See "Field Measurements for Wildlife Plots" on page 65.

Locate plots on level ridge tops, in bottomlands or along the contour of gentle slopes. The site should be open, tillable and next to suitable cover. Placing the plot at least 50 feet from any woodland edge will reduce competition from trees and allow sunlight to reach the planting. A buffer strip of perennial weeds and woody shrubs will develop over time between the browse plot and the timber, if tall fescue is not present.

For deer and turkey, green browse plots should be spaced about 1/4 mile apart or one per 40-acre area. To be effective for rabbits, however, these plots should be about 1/4 or 1/2 acre in size and about 100 yards apart.

Seed-bed preparation, liming & fertilizing

Prepare the seed bed in September or early October. The ground should be plowed and disked until no live vegetation exists. Before seeding, the plot should resemble a vegetable garden ready to be planted. Remember, there is no substitute for a well-prepared seed bed.

Correct fertilization is essential for the successful establishment and long-term maintenance of the green browse plot. Before planting, obtain a soil sample from each plot site. For directions, see "How to Take a Soil Sample" on page 72. Take your samples to a University Outreach and Extension office for analysis. The results of this test will show what fertilizer should be added. The Outreach and Extension agronomist can then provide recommendations for both initial fertilization and annual topdressings of fertilizer. For details on how to interprete the soil test results, see page 74.

Disk fertilizer and limestone into the soil at the time of seed-bed preparation. If recommendations on fertilizer amounts cannot be obtained in time for planting, the following starter application should be sufficient. Correct any deficiencies by top dressing with additional fertilizer at a later date.

Starter Fertilizer—Apply 500 pounds of 6-12-12 fertilizer per acre at the time of seed-bed preparation. This amount may be sufficient for three to four years, after which time a fertilizer top dressing may be required. This initial application will supply 30 pounds of nitrogen (N), 60 pounds of phosphorus (P205) and 60 pounds of potassium (K20) per acre.

Lime—If the site has never been limed, apply agricultural limestone at the rate of 3-4 tons per acre. A soil test will indicate whether the soil pH needs to be regulated by adding more limestone.

Seeding

Each 1-acre green browse plot should be uniformly seeded with a half bushel (30 pounds) of winter wheat and 2 pounds of orchard grass at the time of seed-bed preparation (late September or early October). At the same time or in early winter, half of the plot should be overseeded with 2 pounds of ladino clover and 2 pounds of red clover. The following spring (January-March), the other half is overseeded with 10 pounds of lespedeza, which can be Korean, Kobe, Summit or a mixture of these. The lespedeza will provide seed for quail and green forage for other wildlife during the summer when clovers may become dormant.

Maintenance & protection

Mow the plots each year between July 1 and July 15 to reduce any unwanted weeds, using either a rotary or sickle mower. Renovate and reseed the plot in three to four years, if the grasses or weeds have crowded out the legumes.

For maximum value to wildlife, plantings must be protected from excessive grazing. Light grazing to remove about one-half of the growth during the last half of June is desirable in lieu of mowing; however, do not graze during the fall or winter months.

Annual Grain Food Plots

Many wildlife species depend on and prefer native weed seeds and wild fruits for winter food. When ice and snow cover these natural food sources, wildlife will then benefit from standing grain. High-quality food can be provided by planting small grains in properly located food plots.

Grain plots with soybeans or other legumes will attract insects and provide seed and succulent green browse that quail chicks, deer, turkey and many songbirds will use.

Size of the grain food plot

A grain food plot should be at least 1/2 acre in size. Smaller plots will not supply enough food for the long winter months. See page 65 for details on how to measure your wildlife plot.

Each year, plant half of this area (1/4 acre) with grain and allow the other half to grow weeds for seed and cover. The following year, plant the "weedy" part and allow the first half to grow weeds. This rotation will provide native seeds for food, some bare ground for dusting and standing grain for emergency food. It also will make better use of the fertilizer that you have applied.

The shape is not really important; however, an irregularly shaped plot with "islands" of good cover within the planted area is better than a rectangular plot.

Location & protection

Grain food plots must be located near brushy draws, in corners of shrubby fence rows and along edges of wooded areas. Old fields or idle areas are excellent sites. Brush piles can be added for escape cover, and weeds should be allowed to grow. At least six brush piles about 15 feet in diameter should be located around each grain food plot. See page 68 for details on how to construct bush piles.

Caution: Livestock must be excluded if the grain plot is to be of any value to wildlife. Also, after frost or drought, grain sorghum can be poisonous to livestock. For these reasons, grain food plots should be fenced or located in ungrazed areas.

Number of plots to plant

As a rule, one grain plot for every 40 acres of farmland is a minimum. On farms where grain crops are grown, fewer plots are necessary if crop residue and some grain is left standing next to cover. More plots, however, would be required on a pasture farm where no grain is produced.

Seed-bed preparation & planting time

Grains must be planted in a clean-tilled seed bed. The ground should be plowed and disked in early spring until no live vegetation remains, and it resembles a vegetable garden before planting. The fertilizer and limestone should be worked into the soil at this time. Planting time for most of Missouri is between May 10 and June 20, depending on the amount of spring rainfall and other local factors.

Fertilizer & lime

The 1/4-acre plot should be treated with at least 150 pounds of 12-12-12 (or 13-13-13) fertilizer at the time of seed-bed preparation. Fertilize larger plots accordingly. This amount will nearly equal the nitrogen used by the grain crop and will more than replace the phosphorous and potassium. This is a general recommendation when the results of a soil test are not available. If time permits, use soil test results to determine fertilizer and lime requirements. See “How To Take a Soil Sample” and “Interpreting Missouri Soil Test Reports” on pages 72-77.

Limestone is added to regulate the active soil acidity, or pH, which affects the availability of many other soil nutrients. Grain sorghum grows best in a soil pH of 6 to 6.5. If the soil test shows a pH of around 5, for example, a 1/4-acre plot will require approximately 3/4-1 ton of crushed limestone. Should the pH be near 6, only 400 to 500 pounds of limestone will be needed.

Kinds of grain to plant

Sorghum (milo) seeds are rich in energy, persistent on the plant and usually available to wildlife when other seeds are covered by snow or ice. If only one grain is to be planted, grain sorghum will give the best results. Plant grain sorghum at the rate of 4 pounds per 1/4-acre plot (or 8 pounds per 1/2 acre and 16 pounds per acre).

Additional grain mixtures, in order of preference, are:

	Ibs./fourth acre	Ibs./acre
No. 1		
Grain sorghum	2.0	8
Soybeans	3.0	12
No. 2		
Grain sorghum	2.0	8
Soybeans	2.0	8
German millet	0.5	2
No. 3		
Grain sorghum	3.0	12
Sunflowers	2.0	8

Caution: Planting too much seed will result in competition between the plants and will reduce the amount of grain produced. The above seeding rates will allow the production of both grain and beneficial weeds that supply food and cover.

Field Measurements for Wildlife Plots

Number of feet	Number of steps (2.5 feet/step)	Number of yards
105 x 105	42 x 42	35 x 35
75 x 150	30 x 60	25 x 50
65 x 170	26 x 68	22 x 57
50 x 220	20 x 88	17 x 73
40 x 275	16 x 110	13 x 92
30 x 365	12 x 146	10 x 122
20 x 550	8 x 220	7 x 183

These measurements will define an area of approximately 1/4 acre. For larger plots, multiply one of the numbers of a pair by: 2 = 1/2 acre; 3 = 3/4 acre; and 4 = an approximate acre. For a field corner plot, measure along each fence (or axis) 150 feet from the corner post, and then connect the two points.

Acre/Square Feet Conversions:

1 acre	208.7 x 208.7 feet = 43,560 square feet
1/2 acre	104.4 x 208.7 feet = 21,788 square feet
1/4 acre	104.4 x 104.4 feet = 1 0,899 square feet

Grass/Legume Mixtures Beneficial to Wildlife

No. 1 Green Browse (All Purpose)

Wheat (fall)	30
Orchard grass	2
Ladino clover	2
Red clover	2
Korean lespedeza	10

No. 2

Wheat (fall)	30
Timothy	1
Bromegrass	10
Alfalfa	12
Ladino clover	0.5

No. 3

Timothy	8
Bluegrass (optional)	1
Medium red clover or alfalfa	8

No. 4

Orchard grass	8
Korean lespedeza or medium red clover	10
Ladino clover	1
or alfalfa	8

Rate = Bulk pounds per acre, broadcast

Plantings Beneficial to Wildlife

Kind of Seed	Pounds Per Acre	Time to Sow
Alfalfa	25-30	Spring, Early Fall
Barley	96-120	Sept. 1-Oct. 10
Bluegrass-Pasture	20-30	Early Spring-Early Sept.
Bluegrass-Lawn	30-40	Anytime
Bromegrass	10-20	Spring, Fall
Buckwheat	60-80	Late Spring
Clover, Alsike	8-10	Winter to April
Clover, Crimson	15-30	Winter to April
Clover, Red	12-15	Winter to Early April
Clover, Ladino	2-4	Spring, Fall
Clover, White Dutch	3-6	Aug.-Oct., Spring
Corn (rows)	10-15	Spring
Lespedeza (Korean, Kobe)	15-30	Mid-winter to Early Spring
Millet, German	20-30	Late May-Early July
Millet, Pearl	20-30	Late May-Early July

Kind of Seed	Pounds Per Acre	Time to Sow
Oats	96-120	Jan. 20-March 20
Orchard grass	20-40	Early Spring, Early Fall
Redtop	8-10	Aug. 15-Oct. 30, Spring
Rye, Winter	112-168	April, Early Sept.
Sorghums, Forage	10-15	May to June 20
Sorghum, Grain (milo)	16-20	June 15 to July 1
Sunflower	12	Late April to Late June
Soybeans (rows)	35-40	April 1 (S) to June 10 (N)
(broadcast)	45	April 1 (S) to June 10 (N)
Timothy	12-16	Aug. 15-Oct. 20
Wheat, Winter	120-180	Sept. to Nov.

Rate = Bulk pounds per acre, broadcast

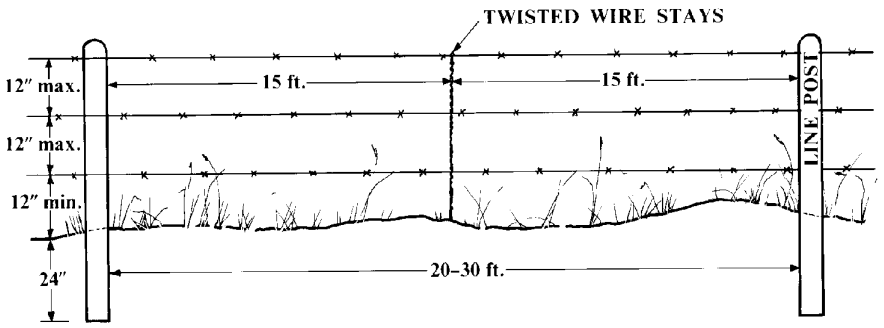
Note: The following plants could have a negative impact on wildlife habitat due to their aggressiveness and growth characteristics: birdsfoot trefoil, Caucasian bluestem, crownvetch, fescue, reed canarygrass, sericea lespedeza and sweet clover. Contact an agency specialist for details.

Fencing to Protect Wildlife Food & Cover

Fencing is costly but important when managing farmland for wildlife. Fences help protect wildlife food and cover from grazing livestock.

Woven wire or four strands of barbed wire will contain or exclude most livestock. Line posts of either steel or treated wood should be set 15-20 feet apart. If the livestock is not too aggressive, a less expensive “suspension” or three-wire division fence may be adequate. In this situation, the line posts can be set 30-50 feet apart, with wire stays at 10-foot intervals.

Barbed wire is purchased in 1/4-mile rolls (1,320 feet or 80 rods). To help you determine how much wire you will



need to fence four sides of an area, see chart below.

Rolls of wire required to fence all four sides

Plot size (acres)	1 wire	3 wires
l/4	0.4	1.2
1/2	0.5	1.5
1	0.6	1.9
5	1.5	4.5
20	3.0	9.0
40	4.0	12.0

Brush-Pile Construction for Escape Cover

Nearly all animals need cover so they can escape from predators, rest in safety, nest and raise their young. What constitutes suitable cover depends on the wildlife species. Some animals use hollow trees, while others use brushy areas and dense stands of grass. To several species of small mammals, ground-nesting birds, amphibians and reptiles, brush piles represent an important type of cover. Brush piles located in the right places bring the quickest response of all the management tools. Rabbits often take over a brush pile the night after construction.

Proper placement of brush piles allows relatively safe access to food sources and permits wildlife to forage over a larger area. Brush piles should be placed at intervals near feeding areas, along field borders and within idle fields or abandoned areas. Avoid the bottoms of drainages and low spots where standing water might render the brush pile useless.

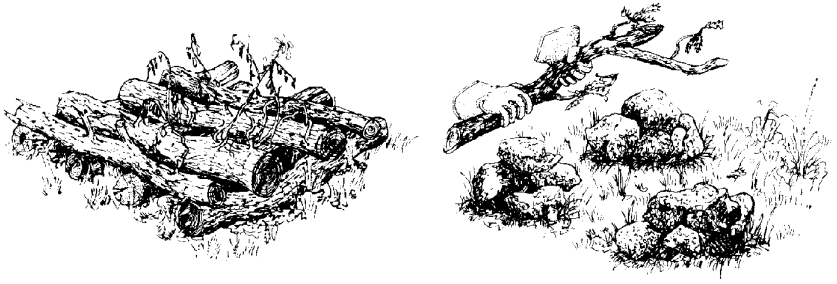
A brush pile should be constructed on a base of larger materials that will provide tunnels and openings at ground level. Three types of bases work particularly well: 1) large pole-size logs, 2) piles of rocks and 3) stumps.

First, lay four poles measuring 6 feet by 6 inches on the ground, parallel to one another and about a foot apart. Then lay four more perpendicularly across the first four. If rocks are used, they should be at least 12 inches in diameter and piled in stacks about 2 feet high. Make three stacks, one at each corner of a triangle. An optional, but effective, part of a good brush pile would be a sheet of discarded roofing tin or an old car hood placed across this base material.

When either of these bases is in place, stack limbs and

brush, using the large limbs first, until the pile is 6-8 feet tall and at least 15 feet wide. If poles or rock are not available, pile the limbs and brush against or over a relatively high stump.

"Living" brush piles may be constructed for long-lasting shelter. These are created by cutting partway through small trees and shrubs so that the tops fall to the ground, but enough stem remains uncut on each tree to keep it alive. If the trees are cut to fall in a crisscross pattern over each



Both rock piles and poles make good bases for brush piles.

Brush can be stacked against stumps to provide tunnels at ground level.

Low limbs can be broken and bent to the ground.

These small trees are only partially cut through and will continue to live for some time.

other, a living brush pile is created. Brush piles of this type are loosely formed and do not give the best protection from severe weather. They can be made denser by using the bases of the cut trees as foundations and piling dead limbs and brush over them. Care should be taken to leave the live tops of the cut trees uncovered so they will continue to grow. Either deciduous trees and shrubs or conifers may be used. Grapevines should be encouraged to grow over the brush pile for added cover.

Discarded Christmas trees, without the tinsel, make ideal brush piles that will last for several years. To make them even more effective, place an old skid or similar material on the ground and then pile enough Christmas trees on top to make a pile about the size of pickup truck.

Regardless of the type, brush piles add a valuable dimension to the wildlife habitat on your land. If properly located and constructed, they will provide important wildlife cover for many years. It should be noted, however, that brush piles are not permanent structures. Rot and decay will quickly reduce the effectiveness of a brush pile. To provide adequate escape cover, brush piles must be added to your management area on an annual basis.

Squirrel Den Box

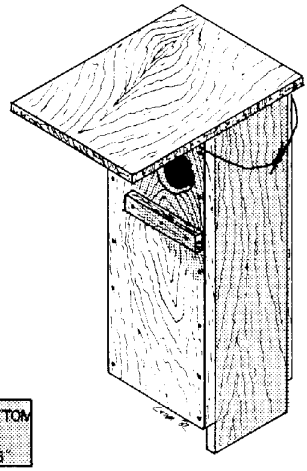
Studies of leaf nests and dens, show that each pair of squirrels requires three dens—one for the male, one for the female and another in which the young are born. The pair will live in one den until just before birth of the young. At this time, the female evicts the male, who then needs an additional den or nest. After the young leave the nest, the male rejoins his mate. The young require more dens; and if none are available, they will either migrate to another area or will be eliminated by predators.

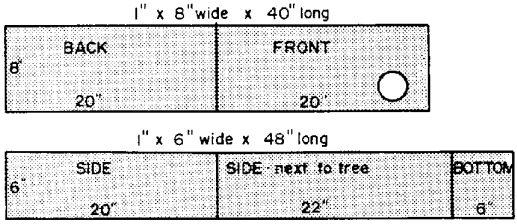
Other animals that commonly use squirrel den boxes are kestrels, screech owls, honeybees, some woodpeckers and even black rat snakes. Crested flycatchers and other songbirds have been known to nest in squirrel den boxes.

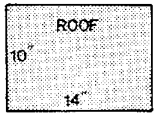
Construction

Scrap lumber of nearly any kind can be used to build a squirrel den box. Exterior-grade plywood may be used, but squirrels may gnaw on the box and damage it. Treated

Plans for Building a Squirrel Den Box







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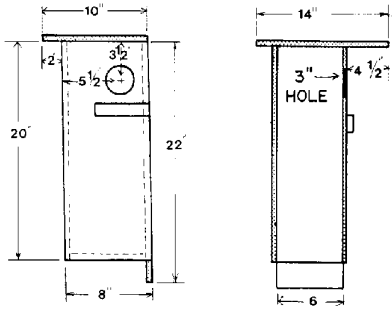
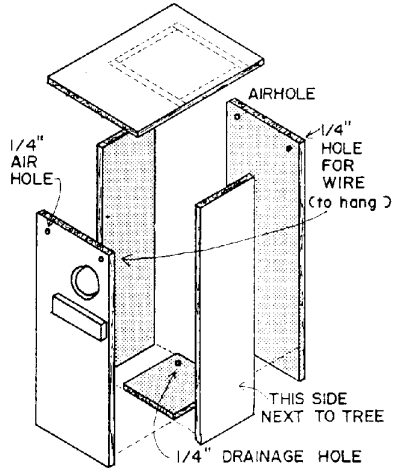




lumber also is acceptable. The main items to consider during construction are the cavity size and entrance hole. The cavity should be a minimum of 6 x 6 x 20 inches, and the entrance hole must be at least 3 inches in diameter and located about 2 inches from the top. The hole is located on a side that will be next to the tree trunk; however, squirrels will use the box no matter where the hole is located. The top must be weatherproof, and the bottom should have four or five small drain holes. Experience has shown that the bottom will deteriorate within about five years unless the box is cleaned at least every third year. The bottom or top may be hinged to allow cleaning. Before hanging the

box, place about 3 inches of dry sawdust or leaves in the bottom to encourage its use.

A good cypress or cedar den box will last 10 years or more and furnish a home for about 20 squirrel families, or nearly 75 squirrels, in a decade of full use.

Installation

The box should be placed on a tree at a height of 10-30 feet. Use No. 9 aluminum, copper or galvanized wire to avoid rusting. If this is not available, a heavy coat hanger will do nicely.

Note: Several existing plans recommend that the wire pass through the box and then around the tree trunk. Experience has shown that the growth of the tree will crush the box within a few years.

A better and easier method to install the box is to pass the wire through holes next to the top of the box. Make a loop on each end of the wire. Hang the box from two nails driven into the tree trunk. Squirrels don't seem to mind if their new home swings in the breeze a bit. Use aluminum nails if possible and bend them over the wire. Face the hole toward the south or east, away from prevailing winter winds. Boxes placed at or near the edge of large forests are more attractive to fox squirrels, and those placed well within a densely wooded area will attract gray squirrels. Construction of squirrel den boxes makes a fine home-shop project during the winter months, and the boxes can be installed at any time during the year.

How to Take a Soil Sample

For routine testing of the soil to determine lime requirements, organic matter and the amounts of available nutrients in the plow layer (upper 7 inches), use the following procedure.

A good first step is to obtain a Soil Survey map of your area. These maps are available from the Natural Resources Conservation Service office in your county. If a map is not available, draw a sketch of the farm and the individual fields for a reference.

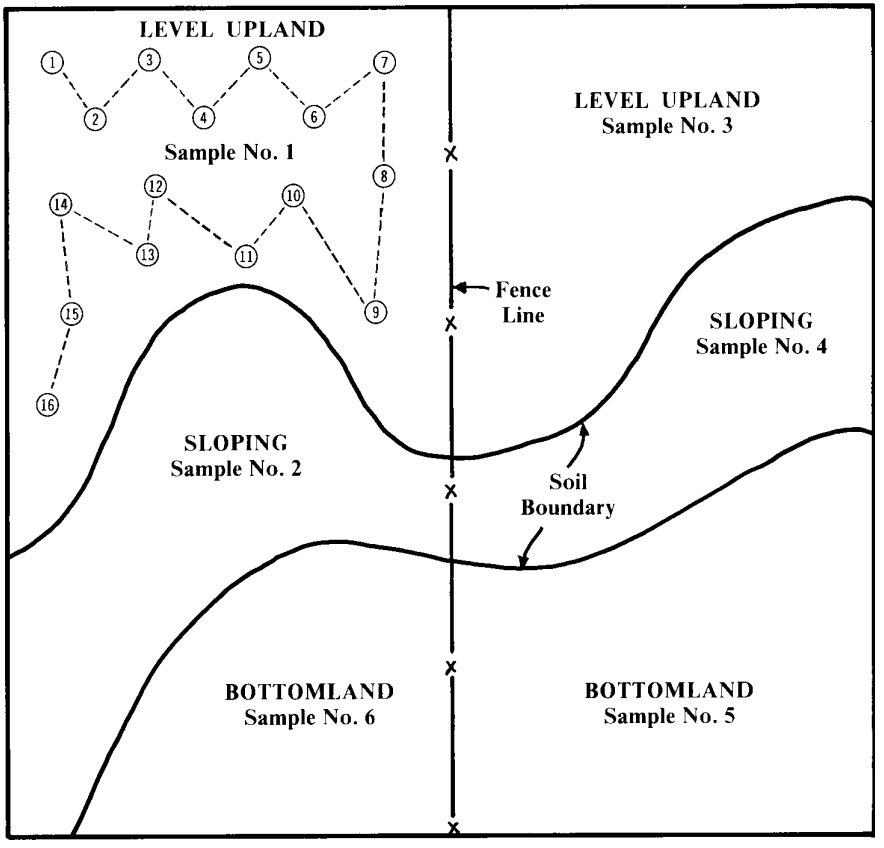
On the map or sketch, divide your farm into fields or soil types. Within an identified field or soil type, outline

several 5- to 10-acre sampling sites. Within each site, take from 15 to 20 soil samples; then combine these samples into one larger sample for each site. Number these site samples and record the numbers on the map or sketch. See illustration below.

Samples should be taken to a depth of 7 inches, using a spade, trowel, auger or soil tube. If you use a spade, dig a V-shaped hole to the plow depth and remove a 1/2-inch thick slice of soil from one side of the hole. Then trim from each side of the spade all but a thin ribbon of soil down the center of the spade face. Collect both the "slice" and the "ribbon" as the sample.

Air dry the sample, but do not use heat. When the sample is dry, mix it thoroughly and remove about a half pint of the soil for testing.

Take your soil samples to a University Outreach and Extension office for analysis. A small fee will be charged for each sample. Be prepared to furnish information on the field's history of cropping, liming and fertilizing. Include



the soil type listed in the Soil Survey, which is available from the Natural Resources Conservation Service.

Keep the results of soil tests with your wildlife or farm plan for future reference. Soil test results can be interpreted by your University Outreach and Extension agronomist, Natural Resources Conservation Service district conservationist or agricultural supply dealer. Guide sheet No. G9112 from University Outreach and Extension is helpful. Also see "Interpretation of Soil Test Results" below.

Interpreting Missouri Soil Test Reports

The Missouri Soil Test Report is an important tool in making management decisions for crop and forage production. However, inability to interpret the results often limits the usefulness of the report. This information should help you interpret the soil test report form and make it more useful in your farming operation.

Each section of the sample report on page 76 is indicated by a letter. An explanation of the section is given after the corresponding letter below.

A: FIELD INFORMATION—Contains information that helps you identify this soil test report from others you may receive. This information includes the field name or number, field size, etc.

B: SOIL TEST INFORMATION—Contains the analytical results of the sample you submitted for testing. The regular soil analysis shows the soil pH, along with amounts of phosphorus, potassium, calcium, magnesium, organic matter, neutralizable acidity and cation exchange capacity. Analyses for certain other factors can be made upon request at additional charge.

C: RATING—Gives a rating for the pH and certain other factors shown in section B. The ratings identify deficiencies or excesses of the factors tested.

D: SUGGESTED ANNUAL TREATMENTS—Contains three parts: cropping options (Section E), yield goal (Section F), and fertilizer recommendations (Section G). Each of these parts is described below.

E: CROPPING OPTIONS—Lists crops for which you requested fertilizer recommendations. You can request up to four different recommendations for the same crop or

single recommendations for up to four different crops. You can get recommendations for other crops later without taking another soil sample. This update can be done at your local University Outreach and Extension office after you receive your lab report.

F: YIELD GOAL—Shows the level of production you desire for the crops listed in Section E, "Cropping Options." The yield goal you choose should be based on soil type, field history, management ability and economic considerations.

G: POUNDS PER ACRE—Lists the fertilizer recommendations for the crops and yield goals listed in Sections E and F. The recommendations are reported as pounds of N (nitrogen), P2O5 (phosphate) and K2O (potash) per acre. The fertilizer recommendation for the crop is a combination of the nutrients removed with each harvest, plus additional fertilizer to build the soil to a medium level with applications over four to eight years. The recommendation is based on the soil sample analysis.

H: LIMESTONE SUGGESTIONS—Gives the suggested amount of limestone needed to raise soil pH to an optimum level for the crops listed in Section E. The limestone recommendation is given for the crop in Section E that requires the highest pH range. For example, if a cool-season grass and alfalfa were both listed in Section E, the limestone recommendation would be for alfalfa since it requires a higher pH. The recommendation is reported as pounds of ENM (effective neutralizing materials) per acre. To determine the amount of lime needed in tons per acre simply divide the ENM value by the ENM guarantee of your lime dealer. For example, if the soil test ENM requirement is 800 pounds per acre and the lime quarry guarantees 400 pounds ENM per ton of limestone, you need 2 tons of limestone per acre (800/400 = 2).

Limestone is applied to neutralize soil acidity and increase pH. It does contain calcium, but its main use is to neutralize acidity. Dolomitic limestone contains appreciable amounts of magnesium and often is used on soils deficient in magnesium. Some liming materials have higher ENM ratings than calcitic limestone. Applied limestone may take as long as one year to correct soil acidity problems.

I: SPECIAL NOTES—These notes at the bottom of the soil test report will help you with interpretation of your test results and use of the recommendations.

Missouri Soil Test Report (Completed Form)

MISSOURI COOPERATIVE EXTENSION SERVICE

UNIVERSITY OF MISSOURI & LINCOLN UNIVERSITY

Department of Agronomy
Extension Programs
214 Waters Hall
Columbia, MO 65211

Soil Test Report

Serial no. ____ Lab no ____
Area 28 County 039 Region ____
Submitted 07/15/90 Processed 07/23/90

A FIELD INFORMATION

Field ID 5 | Sample no. ____
Acres 20 Last Limed Unknown | Irrigated No
Last crop 99 IDLE LAND

Soil sample submitted by.

This report is for:

John Doe
Conservationist Road
Springfield, MO 65803

B SOIL TEST INFORMATION / **C** RATING

				Very low	Low	Medium	High	Very High	Excess
pH		5.6		**********					
Phosphorus	(P)	3	lbs a	**					
Potassium	(K)	131	lbs a	**********					
Calcium	(Ca)	2494	lbs a	**********					
Magnesium	(Mg)	74	lbs a	*****					
Sulfur	(SO_4-S)		ppm						
Zinc	(Zn)		ppm						
Manganese	(Mn)		ppm						
Iron	(Fe)		ppm						
Copper	(Cu)		ppm						

Organic matter 2.0 % Neutralizable acidity 3.0 meq 100g Cation Exchange Capacity 9.7 meq 100g
Sodium (Na) lbs a Electrical Conductivity mmho cm

D SUGGESTED ANNUAL TREATMENTS

E Cropping options	**F** Yield goal		**G** Pounds per acre N	P_2O_5	K_2O	Zn	S
1 ALFALFA, ALF-GRASS EST	0		20	135	45	.	.
10 ALFALFA, ALF-GR HAY	4	T/A	0	105	225	.	.
10 ALFALFA, ALF-GR HAY	5	T/A	0	115	270	.	.
10 ALFALFA, ALF-GR HAY	6	T/A	0	125	315	.	.

H LIMESTONE SUGGESTIONS

Effective neutralizing material (ENM)	800
Effective magnesium (EMg)	80

I To determine limestone needed in tons/acre, divide your ENM requirement by the guarantee of your limestone dealer.
Suggest using dolomitic limestone to increase magnesium in your soil. If dolomitic limestone is not available, under high management use a soluble source of magnesium fertilizer at a rate of 30 to 40 pounds Mg per acre.
Do not use nitrogen on spring seedings of legumes after May 1st, because of potential weed competition.
For alfalfa production, apply 1 lb. of boron per acre annually.

Area Agronomy Specialist ____ Phone ____ ____
MP 189 (rev. 8 86) White - Farmer Yellow - ASCS Blue - Firm Pink - Extension Signature

University of Missouri Lincoln University U.S. Department of Agriculture & Local University Extension Councils Cooperating

An equal opportunity institution

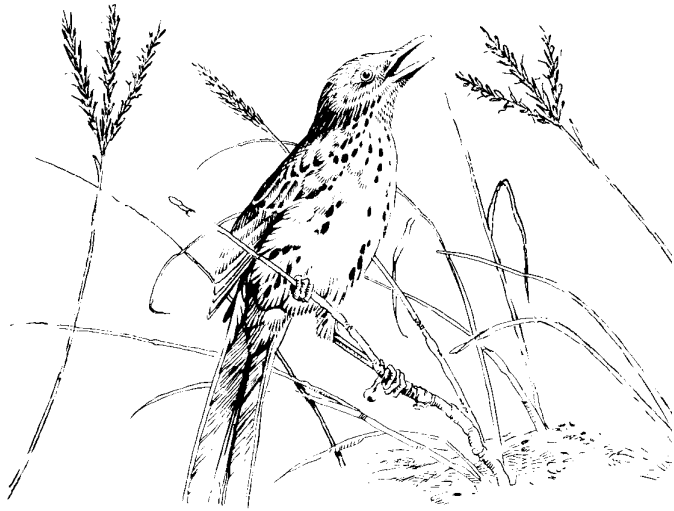
Crop	Soil pH: Ozark soils	Soil pH: All other Missouri soils
Alfalfa and alfalfa establishment	6.6-7.0	6.1-6.5
Birdsfoot trefoil and birdsfoot trefoil est.	6.1-6.5	5.6-6.0
Clover and clover establishment	6.1-6.5	5.6-6.0
Cool-season grass and Cool-season grass est.	5.6-6.0	5.6-6.0
Lespedeza and lespedeza establishment	6.1-6.5	5.6-6.0
Overseeding legumes	6.1-6.5	5.6-6.0
Warm-season grass and warm-season grass est.	5.6-6.0	5.6-6.0
Sudan grass and sudan/sorghum crosses	5.6-6.0	5.6-6.0
All row crops	6.1-6.5	6.1-6.5

Soil test results can be interpreted by your University Outreach and Extension agronomist, Natural Resources Conservation Service district conservationist or agricultural supply dealer.

Establishing Native Warm-Season Grasses

With the exceptions of switch grass and eastern gama grass, most of the native warm-season grasses produce fluffy seed. For this reason, warm-season grass seed should be purchased and planted on a pure live seed, or PLS, basis. PLS is determined by adding the percent germination and the percent dormant seed, and then multiplying by the percent purity. These values will be shown on the seed tag or will be available from the seed dealer. Details of this calculation and a chart to determine the amount of bulk seed to plant are given on page 80 in the section on how to calculate pure live seed.

Because of their fluffy character, most warm-season grass seeds will not flow through a regular grain drill. Special grass drills have been developed that will accommodate this type of seed. Some of these drills may be available for



loan or rent from various agricultural agencies (usually the local Soil and Water Conservation District office) throughout the state. Smaller acreages can be successfully seeded by hand broadcasting seed onto a rolled seed bed, followed by rolling twice with a heavy smooth roller.

Since this seed tends to be expensive when compared to other grass seeds, you will want to use the best planting methods available. Both studies and experience have shown that planting in a clean-tilled or conventional seed bed is the best method for normal conditions. Minimum or no-till seeding methods also have produced good stands of native grass, if the correct chemicals were used to kill the existing sod and to control any annual grass competition. You should consult with local agency personnel for the current information on seeding methods, seeding dates, chemical weed control and stand management.

Seeding Rates for Planting Native Warm-Season Grasses

Rate = Pounds per acre, Pure Live Seed (PLS)
See PLS Calculation on page 80.

Pure Stands for Hay and/or Pasture
Native legumes and forbs also should be added to plantings to provide plant diversity. Contact seed dealer for rates.

Big bluestem 7
(Kaw or Roundtree, Missouri native)
Indian grass 7
(Cheyenne, Osage, Nebraska 54, Rumsey)
Switch grass . . . . . .4 to 6
(Upland = Blackwell, Cave-in-rock, Trailblazer)
(Lowland = Alamo or Kanlow, Missouri native)
Eastern gama grass . . . . . .8 to 10
(Pete, Shepherd's, PMK-24, Iuka IV)

Mixtures Most Beneficial for Wildlife
Purchase seed mixtures harvested from Missouri remnant prairies if available. Wildlife plantings should not be dense stands, compared to pasture and hay plantings. Native legumes and forbs should be added to these mixtures to provide more plant diversity.

Note: Switch grass is not used in mixtures.

No. 1
Big bluestem (Mo. native) . . . . . .1 to 6
Indian grass (Mo. native) . . . . . .1 to 6
Combination total = 7 Ib./acre

No. 2
Big bluestem (Mo. native) . . . . . .1 to 3
Indian grass (Mo. native) . . . . . .1 to 3
Little bluestem (Mo. native or Aldous) . . . . . .1/2 to 2
Sideoats grama (Mo. native or El Reno) . . . . .1/2 to 2
Combination total = 6 Ib./acre

How to Calculate “Pure Live Seed”

Most seeding rates in the past have been listed in pounds of seed per acre. These rates have not been reliable because they do not take into account the viability of the seed. In addition, native warm-season grasses tend to be “chaffy” and bulky compared to domestic crop seeds, such as wheat or corn. In the case of native grasses, calculation of “pure live seed,” or PLS, is necessary to avoid paying for material other than seed.

Calculation Method: (formula)
% PLS = percent pure seed x (% germination + % dormant seed)

Example—The tag from a bag of Summit lespedeza seed lists the following information, which can be used to calculate PLS. See below.

Labeled by: Seed Company
Kind & Variety: SUMMIT LESPEDEZA

% Pure Seed	99.00	% Germination	75
% Other Crop	.10	% Dormant (Hard)	10
% Inert Matter	.50	% Total Germ.	85
% Weed Seed	.40	Noxious Weeds	432

Lot No. S1997 RRS3; Date Tested 11-86; Net Wt. 50 Ibs.; MO Permit No. W09377; AR Permit No. R876; OK Permit No. W0279.

The percent PLS for the above lot of seed would be: 84%

% PLS = .99 x (.75 + .10)

% PLS = .99 x .85 = 84%

Pure Live Seed

To determine percent of pure live seed, locate the number where the appropriate row and column meet.

% Germination

% Purity	100	95	90	85	80	75	70	65	60	55	50
100	100	95	90	85	80	75	70	65	60	55	50
95	95	90	86	81	76	71	66	62	57	52	48
90	90	86	81	77	72	68	63	58	54	50	45
85	85	81	77	72	68	64	60	55	51	47	43
80	80	76	72	68	64	60	56	52	48	44	40
75	75	71	68	64	60	56	53	49	45	41	38
70	70	66	63	60	56	53	49	46	42	39	35
65	65	62	58	55	52	49	46	42	39	36	33
60	60	57	54	51	48	45	42	39	36	33	30
55	55	52	50	47	44	41	39	36	33	30	28
50	50	48	45	43	40	38	35	33	30	28	25

Bulk Seed Required

To determine the amount of bulk seed required, locate the % PLS of the seed to be planted in the left column and the desired PLS planting rate in the top row. The bulk rate will be the number where the row and column meet.

Desired pounds PLS per acre

% Purity	1	2	3	4	5	6	7	8	9	10
20	5	10	15	20	25	30	35	40	45	50
30	3	7	10	13	17	20	23	27	30	33
40	3	5	8	10	13	15	18	20	23	25
45	2	4	7	9	11	13	16	18	20	22
50	2	4	6	8	10	12	14	16	18	20
55	2	4	5	7	9	11	13	15	16	18
60	2	3	5	7	8	10	12	13	15	17
65	2	3	5	6	8	9	11	12	14	15
70	1	3	4	6	7	9	10	11	13	14
75	1	3	4	5	7	8	9	11	12	13
80	1	3	4	5	6	8	9	10	12	13
85	1	2	4	5	6	7	8	9	11	12
90	1	2	3	4	6	7	8	9	10	11
95	1	2	3	4	6	6	7	8	9	11

Developing Wetlands

Many areas in Missouri could be developed into productive wetlands with little expense. As a landowner, your first consideration should be the overall objective for the wetland. This objective will influence both the development and management of the wetland. For example, if the objective is to benefit migrating waterfowl and to provide hunting opportunities, the wetland must be designed and managed to provide a seasonally constant (fall and early spring) water level and a sufficient quantity and quality of food to attract waterfowl. This usually requires a water-control system. However, if the wetland will be used mainly for water filtration, natural flooding will accomplish this objective.

Before selecting the final site, you should consult someone with experience in wetland development and construction. Conservation Department personnel can inform you of any restrictions or permits that might be required before construction begins. They also will be aware of any cost-share programs that might be available.

Actually, many wetland areas in Missouri need only be identified, preserved and protected. In such cases there is no development cost.

Site selection

Site selection is critical. The topography, soil type, water source and overall objective for the wetland will influence the final site selection. The topography, or lay of the land, should be flat enough to allow shallow flooding of an area large enough to be functional. The soil must have the capacity to hold water.

Potential sites include areas below ponds or lakes, which provide excellent water sources. Extremely wet areas in fields often can be converted back to wildlife-beneficial wetlands. If the crops in an area are ruined by floods in one year or more out of 10, it may be better to eliminate this income risk by restoring the area to a wetland.

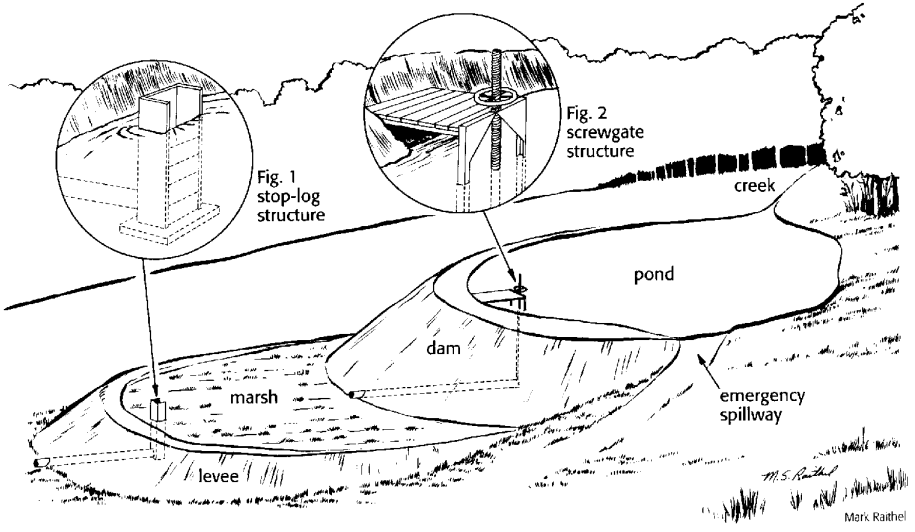
A good water source at the site is a very important consideration because a wetland cannot function without water. Your intended use of the wetland will dictate the quantity of water needed and the timing of delivery. The

water can come from underground sources, such as wells or springs, or from ponds, lakes or streams. Pumping water from underground sources can be expensive but will usually provide dependable water levels. If the water comes from natural sources or intermittent flooding, flood frequency and flooding heights of the adjacent stream must be considered.

Wetland construction

Once you have selected an appropriate site, development of the wetland can begin. Some wetlands may only require repair of natural levees, but others may need more extensive levee construction. Levee design will be determined by the intended use of the wetland and the topography of the site.

Levees should be built to a height of at least 18 inches above the water line. This amount of "freeboard" will prevent destruction of the levee by wave action and water saturation. Usually a 3:1 slope is adequate on small levees; but if the levee will be subjected to overtopping by flood waters, a 6:1 slope should be used. The levee should be wide enough to allow maintenance of the top and side slopes. Riprapping the shoreline with rocks will prevent damage from burrowing animals. Levees should be



A stop-log gate, Fig.1, and screw-gate valve, Fig. 2, can be used to control water flow for a wetland situated below a pond. The Natural Resources Conservation Service and the Conservation Department can provide technical help in building these structures.

constructed away from stream banks to reduce erosion by the stream.

The type of water-level control device you install will be influenced by the intended use of the wetland and by the water source. A water-control structure typically consists of a culvert and a gate device to stop the flow of water. Various types of gates are available. Choose one to fit your specific situation.

Wood Duck Nest Box

Wood ducks nest from mid-February to mid-March in Missouri. Their eggs are laid in tree cavities, which are often high above the ground, or in man-made nest boxes. A dozen eggs is an average clutch, and incubation is about 32 days. Ducklings leave the nest immediately after hatching. Free falls of up to 40 feet apparently do them no harm. First flight is at about nine weeks. One brood per year is normal, but two broods can occur in southern Missouri. Early foods are primarily insects, but later these ducks will eat vegetable foods. They winter in the lower Mississippi Valley.

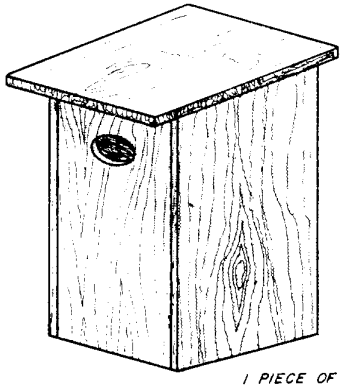
Although these nesting boxes are intended primarily for wood ducks, other species of wildlife may find them attractive for homes. Possible users include owls, kestrels, woodpeckers, hooded mergansers and even a honeybee swarm or two. All of these are important parts of the wildlife scene in Missouri wetlands.

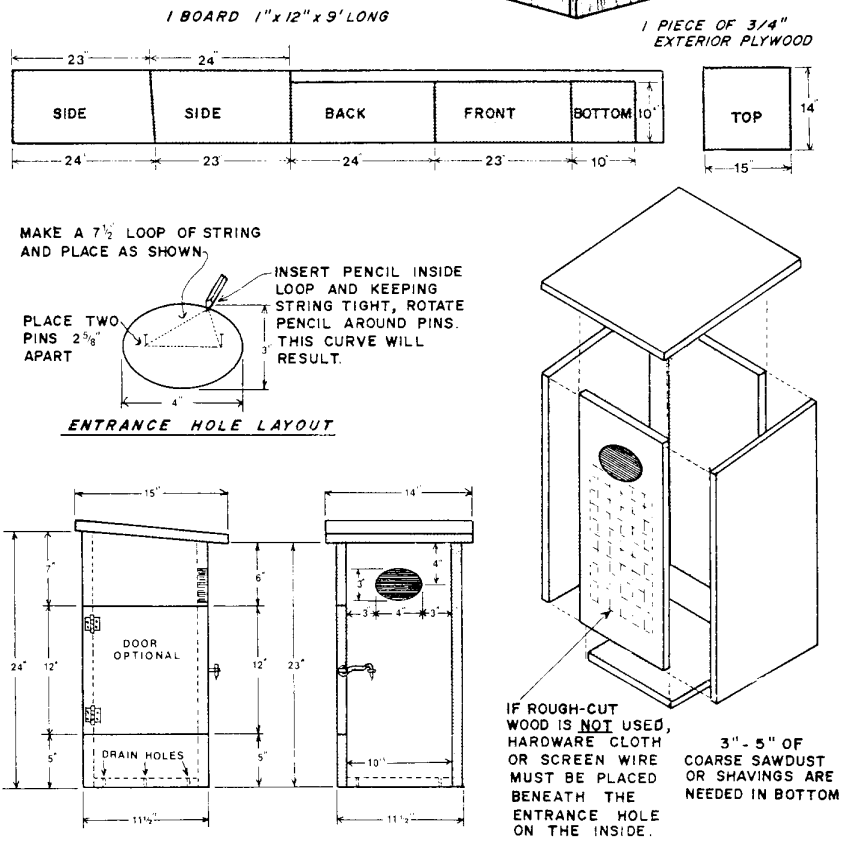
Construction and installation

No man-made nesting device for waterfowl has gone through more design changes than that for the beautiful wood duck. Early types were usually made of wood, but newer models are constructed predominately of plastics or metal. Each box should have a 6-inch wide strip of 1/4-inch hardware cloth or screen wire stapled inside, from the bottom to the hole, so the ducklings can climb out.

Lakes, ponds and marshes throughout the state are potential production sites for wood ducks. We recommend that all wood duck boxes be erected over water, using steel or wooden posts with predator-proof metal cones or sleeves. Place the post in water 2-4 feet deep and as far from the shoreline as possible at this depth. The bottom

Plans for Building a Wood Duck Nest Box





of the box should be no lower than 4 feet from the water surface, and higher if possible. If the water level fluctuates radically during floods or heavy rainfall, the box should be mounted above the high-water elevation. Be sure to place 6 inches of wood shavings or sawdust in the box. Boxes may be erected in the winter when ice is thick enough to safely support the person who is driving the posts.

Bluebird Nest Box

Bluebirds are year-round residents of Missouri and the official state bird. Many types and styles of bluebird nest boxes will be accepted by a mated pair of birds.

Construction

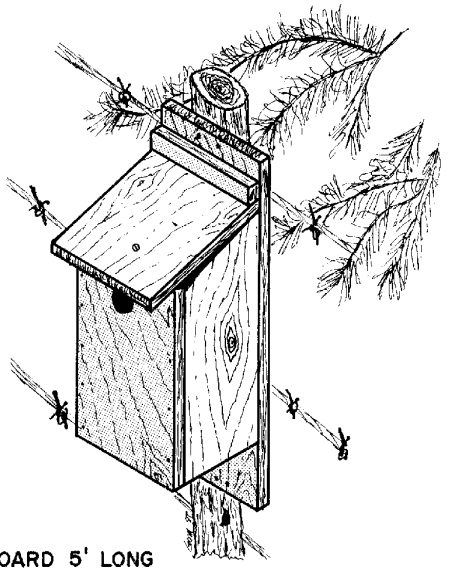
Access from the top is usually better because those boxes that open from the side or front may result in fledglings prematurely flying from the nest at inspection time. The top may be mounted on a hinge, or a 1/2-inch dowel may be substituted for the hold-down strip for the roof. If the beveled corners on the bottom are omitted, drill four 1/4-inch holes for drainage. Note that the front edges of the sides are 1/8-inch shorter than the nest box front. The resulting crack provides ventilation. The 1 1/2-inch hole size is important, since it helps to keep out starlings and cowbirds. If woodpeckers or squirrels enlarge the hole, replace the front panel or patch it with a piece of wood with a 1 1/2-inch hole. Painting is not necessary, but if you do paint, light grey or tan is preferred.

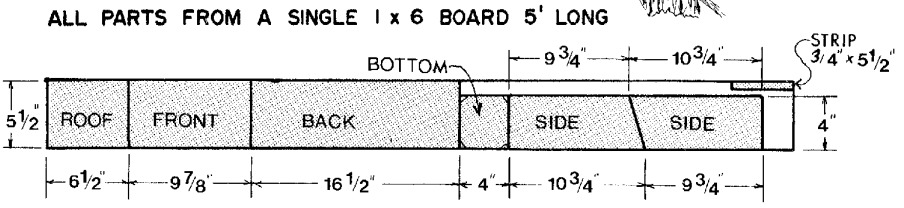
Installation & maintenance

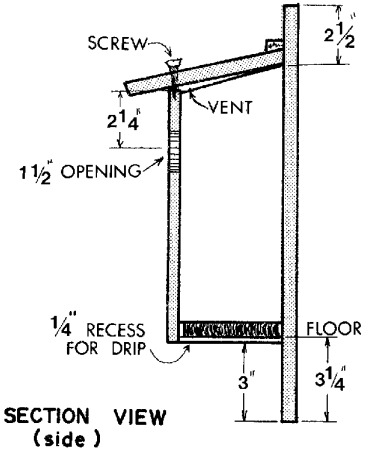
Bluebirds usually begin nesting in the first half of March. These birds lay from three to six light blue, sometimes white, eggs. The incubation period is about 14 days, and the young birds fly from the nest about 16 days after hatching. Clean out the box as soon as the young have left, and the chances are good that the adults will use the box again. Two and three broods per year are common, and five broods have been documented in south Missouri. If the box is not cleaned, the pair will simply build their new nest on top of the old, causing the young birds to be more accessible through the entrance hole. Many bluebirds spend the winter in Missouri, so it is a good idea to leave the last nest for insulation.

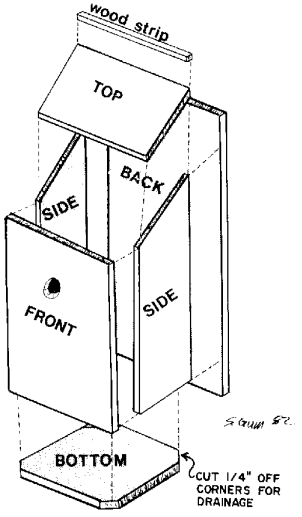
If you take the time to build and install a bluebird nest box, you also should maintain it on a regular basis. After a pair has accepted a nest box, bluebirds are not easily driven away by your presence. You should inspect the nest box on a 12- to 15-day interval. Gently open the box and

Plans for Building a Bluebird Nest Box









remove any unwanted guests, such as tree frogs, wasps, spiders or ants. Sparrows can be a problem, too. Tear out their nests, and temporarily plug the hole until they move elsewhere. Predators, such as cats, raccoons and snakes, can destroy nests. An inverted metal cone or a metal sleeve can help keep these animals from nests. Steel fence posts

or pipes coated with grease will help discourage predators.

Mount your nest boxes 4-6 feet high on posts. Avoid installing them on trees and power-line poles. Face the entrance toward the nearest large tree or shrub. If you put up more than one box, space them at least 100 yards apart because bluebirds are very territorial. Bluebirds like open or lightly wooded country, but don't be afraid to place one near your residence. They seem to like being around people. Pastures with wooded draws or scattered trees are ideal. New subdivisions, cemeteries, golf courses, farmsteads and road rights-of-way are all good areas on which to install boxes.

This nest box is designed for bluebirds, but it may be used by wrens, chickadees, titmice, tree swallows or even flying squirrels. If you want to attract these species, place the box in trees 10 to 15 feet above the ground in wooded areas. Place this nest box on poles or in dead trees located in or over water to attract tree swallows and prothonotary warblers.

Windbreaks

The following information will help you decide whether or not a windbreak would be useful on your property; and if so, how to plan and maintain the right windbreak for your needs.

Windbreak benefits

The most obvious benefit of a well-planned windbreak is protection from wind. Depending on the plant species and the density or thickness of the windbreak, wind velocities can be significantly decreased on the downwind side for distances of 10-20 times the height of the trees. This amount of wind reduction can:

- Reduce wind chill and home heating bills by 15-20 percent.
- Increase crop yields in protected fields up to 18-22 percent by buffering moisture-sapping summer winds.
- Improve livestock performance by buffering winter winds and providing shade in summer.
- Reduce pond, dam and shoreline erosion.
- Block direct snow deposits because drifting snow is deposited within 60 feet downwind of the windbreak.

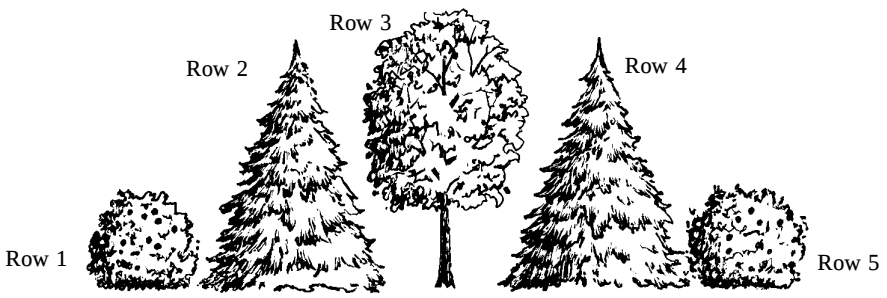
Windbreaks provide many other benefits to the home, farm and field. Besides reducing wind velocity, they also:

- Benefit crop production by attracting insect-eating birds.
- Reduce noise, dust and pollution.
- Provide food and cover for many species of wildlife.
- Provide a source of nuts, berries, firewood and Christmas trees, depending on the tree and shrub species selected.
- Add beauty to the area.

Establishing a windbreak

Proper planning and design are important for establishing a windbreak that will meet specific needs. Windbreak planning and design should be carried out in the fall. Sources for tree and shrub seedlings should be lined up in the fall or winter, and seedlings should be planted in early spring.

Windbreaks can be established with trees, shrubs, grasses or any combination of these. Hardwood or deciduous trees, which shed their leaves in the fall, are not as effective as evergreen species for wind protection; however, even the bare limbs reduce wind velocities. Some advantages of hardwood species are that they are hardier, make faster growth and are taller at maturity than evergreens. For these reasons, the use of both evergreens and hardwood trees in windbreaks is recommended, providing each can be given adequate space to grow.



Rows 1 & 5: Black haw, deciduous holly, redbud, blackberry, gray dogwood, hazelnut, aromatic sumac and gooseberry
Rows 2 & 4: Hawthorn, persimmon, red cedar, serviceberry and Jack pine
Row 3: Pin oak, northern red oak, shingle oak, white pine, green ash, shortleaf pine, yellow poplar, pecan, burr oak, swamp white oak and red pine

The diagram below shows the planting arrangement of a hardwood and evergreen windbreak. The staggered row arrangement gives best coverage.

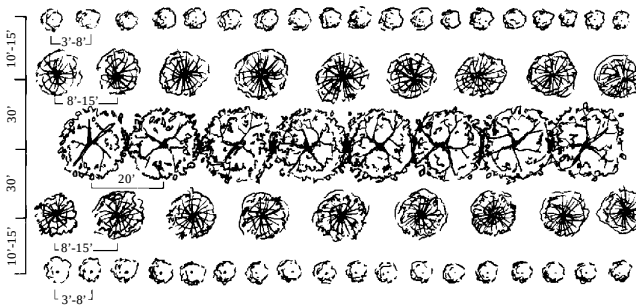
Row 1: shrubs

Row 2: med. trees

Row 3: tall trees

Row 4: med. trees

Row 5: shrubs



As a rule, five-row windbreaks—as shown in the figure above—are the most effective. However, an acceptable windbreak can be developed by planting rows 1, 2 and 3.

Other considerations in windbreak planning and maintenance are:

- Locate windbreaks 100 feet from the area to be protected if possible.
- Locate windbreaks for winter wind protection on the north and west sides of the area to be protected, and plant evergreens in at least two of the windbreak rows.
- Locate summer windbreaks on the south and west sides of the area to be protected, and plant deciduous trees in at least two of the windbreak rows.
- Control weeds and grasses within the windbreak plantings until trees and shrubs become fully established—up to five years, depending on how fast the seedlings grow.
- Protect plantings from livestock trampling and grazing. Fencing may be necessary.
- When planting, make sure the roots of the seedlings are spread out and not curled up in the planting hole.
- Do not fertilize the seedling trees and shrubs in the first and second years of establishment. Fertilization with a 12/12/12 fertilizer beginning in the third growing season is appropriate.
- For maximum survival and growth, water new seedlings to a depth of 6 inches once per week in the absence of significant rainfall during the first, second and third growing seasons.

Contact your local Conservation Department or University Outreach and Extension office for more details.

Important numbers

When you look up the name and number of a local resource person in your telephone directory, make a note below for later use.

Regional Conservation Department Office_____

Phone No._____

Conservation Agent_____

Phone No._____

Wildlife Management Biologist_____

Phone No._____

Urban Biologist_____

Phone No._____

Fisheries Management Biologist_____

Phone No._____

District Forester_____

Phone No._____

Urban Forester_____

Phone No._____

Wildlife Damage Biologist_____

Phone No._____

Other Conservation Department resource_____

Phone No._____

NRCS District Conservationist_____

Phone No._____

University Outreach & Extension_____

Phone No._____

Other Agency_____

Phone No._____

CONSERVATION DEPARTMENT

MISSOURI