PRACTICAL WILDLIFE MANAGEMENT INFORMATION

WILDLIFE TRENDS

March/April 2005 *Volume 5, Issue 2*

Conservation Buffers

By: Wes and Leslie Burger

The long-term success of wildlife populations in the Southeastern United States is largely in the hands of private landowners. Nearly 80% of the total land base in the Southeast is privately owned forests, agricultural lands, and rural properties. As demand for food and fiber products has increased and technology advanced, agricultural practices have intensified. The result has been farm consolidation and larger fields, monocultural production, loss of idle fields, conversion and loss of native grasslands and wetlands, and reduction in overall landscape diversity. In other words, the environment has been simplified and there

A native warm season grass field bordering a soybean field provides nesting and brood rearing cover during the breeding season, increases usable space and supports winter grassland songbirds. Photo courtesy of USDA-NRCS.

In This Issue

Visit us at www.wildlifetrends.com
Call us at 1-800-441-6826

WILDLIFE TRENDS
P.O. Box 3504
Auburn, Al 36831-3504
ADDRESS SERVICE REQUESTED

PRESORTED
STANDARD
U.S. POSTAGE PAID
AUBURN, AL
PERMIT NO. 78

are now fewer places for wildlife to exist and thrive. In response to these land use changes, an entire suite of early successional wildlife species is slowly disappearing from the landscape. Among these species is the northern bobwhite which has declined by more than 70% (3.8%/year) over the last 3 decades.

However, many agricultural producers value wildlife and are interested in improving wildlife habitat on their properties, if the management practices can be implemented without compromising their agricultural production goals. Agricultural producers are the stewards of our working lands. Conservation practices that are easily integrated into production systems, achieve multiple environmental benefits, enhance wildlife habitat and improve whole-farm profitability are most likely to be adopted by producers. Conservation buffers uniquely meet these criteria. Conservation buffers are narrow strips of land maintained in permanent vegetation designed to trap pollutants, reduce water and wind erosion, and provide other environmental benefits, including wildlife habitat. The National Conservation Buffer Initiative, launched in 1997 by the USDA, encourages the use of conservation buffers by agricultural producers and other landowners. This initiative utilizes USDA conservation programs to assist landowners in developing or enhancing wildlife habitat using cost shares and incentive payments to offset direct costs or lost revenue associated with changes in production systems.

Conservation Buffers

Conservation buffers are a suite of management practices that can be implemented individually or in concert with other buffer or agricultural practices, including conservation tillage, nutrient management, and pest management. There are many kinds of conservation buffers including: filter strips, riparian corridors, shelterbelts, grass waterways, contour grass strips, alley cropping, vegetation barriers, and field borders. Each of these buffer types accomplishes specific objectives such as: soil erosion reduction, herbicide retention, water quality improvement, and wildlife habitat provision. The environmental benefits of a buffer will change in relation to its type, surrounding landscape, hill slope position, vegetation structure, and management.

Conservation buffers, particularly forested riparian buffers along streamsides, improve water quality and aquatic habitat by reducing soil and agri-chemical runoff, stabilizing creek banks, and reducing water temperatures. They also provide important nesting, feeding and protective cover for birds and smaller mammals. Similarly, alley cropping and windbreaks, narrow strips of trees that border fields or divide larger fields into small units, provide reduction in wind erosion and comparable wildlife benefits. Conservation buffers provide

Riparian buffer and herbaceous buffer along drainage ditch intercepts agrichemicals, stops erosion and improves water quality. Photo courtesy of Haren Brasher, MSU-FWRC.

travel corridors, linking patches of similar habitat and facilitating movement of animals through inhospitable landscapes.

Although riparian buffers that include trees, shrubs and grass likely provide the greatest multiple environmental benefits, gains in soil erosion reduction and water quality can also be accomplished with grass filter strips, waterways, and contour strips. Four-meter-wide grass strips, regardless of plant species, have been shown to reduce herbicide leaving fields by 66-95%. The type of grass species does, however, substantially affect wildlife habitat value. Sod-forming grasses such as Kentucky Tall Fescue and Bermuda grass have been traditionally used for erosion control, but their dense structure is not nearly as beneficial to wildlife as native warm season grasses, such as Eastern gama grass, big bluestem, little bluestem, Indian grass and switch grass. Management practices also influence wildlife habitat value. For example, frequent mowing will diminish wildlife value, whereas periodic burning (2-3 year rotation) can enhance wildlife value.

Buffer Function and Position

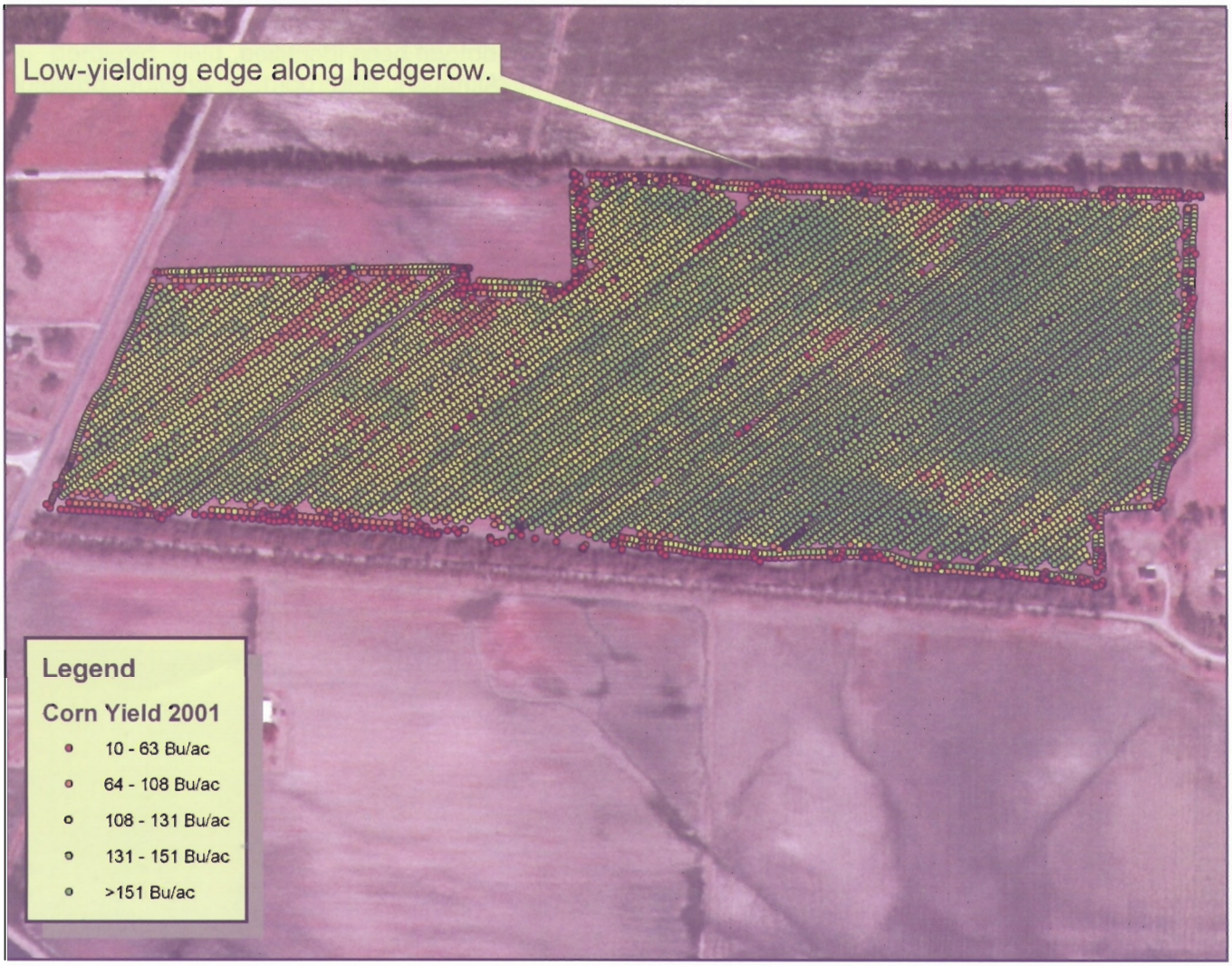
The various types of conservation buffers should be located in different positions in the field, depending on what function or purpose the buffer is to serve. For example, riparian buffers and grass filter strips are usually used on the down slope side of crop fields, adjacent to rivers, streams, or lakes. Their primary purpose is to retain sediments and herbicides and improve water quality. Grassed waterways, terraces, and contour strips are placed within the field, relative to topographic or drainage features. They are designed to slow and direct

Herbaceous field border dominated by ragweed provides excellent brood habitat during the breeding season and cover and food during the fall and winter. Photo courtesy of Wes Burger, MSA-FWRC.

water flow, trap sediments, and reduce erosion. In contrast, field borders are designed primarily for wildlife habitat and can be used around the entire field edge. A field border consists of 20-150' wide strips of idle, herbaceous vegetation maintained between the crop and adjacent non-crop habitat. Field borders may also make good economic sense. Research in North Carolina and Mississippi has shown that field borders can replace low-yielding field margins with a subsidized conservation practice, increasing overall economic return. Use of GPS-equipped yield monitors can help producers to identify poorly producing areas of a field. For example, figure 1 shows corn yield on one Mississippi farm in relation to an adjacent wooded plant community and Figure 2 demonstrates the type of situation in which replacing a low yielding edge with a conservation buffer can increase farm profitability. Because creation of wildlife habitat is a primary function of field borders, the rest of this article will focus on field border benefits and design.

Wildlife Benefits of Field Borders

Managed herbaceous field borders provide habitat for many farm wildlife species. For example, studies in North Carolina have shown that Northern Bobwhite were nearly 2 times

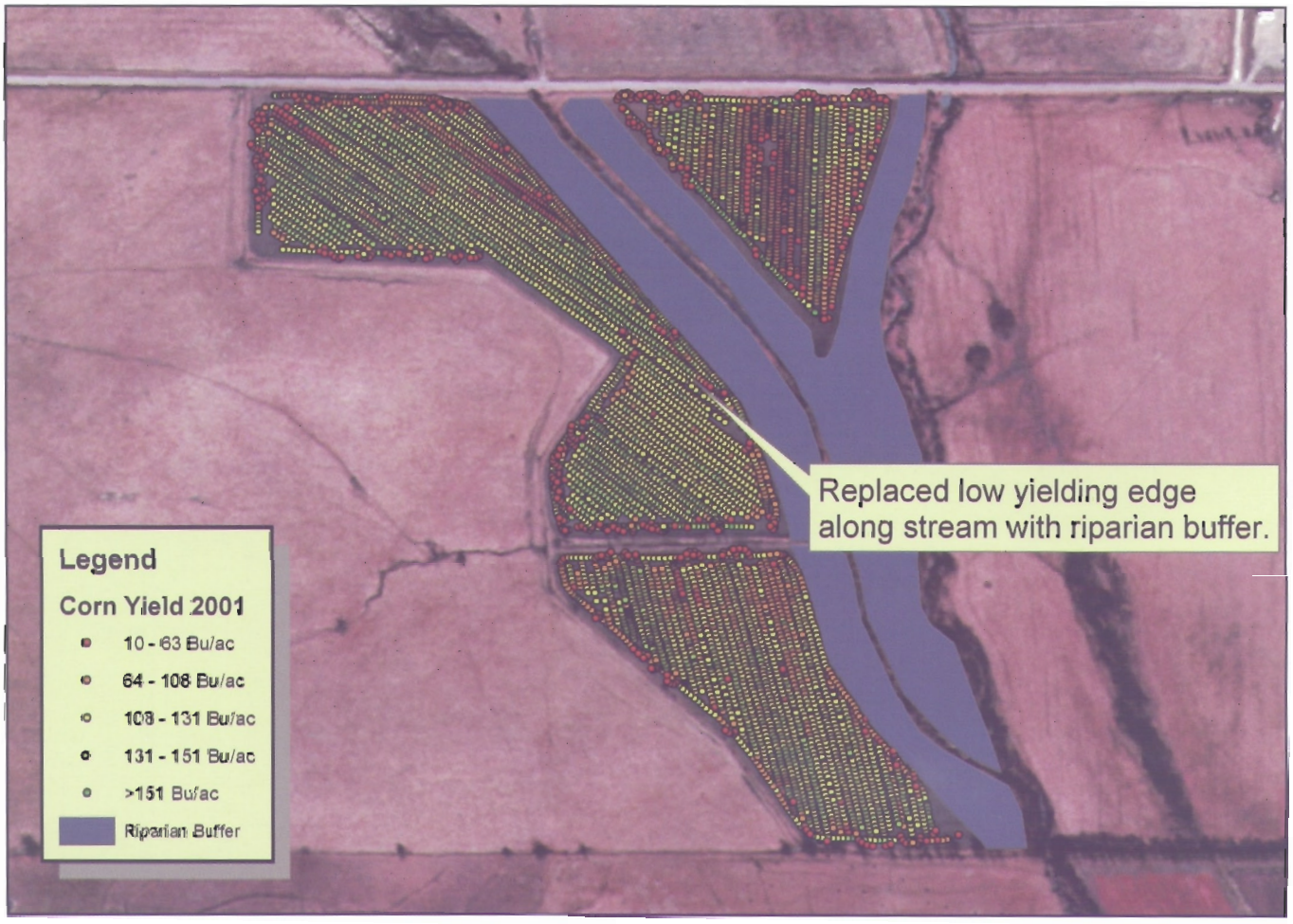


Competition for sunlight, water and nutrients producces low corn yields adjacent to hedgerow. These areas are often negative profit regions if costs of production exceed return. The producer can increase field and farm-level profits by taking these areas out of production and enrolling them in an incentivized conservation practice.

more abundant on row-crop farms with field borders compared to farms without borders. Research in Mississippi demonstrated a 69% average increase in local fall bobwhite populations from converting as little as 5-6% of row crop acreage to field borders. On one 1600 acre working farm, a 6% change in land use (crop lands to field borders) resulted in a 16% increase in usable space for bobwhite. This disproportionate response occurs because the field border not only provides habitat but also increases the utility of adjacent croplands.

Wintering and nesting songbirds also respond positively to the habitat provided in field borders. In Mississippi, 53 bird species were documented using field borders during the breeding season. The most common species included Mourning Dove, Northern Cardinal, Indigo Bunting, Dickcissel, Red-winged Blackbird, and Common Grackle. Dickcissel and Indigo Bunting were nearly twice as abundant on fields with field borders, as compared to fields with no borders. The herbaceous vegetation in field borders provides nesting, foraging, loafing, and roosting cover for these species. Numerous studies have shown that in agricultural landscapes, the density of bird nests in strip cover is very high relative to other available patch types, but the nest success for some species is quite low. Narrow buffers are easily searched by nest predators which tend to forage along edges. Ongoing studies are demonstrating that birds nesting in wider borders (90-150') have higher nest success than those in narrow field borders (10 – 30'), but an optimal or sufficient border width has not yet been identified.

Although field borders provide breeding



Example of a low-yielding area next to a stream corridor that the producer removed from production and enrolled in CCRP CP22 riparian buffer.

season habitat for some songbird species, their greatest value may occur during winter. During winter, herbaceous communities in the Southeast provide important wintering habitat for numerous short-distance grassland migrants, many of which are exhibiting regional declines. A North Carolina study demonstrated that crop fields with conservation field borders supported substantially greater abundance of wintering sparrows than adjacent fields with mowed field margins. One Mississippi study documented 71 different bird species using field borders during winter. In this study, the most abundant species were Red-winged Blackbirds, American Pipits, Song Sparrow, Savanna Sparrow, and American Robins. Winter sparrows were 9-times more abundant on bordered field edges than unbordered. Song Sparrows were 6-times more abundant and Savanna Sparrows were 2-times more abundant on bordered field edges. During winter, the annual weeds in field borders provide food for seed-eating birds and the vertical structure provides roosting and thermal cover.

Field Border Establishment

Field borders can be created by planting a native grass community or by seeding a cover crop and allowing natural succession to revegetate the area. The least expensive method of establishing field borders is to plant a fall, small grain cover crop (wheat or oats), over-seed with a legume in winter (lespedeza, partridge pea, etc.), then allow the plant community to succeed naturally. On most sites in the Southeast, this combination will produce a diverse native community of broomsedge, legumes, and broad-leaved forbs within 2-3 growing seasons. However, if the producer has access to a native grass drill, a prairie grass community can be established within 1-2 growing seasons by drilling a mixture of big-bluestem, little bluestem, Indian grass, and switch grass. Inclusion of native legumes (partridge pea, Illinois bundle flower, etc) and wildflowers (Maximillian sunflower, cone flower, Liatris, black-eyed Susan, etc) will enhance the visual appeal and wildlife value. Regardless of the

establishment method, periodic management will be required to maintain an early successional plant community. Woody vegetation should be controlled with periodic disturbance, such as disking or prescribed fire, but not during the growing season.

Programmatic Assistance

Numerous USDA conservation programs can assist producers and landowners with installation of conservation buffers. Conservation buffers can be cost-shared under the Environmental Quality Incentives Program (EQIP), Wildlife Habitat Incentives Program (WHIP), Wetlands Reserve Program (WRP), and Conservation Reserve Program. However, the programmatic "workhorse" for conservation buffers is the Continuous Conservation Reserve Program (CCRP). CCRP provides cost-share and incentive payments (Signup Incentive Payments, Practice Incentive Payments, and annual rental payments) for a diversity of buffer practices, and unlike regular CRP the land does not need to be highly erodible (HEL) to be eligible. Furthermore, under CCRP eligible land can be enrolled at any time instead of simply during a short enrollment period (hence the name "continuous"). Cropland is eligible for the CCRP if it was planted or considered planted to an agricultural commodity in 4 of the 6 years between 1996 – 2001. Additionally, certain marginal pastureland is eligible for some CCRP practices. Individual CCRP cover practices (CP) are designed to achieve specific environmental benefits and eligibility varies among CPs. For example CP21 Grass Filter Strips and CP22 Riparian Forest Buffers are designed to be used on the down slope side of fields adjacent to a perennial stream, ditch, or water body. CP5 Field Windbreaks, CP8 Grass Waterways, CP15 Contour Grass Strips, and CP16 Shelterbelts are implemented within fields. In August 2004 USDA announced the availability of a new CCRP practice called CP33 Habitat Buffers for Upland Wildlife. This practice provides incentives and cost-share to establish 30 – 120' native grass and legume buffers around row crop fields. Incentives include $100/ac Signup Incentive Payment, an annual per acre rental payment, 50% cost-share on establishment costs, and 40% Practice Incentive Payment on establishment costs. CP33, in particular, provides a tremendous programmatic tool for creating wildlife habitat in agricultural landscapes. For more information on these programs, contact your local USDA Service Center or see http://www.fsa.esda.gov or http://www.nres.usda.gov. Landowners and producers will achieve greater wildlife benefits from federal farm programs if they work with a knowledgeable wildlife biologist to develop a comprehensive farm conservation plan with wildlife as a specific objective.

Conservation buffers are common-sense conservation practices that provide landowners and producers with tremendous flexibility and incentive to develop a conservation cropping system that meets production objectives, improves environmental quality, enhances wildlife habitat, and helps farmers be good stewards of our natural resources.

Wes Burger *is a Professor of Wildlife Ecology in the Department of Wildlife and Fisheries at Mississippi State University. Wes received a dual major B.S. in Biology and Mathematics from Murray State University and a M.S. and Ph.D. in Wildlife Biology from University of Missouri-Columbia. His research interests include bobwhite population ecology, impacts of federal farm rograms on wildlife populations and response of early successional bird species to forest and agricultural management regimes.*

Leslie Burger *has B.S. and M.S. degrees in Biology from Murray State University and University of Missouri, respectively. She has conducted field research from the Galapagos Islands to Hudson Bay, and several places in between. She has held professional positions with the Missouri Department of Conservation as an assistant research biologist and Vertebrate Ecologist, She currently works full time home schooling the Burger's 3 sons.*

Grassland Bird Response to Agricultural Field Borders

In the Southeast, privately owned rural lands constitute almost 80% of the total land base with timber and agriculture as the primary land uses. Consequently, the health of wildlife populations in the Southeastern United States is largely determined by the land management decisions of private landowners. These privately owned forests and farmlands not only produce food and fiber products to meet growing global markets, they also provide essential habitats for hundreds of wildlife species.

However, increasing demand for food worldwide and advancing technology have resulted in dramatic intensification of agricultural practices and changes in our agricultural systems. Notable changes have included farm consolidation, larger field size, single-crop production, loss of idle non-crop plant communities, conversion of native grasslands to row crops or exotic forage grasses, and wetland loss. All of these factors have contributed to a reduction in overall landscape diversity, leaving fewer places where wildlife exist and thrive.

Agricultural producers are the stewards of some of America's most important natural resources and are often interested in enhancing wildlife habitat value if management practices can be implemented without compromising their agricultural production goals. Enhancement of farmlands for grassland birds can be accomplished by incorporating conservation buffers as part of a comprehensive resource management system.

Conservation buffers are practical cost-effective conservation practices which provide multiple environmental benefits (increased herbicide and nutrient retention, reduced soil erosion) while providing habitat for grassland birds. Conservation buffers are vegetative barriers (grass, shrubs, trees) strategically located within or at the edge of crop fields to protect elements of the natural environment from effects of weather and human activities. Within intensive agricultural production systems, conservation buffers may be the only source of semi-permanent grassland habitat for nesting birds. Idle herbaceous field borders are one type of conservation buffer, but unlike other buffer practices, such as riparian buffers and filter strips, field borders can be deployed around the entire field margin, instead of just along down-slope edges. Field borders are intentionally managed non-crop herbaceous plant communities along crop field edges to provide environmental and wildlife habitat benefits. Field borders are often employed in addition to existing field edge habitats such as fence rows and drainage

FWRC
RESEARCH ADVANCES
Forest & Wildlife Research Center

ditches and may vary in species composition or width depending upon the objectives for their establishment.

Field borders may offer opportunities for enhancing farmlands for numerous grassland birds throughout the United States. Scientists in the Forest and Wildlife Research Center have extensively studied the use of field borders to enhance bobwhite quail habitat. However, little information is available on nongame grassland bird use of field borders. If field borders are to be implemented on a nationwide basis to enhance grassland bird habitat within agricultural production systems, as encouraged through many government sponsored conservation programs, information regarding grassland bird use of field border habitats is required. In this study, scientists measured the effects of field borders on populations of breeding and wintering grassland birds and northern bobwhite in the Black Belt prairie of northeastern Mississippi.

The studies were conducted on three privately owned working farms located within the Black Prairie physiographic region in Clay and Lowndes counties, Mississippi. Primary agricultural practices were rowcrop, forage, and livestock production. During early spring 2000, experimental field borders were established along agricultural field margins (fence rows, drainage ditches, access roads, and contour filter strips) on half of each farm. Across these farms an average of 6% of rowcrop field area was converted to field border habitats. This amounted to 1-2% of the land base of each farm.

Producers were paid a monetary incentive similar to those used in common USDA conservation buffer programs at the end of each growing season for land placed into field borders. Furthermore, producers were required not to mow, herbicide, or disk field borders during the duration of the study.

Grassland Songbird Response to Field Border Management

Researchers measured summer and winter abundance and diversity of grassland birds relative to field border management practices during June-July 2002 and February 2002 – 2003.

American Robin

Breeding Season Songbird Response

During breeding season surveys, 53 species of birds (1443 individual birds) were observed on experimental fields. The 6 most abundant species were Red-winged Blackbird (20%), Indigo Bunting (15%), Dickcissel (13%), Mourning Dove (8%), Northern Cardinal (7%), and Common Grackle (6%).

Dickcissel and Indigo Bunting were nearly twice as abundant where field borders were established, regardless of adjacent plant community type or width. Dickcissels and Indigo Buntings have been declining at 4 percent per year and 1.5 percent per year, respectively, during the previous 24 years in the Black Prairie region, so field border habitats may contribute to regional conservation. Although Indigo Buntings are primarily a forest bird, the field borders provided a herbaceous plant community along existing wooded edges making these areas more favorable for foraging, loafing, and nesting sites. Field borders provide vertical and horizontal vegetation complexity and may enhance the suitability of existing linear habitats (ditch banks, fencerows, road edges) for Dickcissels.

Species richness was greater along bordered than non-bordered transects, however diversity did not differ. Overall bird abundance was greater along bordered linear habitats than similar non-bor-

Indigo Bunting

Northern Cardinal

dered edges. However, addition of field borders along larger patches of grasslands or woodlands did not alter the number of birds using these edges. We speculate that in linear habitats characteristic of modern agricultural landscapes, field borders provided greater plant structure and diversity, thus supporting a greater number individuals and species. Although our results are based on 1 year of data, we believe that the magnitude of observed field border effects suggests that field borders may increase the abundance of selected species of grassland/shrub birds during the breeding season.

Wintering Songbird Response

During winter surveys, 71 species of birds were observed on experimental fields. Of the 17,562 individual birds, the 5 most abundant species were Red-winged Blackbird (45%), American Pipit (11%), Song Sparrow (7%), Savannah Sparrow (6%), and American Robin (5%).

Wintering sparrows were one group of birds that seemed particularly responsive to the presence of field borders. Many sparrow species breed on grasslands in the Midwest and winter in agricultural landscapes in the Southeast. Most sparrows are ground foragers and their use of linear habitats often depends on vegetation structure. Collectively, across most adjacent plant communities, we observed greater densities of Song, Field, and Swamp sparrows along bordered transects than non-bordered transects. Song Sparrow and Swamp Sparrow densities were greater where field borders were established along existing grasslands. Whereas the addition of herbaceous field borders adjacent to grasslands may seem redundant, most grasslands within our study farms were monotypic stands of cool-season, exotic forage grasses and provided little vertical structure and few quality food producing plants. Song Sparrow densities were also greater along field borders adjacent to wooded strip habitats than comparable wooded strips without a field border.

Song Sparrow

After crops were harvested, field border habitats provided suitable cover and food resources for many sparrow species. Field borders in our study were recently established (<3 years old) and consisted primarily of seed producing grasses and forbs coupled with a relatively open understory. This combination likely facilitated ground-based foraging. Additionally, field borders may provide escape cover in close proximity to foraging sites within the crop stubble. Therefore, we believe that field borders may enhance the value of existing grasslands and crop fields by producing additional foraging habitat and providing escape cover in close proximity to waste grain food sources.

Northern Bobwhite Response

Previous studies have demonstrated that field borders may increase forging efficiency of bobwhite chicks, use of rowcrop fields, breeding season survival, usable space, and local abundance. Although during our study autumn and breeding season bobwhite density at bordered and non-bordered farms were not statistically different, the average autumn density at bordered sites was about 66% greater and the average number of males during the breeding season was about 23% greater than non-bordered sites. These relative effect sizes were similar to those from previous field border studies. We evaluated the net effect of field borders on the proportion of the landscape usable by bobwhite by developing a space-use based habitat model constructed from utilization distributions of radio-marked bobwhite. We applied

Research Advances
Volume 8, Number 2
February 2005

Research conducted by
Phillip J. Barbour
L. Wes Burger, Jr.
Rick Hamrick
Mark D. Smith

Mississippi State University

For more information contact:
Bob L. Karr, Interim Director
Forest & Wildlife Research Center
Box 9680
Mississippi State, MS 39762
662-325-2696
Fax: 662-325-8726
bkarr@cfr.msstate.edu
www.cfr.msstate.edu

Karen Brasher, editor

WF210

the habitat suitability model to an agricultural landscape in Clay County, MS and simulated usable space before and after 6% of the row crop was converted to 20' field borders. A 6% change in land use increased usable space for bobwhite by nearly 15%. Thus, a relatively small change in land use, disproportionately alters usable space in the landscape for bobwhite and may elicit an even larger proportional population response.

Summary

Within intensive agricultural landscapes, field borders provide important idle herbaceous cover for grassland and early successional birds. Field borders may provide nesting, foraging, roosting, loafing, and escape cover. During winter, field borders may provide important habitat in southern agricultural systems where most short distance migrants overwinter. Field borders provide important habitat for many grassland birds due to their greater abundance of food (weed seeds) and more complex vegetation structure compared to non-bordered field margins.

Field borders should be maintained as early successional communities through periodic disturbance (e.g. winter disking) to maintain seed producing plants, vegetation structure, and arthropods for grassland birds.

Resource management systems that support both birds and farm operators are important for maintenance of a diverse farmland bird population. However, implementation of conservation practices rest solely upon farm operators. Only cost-effective farmland conservation practices that accrue multiple environmental benefits while enhancing farmland wildlife will gain widespread acceptance and implementation.

A Guide to Conservation Reserve Program: Northern Bobwhite Quail Habitat Initiative

- Only 9,400 acres of field borders available for enrollment in Mississippi.
- Cropland must be suitably located and adaptable to the establishment of bobwhite quail
- Conservation practice CP33: Habitat Buffers for Upland Birds can be applied around field edges of eligible cropland.
- This is a continuous conservation reserve program.
- Field borders must be a minimum of 30' to a maximum of 120' wide
- Incentives include $100 per acre sign up, 50 percent cost share and 40 percent practice incentive payment.
- Contact the USDA Farm Service Agency for further information.

Acknowledgements

Information in this publication was adapted from the doctoral research of Mark D. Smith and Phillip J. Barbour, working under the direction of L. Wes Burger, Jr., Department of Wildlife and Fisheries, Forest and Wildlife Research Center, Mississippi State University. This research was supported by the Mississippi Department of Wildlife, Fisheries, and Parks, the USDA Natural Resource Conservation Service's Wildlife Habitat Management Institute, MSU's Forest and Wildlife Research Center, MSU's GeoResources Institute, USDA's Sustainable Agriculture Research and Education and the cooperation of landowners in Lowndes and Clay Counties, MS.

NRCS · Mississippi Wildlife Fisheries & Parks · FWRC · SARE Sustainable Agriculture Research & Education Program · GRI

United States Department of Agriculture

NRCS Natural Resources Conservation Service

CRP Practice CP33

Habitat Buffers for Upland Birds Job Sheet

DESCRIPTION

Habitat buffers for upland birds are strips of vegetation established around the edges of crop fields to provide habitat for bobwhite quail, ring-neck pheasant, and other upland birds. Many of these birds have suffered population declines due to loss of habitat. These buffers can provide important nesting, brood rearing and escape cover while also serving as travel corridors between areas of suitable habitat. In addition to habitat for upland birds, these buffers may provide habitat for other animals and may limit sediment, nutrients, pesticides and other contaminants from entering streams and other water bodies.

By diversifying vegetation in these buffers, desirable habitat will develop. The growth forms of a variety of species, combined with management to increase open cover, will provide food sources in the forms of seed, insects and soil invertebrates. Shrubs may be included to diversify cover and food, but are optional.

It is highly recommended that the local Indiana Department of Natural Resources (IDNR) district biologist be consulted for technical assistance (http://www.in.gov/dnr/fishwild/huntguide1/wbiolo.htm). It is important that site selection and layout, seeding mixture selection, and other critical planning issues be performed correctly in order to maximize population gains.

PRACTICE REQUIREMENTS

CP33 can be established through either natural succession, or through planting a mixture of native warm season grasses (WSG), legumes, and forbs. Limited tree and shrub plantings, on up to 10% of the practice acreage, are allowed. The Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) Standard 645 - *Upland Wildlife Habitat Management* (September 2004) will be used when developing seeding mixes and to determine tree and shrub species for this practice. Standard 645 is available at http://www.nrcs.usda.gov/technical/efotg/.

Allowable buffer widths will be a minimum of 30 feet and up to a maximum average width of 120 feet (measured from the edge of the field).

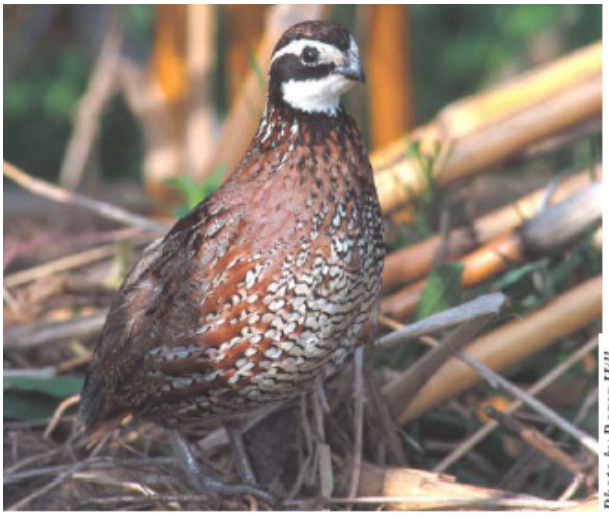


Photo by Roger Hill

Shrub rows will be six (6) feet apart and spaced three (3) to four (4) feet apart within each row.

Habitat buffers for upland birds do not include food plots. Food plots will not be established within habitat buffers for upland birds.

Buffers can be established around field edges on any eligible cropland. Buffers can be planted along one or more sides of a field, however establishing a buffer around the entire field should be considered and is highly encouraged. CP33 should be designed to be adjacent to cropland and is not intended as a whole field retirement practice. The "infeasible to farm" rule does not apply. See Farm Service Agency (FSA) INDIANA NOTICES CRP-04-07 and CRP-05-02 for additional guidance.

Habitat buffers for upland birds will not be used as turn rows, lanes, roads, or for storage of crops or equipment. However, crossing the buffer for normal farming operations to access the field is permitted. Habitat buffers will not be grazed, hayed, or mowed during the life of the contract. CP33 is considered year-round habitat, and as such, should be considered "hands off" from any farming operations.

CP33 requires monitoring and evaluation of grassland bird populations (especially quail) to show the success of this practice. These activities will be coordinated with the IDNR Division of Fish and Wildlife. Although not mandatory, landowner cooperation in this effort is critical and strongly encouraged.

ESTABLISHMENT

Natural Succession A unique feature of CP33 is that it allows natural succession to be used as an establishment method.

- Agricultural management practices will be terminated to allow natural plant succession to occur.
- Natural succession will be planned for the least erosive parts of fields and will not be planned where gully formation is a problem.
- A temporary cover, such as winter wheat or oats, will be established where erosion is a concern or where noxious weeds are expected to be a problem. See Standard 327 – *Conservation Cover* (http://www.nrcs.usda.gov/technical/efotg/) for additional guidance.
- Spot spraying will be used where noxious weeds, such as Canada thistle and Johnsongrass, or other invasive species exist.
- Consider including a light legume seeding to enhance the wildlife value. See Table 1 below.

Table 1 - Legumes

Species	Rate (lbs./ac)
Alfalfa	3
Alsike Clover	1
Ladino Clover	0.5
Red Clover	2.5
Annual Lespedeza[1]	2.5

[1] Best suited for sites south of Interstate 70.

- See the NRCS job sheet *CRP Mid-Contract Management: Inter-seeding* for additional guidance on inter-seeding legumes (and forbs) at: http://www.in.nrcs.usda.gov/programs/CRP/crphomepage.html.
- See Standard 647 - *Early Successional Habitat Development/Management* (August 2004) for additional guidance. Standard 647 is available at http://www.nrcs.usda.gov/technical/efotg/.

Planning and Site Preparation Successful establishment of warm season grasses begins the fall before seeding. Existing cover must be eliminated by spraying or tillage. Both methods will be most successful if started in the fall. If spraying, work with a local consultant to determine the best herbicide combination and apply it at the appropriate time in the fall. Consider using a cover crop if conventional tillage is used in the fall to prepare the site.

Seeding Dates For conventional and no-till seeding, warm season grasses (WSG) will be seeded between April 15 and June 1. WSG need adequate soil moisture and warm soil temperature (at least 50 degrees) to germinate. The June 1 cutoff date can be adjusted somewhat based on local conditions, assuming there is adequate moisture for seed germination and growth.

Do not seed WSG in the fall. They require a minimum of eight weeks growth between emergence and the first frost to become established enough to survive the winter. Emergence can take 21 to 28 days after seeding for many species. A dry fall and early frost may not provide the required time for establishment.

Table 2 below is an excellent species mix for quail.

Table 2 – Grass/Forb Mix

Species	Rate (lbs./acre)
Little Bluestem	2.0
Indiangrass	0.50
Sideoats Grama **or**	0.75
Canada Wildrye	1
Annual Lespedeza[1], **or** ½ to 1 lb. of a forb mix[2] (min. 5 species)	2

[1] Best suited for sites south of Interstate 70
[2] See Standard 645 - *Upland Wildlife Habitat Management*

No-till Seeding Use a drill designed to handle the light fluffy WSG seed. Conventional drills will not work successfully with fluffy seeds such as Big Bluestem, Little Bluestem, Indiangrass, and several other WSG. Conventional drills will work with Switchgrass seed. Many Quail Unlimited and Pheasants Forever chapters, as well as local Soil and Water Conservation Districts, have WSG drills available.

Conventional Seeding Work the seedbed to a depth of three (3) inches. Level and firm the seedbed by disking and follow by culti-packing. Drill to a depth no greater than ¼ inch (1/8 inch is better). Seeding WSG deeper than ¼ inch will lead to potential failure. Seed may be broadcast if accomplished in a uniform manner. Pre-mixing the seed with 200 lbs. per acre of pelletized lime and utilizing an airflow applicator is effective. The seedbed should be culti-packed before and after seeding. It is acceptable to see up to ⅓ of the seed on the soil surface. Wind speed should be less than 15 m.p.h. when using this method.

Frost Seeding **Due to the high cost of seed and lower germination rate, frost seeding should be considered a risky option.** Establish a nurse crop of wheat the fall before frost seeding. Use conventional tillage to establish the crop and seed at the rate of ½ bushel per acre. Seed the WSG into the standing wheat in the early spring when the soil is "honey combing" (natural soil heaving from the

repeated freezing and thawing). WSG are so light they need some kind of "carrier" to help get an even distribution. Pelletized lime at 200 lbs. per acre is an effective carrier. Mix the WSG and lime thoroughly and spread with an airflow seeder. When frost seeding use a half rate and then double seed, making the second pass perpendicular to the first. Use a culti-packer to firm the seedbed if the freeze thaw cycle seems to be ending. A specialized hand seeder can be used on small plots. Wind speed should be less than 15 mph.

Lime and Fertilizer Lime and fertilizer should not be applied to warm season grasses at establishment unless a current soil test shows phosphorus (P) and potassium (K) are in the deficient range or the pH is 6.1 or less. Apply only enough P and K to bring the soil test levels to the moderate range and only apply one ton of lime per acre if the pH is less than 6.1. Additional lime and fertilizer above these rates will encourage weeds and greatly reduce the chance of establishing a successful stand of WSG. Do not apply any nitrogen (N) during establishment.

Use of Herbicides New herbicides have been introduced for use with WSG. They are very effective in controlling weeds during the establishment year. Producers should contact a local consultant who can provide recommendations on proper herbicides and rates.

A request to spot spray or spot mow noxious weeds (such as Canada thistle and Johnsongrass), or other invasive species, can be made to the county FSA office during the establishment period only.

Shrubs Shrub (and tree) plantings will follow the planting guidelines found in Standard 612 - *Tree/Shrub Establishment* (http://www.nrcs.usda.gov/technical/efotg/).

OPERATION AND MAINTENANCE

After the final status review, maintenance of the planting will follow the CRP conservation plan. Maintenance activities are allowed only on a spot basis and only if necessary to maintain stand health, maintain stand diversity, or control pests that will damage the CRP cover or adjacent lands.

Mowing is not an authorized maintenance activity on acreage devoted to practice CP33. If maintenance activities must be performed to control woody vegetation or noxious weeds, a waiver must be requested from the FSA to perform spot maintenance. This could include spot herbicide treatment or hand removal of volunteer trees. **Mowing as maintenance for weed control or for cosmetic purposes is prohibited.**

Other maintenance activities are prohibited between March 1 and July 15 (the primary nesting season for grassland birds). It is also highly recommended, but not required, to delay any disturbance activities until after August 15, thus reducing the chance of harming fledgling birds and other young wildlife. Maintenance activities are allowed only if the FSA County Committee has approved the maintenance activity prior to the activity taking place.

Check for erosion within the buffer. If rill or gully erosion occurs, reshape and reseed the area affected.

Mid-Contract Management All habitat buffers for upland birds must have mid-contract management activities scheduled that are site-specific and will ensure plant diversity, wildlife habitat, and protection of soil and water resources. Management activities include prescribed burning (with an approved burn plan), strip disking, inter-seeding forbs, and strip spraying. For specific job sheets see: http://www.in.nrcs.usda.gov/programs/CRP/crphomepage.html.

Mowing is not allowed as a mid-contract management activity unless used as preparation for prescribed burning, strip spraying, or strip disking.

Mid-contract management activities should start three years after cover establishment. Only ⅓ of the acreage may be disturbed in any one year unless a waiver is received from FSA or it is specified in the conservation plan. If the acreage is small enough that disturbing ⅓ of the acreage each year is not feasible, then ½ of the acreage can be scheduled upon discretion of the NRCS conservation planner and FSA County Committee.

If the site conditions are such that an additional disturbance is needed to maintain an early successional habitat, then an additional rotation of mid-contract management activities will be scheduled. The determination of how often the mid-contract management activities shall be performed is a decision of the NRCS conservation planner. However, in no circumstances can the mid-contract management activity requirement be waived unless permission is obtained from the FSA state office.

HABITAT BUFFERS FOR UPLAND BIRDS (CRP CP33) SPECIFICATIONS SHEET

For:	**Farm #:**
Field(s):	**Tract #:**
Planned By:	**Date:**

SEE ATTACHED MAP FOR HABITAT BUFFER AREA LOCATIONS

GRASS-FORB SEEDING AREAS

Layout	Field border 1	Field border 2	Field border 3	Field border 4
Border width (feet)				
Border length (feet)				
Area (acres)				
Grass Species				
1:				
2:				
3:				
4:				
Total Grass (PLS pounds/acre)				
Perennial Forb Mix (minimum 5 species)				
1:				
2:				
3:				
4:				
5:				
Total Forbs (PLS ounces/acre)				

Planting

☐ Tillage:	Date:
☐ Herbicide:	Date:
☐ Herbicide:	Date:
☐ Lime/Fertilizer:	Date:
Planting Method:	Date:

Post-Planting Maintenance for Noxious Weeds and Woody Growth Control

☐ Herbicide:	Date:

Note: After the final status review has been completed, maintenance activities are allowed only on a spot basis and only with prior approval of the Farm Service Agency (FSA) County Committee. Maintenance activities must be conducted between July 15 and March 1 unless prior approval for work outside these dates has been given by FSA County Committee. **Mowing is not allowed as maintenance or as a mid-contract management activity unless used as preparation for prescribed burning, strip spraying, or strip disking.**

Mid-Contract Management

Starting in year: Portion of field to be disturbed: Repeated every years

☐ Strip Disking	☐ Prescribed Burning
☐ Strip Spraying	☐ Inter-seeding Forbs

Additional guidance:

NATURAL SUCCESSION AREAS

Temporary cover:
Legumes/Forbs to be inter-seeded:

Maintenance for Noxious Weeds and Woody Growth Control

Weed control
☐ Herbicide:
☐ Other:

Note: After the final status review has been completed, maintenance activities are allowed only on a spot basis and only with prior approval of the Farm Service Agency (FSA) County Committee. Maintenance activities must be conducted between July 15 and March 1 unless prior approval for work outside these dates has been given by FSA County Committee. **Mowing is not allowed as maintenance or as a mid-contract management activity unless used as preparation for prescribed burning, strip spraying, or strip disking.**

Mid-Contract Management

Starting in year: Portion of field to be disturbed: Repeated every years

☐ Strip Disking	☐ Prescribed Burning
☐ Strip Spraying	☐ Inter-seeding Legumes/Forbs

Additional guidance:

SHRUB/TREE PLANTING AREAS (optional)

Acres of shrubs or trees to be planted:

Recommended species

Planting

Site Preparation
☐ Tillage:
☐ Herbicide:

Planting Date:	Plant Spacing: ft. x ft.
Planting Method:	Row Spacing: ft.

Post-Planting Maintenance

Weed control
☐ Herbicide:
☐ Other:

Note: After the final status review has been completed, maintenance activities are allowed only on a spot basis and only with prior approval of the Farm Service Agency (FSA) County Committee. Maintenance activities must be conducted between July 15 and March 1 unless prior approval for work outside these dates has been given by FSA County Committee.

United States Department of Agriculture

NRCS Natural Resources Conservation Service

Feathering Wooded Edges

Indiana - December 2005

Conservation Practice Job Sheet (647)

OVERVIEW

Edge, the transitional zone between habitat types, provides an important but increasingly rare habitat for wildlife. The area, for example, between a mature forest and adjacent grassland or cropland is considered edge. In this document, we will also include wooded fencerows as edge.

The purpose of feathering wooded edges is to provide habitat in agricultural landscapes for rabbits, quail, pheasants, and certain songbirds. This practice will create shrubby and weedy areas, an essential habitat component for many wildlife species. In areas with a higher forest component, feathering can be valuable for grouse, turkey, and numerous woodland songbirds. In addition to woodlands and tree-dominated fencerows, this practice can also be applied along the edges of ditch banks, sinkholes, and draws that are located adjacent to cropland, hayland, and pasture.

There are two methods to feather the edge of woodland:

1. Thinning of overstory trees where edge feathering is completed by conducting thinning in and along the woodland edge.
2. Planting field borders where edge feathering is completed by planting trees, shrubs, and grasses along the woodland edge.

THE IMPORTANCE OF EDGE

The amount, quality, and diversity of edge directly affect its quantity and diversity of wildlife populations. In a high-quality wooded edge, a transition in both height and plant composition is created between the wooded component and the adjacent land use. This edge includes a wide band of plants that *gradually* change from one type of vegetation to another. All too frequently, however, this "feathered" edge has been eliminated because of past efforts to maximize the area for other purposes such as agricultural land. This results in an abrupt and quite noticeable change in vegetation with a corresponding loss in important habitat components.

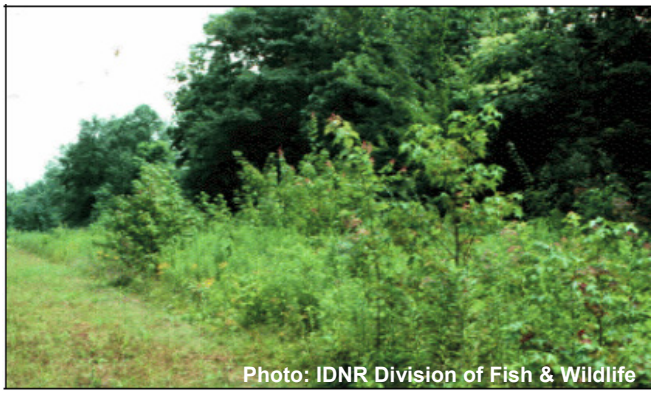


Photo: IDNR Division of Fish & Wildlife

All wildlife species need food, cover, and water within their normal home range to survive. A gradual transition zone (one that moves from grasses to shrubs and vines, to small trees, and then to large trees) provides many benefits for wildlife. These benefits may include providing nesting and brood cover, protection from weather and predators, and food such as berries, seeds, browse, and insects.

Wooded fencerows can also provide habitat similar to that of feathered woodland edges if managed correctly. In addition, feathering may also provide escape cover and serve as travel corridors for wildlife.

Edges are also important because they form an environment for many soft-mast (fruits and berries) producing plants that cannot thrive in mature forests or cultivated fields. Most of these plants are early successional species that

cannot tolerate the shade and competition of a forest or the constant disturbance associated with cultivation and grazing. Soft-mast is an important source of food for many wildlife species, especially during the summer. Tables 1 and 2 list desirable soft-mast producing plants.

Table 1 – Soft-mast producing trees

Common Name	Scientific Name
American Plum	*Prunus americana*
Black Cherry	*Prunus serotina*
Chokecherry	*Prunus virginiana*
Crabapple, Flowering	*Malus sargentii*
Devil's Walking Stick	*Aralia spinosa*
Dogwoods	*Cornus spp.*
Hawthorns	*Crataegus spp.*
Hazelnut	*Corylus americana*
Mulberry	*Morus rubra*
Persimmon	*Diospyros virginiana*
Redbud	*Cercis canadensis*

Table 2 – Soft-mast producing shrubs/vines

Common Name	Scientific Name
Arrowwood	*Viburnum dentatum*
Elderberry	*Sambucus canadensis*
Greenbrier	*Smilax rotundifolia*
Nannyberry	*Viburnum lentago*
Serviceberry	*Amelanchier arborea*
Sumacs	*Rhus spp.*
Virginia Creeper	*Parthenocissus quinquefolia*
Wild Blackberry	*Rubus allegheniensis*
Wild Grape	*Vitis spp.*
Wild Raspberry	*Rubus occidentalis*

Shrubs, vines and briars also provide benefits at ground level. Due to the dense, overhead canopy that these plant groups provide, vegetation at ground level tends to be sparse, allowing wildlife to freely move about to forage, nest, travel, or rest in secure cover.

SPECIFICATIONS

The following apply to edge feathering developed by the thinning of overstory trees.

- Feathering should be applied to the entire width of a fencerow if it is less than 50 feet wide.
- Feathering will extend 30 to 50 feet inward from the woodland edge.
- Removal of woody vegetation will not occur from April 15 through September 15, to avoid the potential for accidental take of the endangered Indiana Bat (*Myotis sodalis*), which may be using trees within this zone to raise their young. This will also minimize disturbance to any other nesting wildlife that may be utilizing the area being feathered.
- For the purpose of this document, a wooded fencerow is considered any portion of a fencerow that:
  a) is not harvested or grazed,
  b) is located between working fields such as cropland, grassland, hayland or pasture,
  c) is at least 10 feet wide, and
  d) has a continuous overhead canopy of tree species whose average drip line extends to, or exceeds, the edges of the fencerow width.
- Apply edge feathering to sections 50 to 100 feet in length along the woodland edge or fencerow.
- Treat any tall fescue or other sod-forming grass growing beneath the tree canopy where the edge feathering is going to occur with an approved herbicide. This is best performed in the fall after the leaves have fallen from any existing desirable shrubs, and while the grasses are still green and actively growing. The removal of sod-forming grasses will hasten the establishment of beneficial, naturally occurring plants, forbs, and shrubs that will respond to the increased exposure to sunlight once edge feathering has been completed.
- Control all woody vegetation greater than four (4) inches in diameter at breast height (DBH) and/or woody vegetation greater than 12 feet tall within the specified boundaries of the feathered area. This is best conducted during fall and winter months after leaf fall has occurred and while the trees are not as heavy with sap.

- Allow desirable fruit-bearing shrubs and trees to grow (see Tables 1 and 2).
- In fencerows, only one-quarter (¼) to one-third (⅓) of the fence line in a particular field will be treated during a one-year period.
- The width of a fencerow will not be decreased because of this practice.
- Alternate the treated areas with undisturbed areas of 200 to 300 feet in length. The resulting staggered pattern of treated and untreated lengths will provide a diversity of habitat types. Additional sites may be treated along the undisturbed sections at no less than 3-year intervals.
- Desirable species that are capable of re-sprouting should be cut at ground level, or no higher than 10 inches from the ground. See Table 3 for desirable species capable of coppice regeneration.

Table 3 - Species capable of re-sprouting

Common Name	Scientific Name
Ash, Green	*Fraxinus pennsylvanica*
Ash, White	*Fraxinus americana*
Basswood	*Tilia americana*
Black Cherry	*Prunus serotina*
Dogwood, Red-Osier	*Cornus stolonifera*
Dogwood, Roughleaf	*Cornus drummondii*
Dogwood, Silky	*Cornus amomum*
Hackberry[1]	*Celtis occidentalis*
Mulberry	*Morus rubra*
Oak, Black	*Quercus velutina*
Oak, Bur	*Quercus macrocarpa*
Oak, Chinkapin	*Quercus muehlenbergii*
Oak, Pin	*Quercus palustris*
Oak, Red	*Quercus rubra*
Oak, Scarlet	*Quercus coccinea*
Oak, White	*Quercus alba*
Persimmon	*Diospyros virginiana*
Sassafras	*Sassafras albidum*
Yellow-Poplar	*Liriodendron tulipifera*

- Chemical control of woody vegetation will be accomplished by using one or more of the following methods: broadcast, spot, cut-stem treatments, or basal spraying.

[1] Poor sprouting from trees greater than 14 in DBH

- Treat the cut stumps of undesirable tree species and vines with an approved herbicide to prevent re-sprouting. The stumps of invasive shrubs such as autumn olive and shrub honeysuckles should also be treated.
- Treetops must remain in the fencerow or wooded edge, and laid shingle-like within the treatment area. See Figure 1. By laying the treetops in this fashion, native grasses, forbs, and weeds will grow up through the tree branches. The resulting complex will provide excellent escape and winter cover.

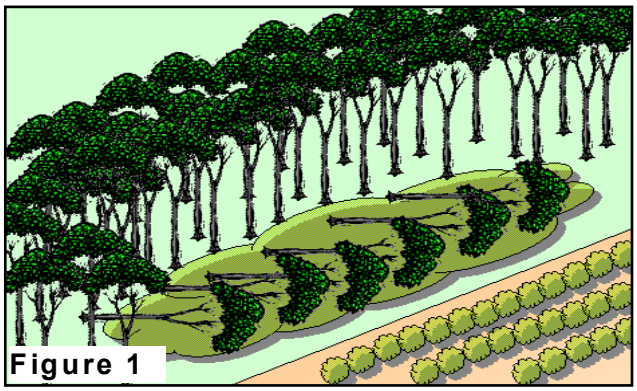


Figure 1

- Edge feathering will not be conducted by use of a bulldozer. See appropriate equipment under "Considerations."

The following applies to planting shrubs and field borders.

- The width of the area to be planted along the woodland edge will be at least 30 feet.
- Divide the area to be planted into at least two (2) zones:

  a) In the zone closest to the woodland, plant at least two (2) rows of shrubs on 6'x 6' spacing. See Indiana Field Office Technical Guide (FOTG) Standard 645 Upland Wildlife Habitat Management for more information and a list of shrub species.

  b) The outside zone nearest the cropland should be planted to a mixture of grasses, legumes and forbs beneficial to wildlife. See FOTG Standard 645 for more information and a list of appropriate species.

- Where the planting area can be wider than the minimum, an addition zone of small fruit, seed, and nut bearing trees should be planted closest to the woods on 10' x 10' spacing.

The following applies to both methods of edge feathering.

- Livestock will be excluded from the edge being feathered.
- All federal, state and local guidelines and manufacturers' label rates will be followed when applying herbicides.

CONSIDERATIONS

- During the planning process, it is important to determine the targeted wildlife species, and any unintended consequences of edge feathering. In some cases, for example, increasing the feathered edge may enhance the ability of invasive plant species to move into the forest and decrease its value to wildlife. Edge may also have a negative impact on some wildlife species such as cerulean warbler that need large, intact forests.
- The best time of year to perform edge feathering is after leaf fall (October through March).
- Landowners may opt to retain one living Shagbark Hickory or other tree having exfoliating (loose) bark per practice site to provide roosting and rearing sites for the Indiana bat. Standing, girdled trees also provide important nesting habitat for a wide variety of cavity-nesting wildlife as the trees begin to decay. The decomposing trees attract insects and other invertebrates, which in turn provide food for other wildlife. For safety reasons, all standing dead and/or girdled trees should be located away from lanes, roads, paths, or other frequently traveled areas.
- Edge feathering may be conducted by hand cutting, shearing, or use of a hydraulic tree clipper, hydro-axe, chainsaw or other approved method.
- Logs from this practice may be used for posts, lumber or firewood.

MAINTENANCE

As tree species within the treated areas grow in height and diameter and shading increases, the structural characteristics and types of vegetation within the site that once provided food and cover close to ground level will decline. To regain the beneficial habitat components, the edge feathering practice must be reapplied to those same sites, or additional edge-feathered sites should be created nearby to replace those that are maturing. It is best to set up a maintenance regime whereby no more than one-third of the existing sites are treated in any given year. Adjacent or nearby sites should not be treated within a 3-year interval.

Use herbicides or other appropriate measures, on a spot basis, to control invasive vegetation and noxious weeds.

REFERENCES

Indiana Department of Natural Resources, Division of Fish & Wildlife, Habitat Management Fact Sheet: *Woodland Edge Enhancement.* (http://www.in.gov/dnr/fishwild/hunt/woodland.pdf)

Kentucky Cooperative Extension Service, *Private Lands Wildlife Management: A Technical Guidance Manual and Correspondence Course*, February 1, 1992.

Missouri Department of Conservation, *Wildlife Management for Missouri Landowners: Edge Feathering,* Forest keepers, Bulletin #27. (http://216.119.79.248/pdfs/27.pdf)

USDA Natural Resources Conservation Service, Indiana Field Office Technical Guide Standard 647 - *Early Successional Habitat Development/Management,* August 2004. (http://www.nrcs.usda.gov/technical/efotg/)

USDA Natural Resources Conservation Service, Illinois Conservation Practices Job Sheet 645D – *Woodland Edge Feathering,* Draft September 2005.

FEATHERING WOODED EDGES
SPECIFICATIONS SHEET

Landowner:	**Farm #:**
Field(s) #:	**Tract #:**
Planned By:	**Date:**
Concurrence of IDNR District Biologist (recommended):	

Specific Recommendations

Purpose of edge feathering:

Target wildlife species:

Method of edge feathering:

Acres of wooded edge to be feathered:

Additional operation and maintenance:

Site/Sketch Map

Published June 2004

NATURAL RESOURCE ENTERPRISES

Wildlife and Recreation

MOURNING DOVE MANAGEMENT FOR LANDOWNERS

For landowners interested in starting a natural resource-based alternative enterprise in the Southeast, managing fields planted to food plots for use by mourning doves (Zenaida macroura), and other wildlife species can be an attractive option.

One thing that makes it an attractive option is that it is not necessary to obligate large land areas to have a successful dove field. Other positive aspects include the small financial investment required, the direct and indirect benefits to other wildlife species, and the high level of social interaction and tradition associated with dove hunting.

The mourning dove is the most popular game bird in the country, with an annual harvest greater than all other game birds combined. In Mississippi, the mourning dove annual harvest is greater than any other game bird species. It is the number two most hunted small game species, second only to squirrels in numbers of hunters. Its quick flight, erratic movement, and its quality for eating make it popular among both hunters and wildlife enthusiasts.

Managing for doves can provide landowners enjoyment and an alternative source of income in the fall and winter.

Life History

Mourning doves are medium-sized migratory birds that range from Alaska to most of South America. Recent surveys estimate there are approximately 500 million doves in the United States. Their song is a low-toned, mournful cooah, coo, coo, coo. The call of doves is a common sound in rural and suburban backyards, although it can easily go unnoticed. Although mourning doves are migratory birds, they will stay in warm climates, such as Mississippi, year-round. Whether they migrate or stay in one place year-round depends on their habitat and forage needs being met and the early winter's not being too severe.

Doves return to their breeding grounds in late winter. If there is an unusually heavy snowfall or temperatures near zero, many birds may die from freezing or not being able to find food. In Mississippi, early migrants may begin nesting as early as late February, and nesting increases through April. Clutch size averages two eggs per nesting cycle but can be as many as four eggs. For the first three days after the young hatch, the parents feed them crop milk, a highly nutritious liquid. After this, the young are fed seeds. The mourning dove nesting cycle takes approximately 33 days, beginning with nest building and incubation and ending with the fledgings leaving the nest. To maintain population numbers, pairs of birds try five or six nestings and often produce three or four broods in three to six nesting cycles per year. Generally five or six young will be raised per pair each year.

Mourning doves have a short lifespan, living on average just longer than one year. The mortality rate for first-year doves is between 60 and 75 percent, and adults have an average mortality rate of 50 to 60 percent. This is similar to rabbit, quail, and many other small game wildlife species. Because of their naturally high mortality rate, many doves that are not taken by hunters will die over the course of winter because of exposure, disease, or starvation. Hunters can annually harvest 15 percent of the mourning doves in the fall seasons without impacting the population as a whole.

Other doves that may be found using managed dove fields in the Southeastern United States include the Eurasian collared-dove (*Streptopelia decaocto*) and the ringed turtle-dove (*Streptopelia risoria*). The Eurasian collared-dove (considered an exotic species) is becoming fairly common in some areas because of its rapid colonization of different parts of North America. The domesticated ringed turtle-dove is much less common and seems to be less capable of increasing its population once released into the wild. Both these species are most often observed in and around cities or suburban areas, but recently the Eurasian collared-dove has been found in rural areas where doves are hunted.

State regulations vary from state to state as to taking these exotic species during migratory bird hunting seasons. Be sure to check with your state wildlife agency regulations before taking such birds during regulated dove hunting seasons. Currently (2004) in Mississippi, you can harvest the Eurasian collared-dove during dove seasons, and this does not count against the specified bag limit of mourning doves.

The Eurasian collared-dove is considerably larger than the native mourning dove, has squared rather than pointed tail feathers, and is pale in color overall as compared to a mourning dove. Seen flying near each other, it is quite easy to tell the difference in species. The ringed turtle-dove is smaller than the Eurasian collared-dove but still slightly larger than the native mourning dove. The colors of this domesticated dove vary, but the overall appearance is usually very pale, almost white, and is very much different in coloration from the native mourning dove. Although the Eurasian collared-dove is larger, and paler, and its flight pattern is slightly different from that of mourning dove's, when prepared for the table in the same manner as mourning doves, the taste is very similar.

For information about proper care of harvested doves in the field and preparation for freezing and for the table, contact the MSU Extension Wildlife and Fisheries Office at (662) 325-3174 or check the website: **http://msucares.com/wildfish/.**

Habitat and Food

About the only things mourning doves eat are seeds and plants, although doves will sometimes eat insects. Their main diet is seeds from agricultural crops (grains), native grasses, and weeds. Mourning doves are poor scratchers and will not scratch for seeds. They feed primarily on open ground.

Fields prepared for doves need to have some disked open areas to keep weeds from becoming established and going to seed. When managing your land for mourning doves, try to have foraging habitat near nesting sites. Doves will travel for food, but they prefer local food sources.

In Mississippi, nesting space is generally not a limiting factor. The preferred nesting habitat for doves is in trees or tall shrubs with an average height of 15 feet from the ground. A nesting site needs to provide cover from predators as well as protection from the sun in summer months and cold in late winter or early spring. In late winter, early nesting doves prefer coniferous trees for nesting to hide them from predators.

Doves require fresh water for drinking. There must be a pond, puddle, or stream near their nesting sites for access to fresh water daily, ideally in the morning and evening. The water source should be in an area with little vegetation. This gives them easy access to the water's edge and good visibility to be able to drink and watch for predators at the same time.

Mourning doves prefer seeds from the following plant species:

American sweetgum
barley
barnyard grass
bristlegrass
browntop millet
buckwheat
Carolina cranebill
common ragweed
corn
cowpeas
croton
crowfoot
Egyptian wheat
dove proso millet
grain sorghum
Japanese millet
Johnsongrass
lespedeza
pine seed
poke weed
primrose millet
rye
sedges
sesame
soybean
Sudan grass
sunflower
wheat
wild peas

Planting and Harvesting

You should begin preparing a field that will provide food for doves and other wildlife species in early spring. By the time late summer arrives, some grains will have begun to shatter to provide food for the returning doves now beginning to flock to available food sources.

Plant a variety of grains, such as sunflower, browntop millet, and sorghum to increase the seed availability to the doves from early fall through winter. As an example, Mississippi Department of Wildlife, Fisheries, and Parks, in cooperation with Mississippi State University Extension Service, planted a demonstration field in 2003. The demonstration field alternated rows of browntop millet, sunflower, and bare ground. Two weeks before dove season, the rows between the millet and sunflower were disked to create bare ground that removed weeds that had grown since planting and provided open areas for doves to alight for feeding and to find grit. Also, leaving bare ground between rows made finding downed birds much easier for the hunters.

Here is a suggested planting sequence for mourning doves: Plant two strips of browntop millet, disk one strip for bare ground, plant one strip of sunflower, disk one strip for bare ground, and so forth. Repeat this sequence throughout the field.

browntop millet
browntop millet
bare ground
sunflower
bare ground
browntop millet
browntop millet
bare ground
sunflower
bare ground
browntop millet
browntop millet

If you plan to harvest grain crops, leave several rows unharvested, to provide seed through the winter for birds and other wildlife. Browntop millet will reseed if not disturbed or manipulated and allowed to mature. Simply disk the field lightly in the spring and fertilize. The millet seed left behind from the previous year will germinate and provide a good stand that can substantially lower your second-year planting costs. If you leave unharvested strips of millet and sunflower, this will provide food and cover for returning doves, coinciding with the split second and third hunting seasons.

Disk unplanted strips two to three weeks before dove season to ensure the open ground doves prefer to alight and walk around on. Disking also lets doves get to the seed that has shattered and is on the ground next to the planted strips. Disking at least two weeks ahead gives the birds enough time to recover from this habitat disturbance. For further information on the feeding preferences and planting recommendations for mourning doves and other wildlife species of the Southeast, see the Wildlife Food-Planting Guide for the Southeast, Extension Publication 2111.

If you don't want to use sunflower, either because of competing wildlife, such as deer eating the sunflower, or for some other reason, substitute a nonbird resistant variety of grain sorghum, milo, or Egyptian wheat. To correct a serious anticipated weed problem before planting, using Extension herbicide recommendations for selective species control as provided in Publication 1532, the 2004 Weed Control Guidelines for Mississippi.

Estimated Costs

Costs for preparing a dove food plot as a wildlife enterprise will vary greatly, depending on the type of seed you plant, how you manage the standing crop, whether you provide cold drinks and water or other amenities to the hunters, whether you provide flagged stands, and if you will provide a meal and/or lodging after the hunt. To recover costs and make a profit, you should think about all of these factors when deciding what you will charge to hunt on your land.

You can use the following figures to calculate the cost of preparing a dove field: plant browntop millet at a rate of 8 pounds per acre if drilled, 10 pounds per acre if broadcast; and for best results, have a soil test before planting to determine the right fertilizer and possibly lime that will need to be added. If you don't have a soil test, 300 pounds per acre of 6-12-12 fertilizer for the browntop millet and 13-13-13 for the sunflower will be adequate on most soils.

An average 10-acre field of browntop millet and sunflower planted in strips will have the following estimated costs: seed will cost $10 to $12 per acre (varies, depending on time of the year you buy it, variety, and brand). Fertilizer prices can range from $350 to $400, depending on the fertility of the soil. Lime prices vary from $45 to $60 per ton (depending on the quality of the soil, it is best to have this tested before planting). Equipment and labor is estimated at $30/hr for 8 hours of preparation, planting, and disking before season, or a total of $240. Estimated total cost: $700 (this is probably a higher estimate than average). Cost of herbicide applications, if needed, would be added to these costs.

Liability Insurance

Liability is a real concern for landowners allowing access to their land. Landowners who charge a fee need more protection for themselves and the hunters or other recreational users who access their land. If there is any doubt as to the potential for litigation from allowing fee access for dove hunting or other recreational use, it is advisable to seek the advice and counsel of an attorney. You can buy liability insurance separately or add it as a rider to an operation policy you already have. Consider developing a waiver or including a release agreement that must be signed by everyone who hunts on your property. If there are any risk factors, such as old well sites, downed power lines, dead trees that may fall, or other risks that could be seen as landowner negligence, you should inform users or solve the problems before allowing access to your property.

When getting insurance, you should be aware that liability insurance covers loss caused by negligence but not loss caused by a willful act of the insured. Negligence is one of the conditions that can be greatly reduced on most private lands through risk planning. Anyone who allows public use of his or her land for recreational use, whether

or not a fee is charged for access and/or use of the property, should consider getting sufficient liability insurance coverage. Liability insurance companies generally limit the total liability of the insurance company to a specific sum per occurrence, which may be much less than the liability incurred by the insured, but it does reduce the risk of loss.

If you already have insurance on your property, you can work with your present insurer to see if a rider can be added as a supplement to the policy you already have to get adequate liability coverage. Others who plan to lease their land to an individual or group may require the lessee(s) to get liability insurance as a part of their written lease agreements. A number of insurance companies offer a rider for coverage of public recreational use or for hunting clubs. If you have questions about the need for liability insurance for the type of natural-resource enterprise you are considering, you may want to consult your attorney.

Regulations

The mourning dove is a federally-regulated migratory bird, but because it is also a widely hunted game species, it requires certain restrictions on hunting. When you are hunting mourning doves, the maximum allowed bore size of a shotgun is 10 gauge, the shotgun must not hold more than three shells at any given time, and it is illegal to use bait or live decoys to attract doves. Federal regulation requires that grains used to attract doves must be planted in a standard agricultural manner. Changing the field after the grain has matured, by disking or bush hogging is allowed, as long as you don't add grain of any type to the field. It is illegal to place piles of grain or to add other grain of any type into the field. If there is any question about the way grain in the field has been manipulated, you can contact the U.S. Fish and Wildlife Service enforcement agent or State Wildlife Agency enforcement officers and ask them to conduct a field check before hunting season to make sure you comply with existing regulations.

It is important for all hunters who will be allowed access to your land to know the rules and regulations that apply to the hunt, and it is essential they abide by them. Have all hunters show up at a set time and location before they enter the field to discuss rules and regulations you expect them to obey while on your property. This discussion would include the following:

1. Inform hunters of shooting hours, for example: 30 minutes before sunrise until sunset. Plan either a morning or afternoon shoot, but do not allow both the first day, or you will find yourself having birds stay around only a very short while. To keep birds returning to a prepared field, set up morning or afternoon hunts only once or twice a week and never on two days in a row. Ideally, it is best to alternate one hunt per week in the morning and, if desired, another in the afternoon later on in the week.

2. To avoid confusion and potential over harvesting of the birds coming to the field, all hunters who are finished shooting or who have shot their limit should leave the field as soon as possible afterward. The legal bag limit is 15 mourning doves in Mississippi, and the possession limit is 30, except on the first day of the season. The possession limit is not allowed on the first day of any of the three separate hunting seasons.

3. Legally, shotguns must not be able to hold more than three shells at any time when hunting doves (one in the chamber and two in the magazine

of pumps and semi-automatics). When hunting doves, except for use of side by side, over and under, or single shot shotguns, the hunter must plug his shotgun so that not more than two shells can be inserted into the magazine.

4. Hunters must have a valid state hunting license that is signed and on their person before going into the field or qualify for an exemption as dictated by the Mississippi Department of Wildlife, Fisheries, and Parks.

For comprehensive regulation information on mourning doves in Mississippi, contact the Mississippi Department of Wildlife, Fisheries, and Parks, Wildlife Division, 1505 Eastover Drive, Jackson, MS 39211. Website: www.mdwfp.com.

Safety

Safety is paramount to having an enjoyable dove hunt. Few things will sour hunter enthusiasm or enjoyment faster than being cited for a violation or having a hunter shot by another hunter shooting at a low-flying bird.

The following simple rules of thumb will help your hunt go smoothly and safely:

- ✔ Keep hunters separated a safe distance, which is at least 100 yards between hunters.
- ✔ Remind hunters never to shoot at low-flying birds or birds that alight in the field because of the danger of shooting a fellow hunter.
- ✔ Recommend that all hunters wear protective glasses.
- ✔ Never allow anyone in the field to drink or take alcohol into the field during shooting hours.

Other Considerations

Managing a dove field properly will provide many hours of shooting enjoyment as well as doves harvested for the grill or skillet. When designing your management strategy, include posting small signs with station numbers, and request that hunters stay near their posts while shooting. This will keep hunters from clustering in hot spots, such as areas where most birds fly into the field, which could lead to a hunting accident.

You need to post starting and ending times for morning and evening shoots, and hunters need to follow them. The earlier all shooters leave a field, the more likely birds will keep returning to the field as long as food continues to be available. For example, hunters who begin shooting 30 minutes before sunrise and leave by 9:30 a.m. or earlier will enable doves to return to the field to feed. However, if doves are shot in the field until noon, many of the birds will find other places to feed. The more time hunters spend shooting doves in your field, the higher the likelihood that the number of returning birds will decrease significantly. The same principles also apply for afternoon hunts. While the birds may fly later in the afternoon on very hot days, it is still best to leave the field as soon as possible to let the birds return to feed before sunset. Once a shooter reaches his bag limit and leaves the field, invite another shooter to move to the empty station if he wants to, to increase his chance for shots.

If you want to shoot your dove field twice per week, it is best to space the hunts apart, for example on a Saturday, and either a Tuesday or Wednesday. Keeping hunts three or more days apart and limiting the number of hours hunters are in the field should keep birds returning to the field through the season.

Finding Downed Birds

It is important for dove management, as well as good sportsmanship, that you make every effort to find downed birds. If you have a retriever, this should be easy. Let the dog do the work for you. Without a dog, though, more effort is needed. One strategy is to stop every time you shoot a bird and remove your shells. Do not reload until you find the downed bird to ensure you are not tempted to take another bird, thus having two birds down in different places. Disking strips into your field will also be helpful. It will let you see into the rows of vegetation and more easily find the downed bird.

Advice for Hunters

You should be ready to answer questions from novice hunters regarding hunting basics. When advising an inexperienced hunter, suggest he aim for birds within 20 to 30 yards, and pick shots based on his level of skill. The hunter's ability will determine how much time is needed in the field and how many

shots he takes to bag his limit. On average, a hunter will use about 75 shells to reach a 15-bird bag limit. This will vary greatly, based on experience and shooting skill. An excellent hunter skilled in wing-shooting may use 25 shells or fewer to take his limit.

The shot size, shotgun action type, and gauge are mostly based on personal preference. Most hunters select small shot sizes from 7 1/2 to 9's. The main point is that doves do not require magnum loads or large-sized shot. Also, shooting a light recoiling shotgun will make a large difference by the end of the hunt for a new hunter's comfort.

For the average hunter, shotgun choke is also a personal choice. Skeet or improved cylinder choke is generally more than enough for shooting doves. For a double gun, ideal chokes are improved cylinder and modified.

Comfort and Fees Charged

The first season is generally quite hot, and it is advisable for hunters to wear either camo or dull colored clothing. Besides dressing light, you may want to carry a small ice chest filled with cold water and sodas for drinking while in the field.

Depending on the facilities and fees charged, some landowners choose to provide water, soda, and/or a meal for the hunters. The costs to hunters can vary from as low as $10 per shooter per hunt to more than $100, depending on costs and amenities the landowner has provided to the hunters. To recover costs of preparing a dove field, landowners must know those costs. Some landowners with lodging and dining facilities offer package hunts for corporate or other groups at appropriate costs, which may be more than $250 per hunter and may have facilities for a morning fishing trip and afternoon hunt

Currently, the most common prices seen advertised for a half-day dove hunt in Mississippi range from $10 per hunter to $150 per hunter. Again, this varies, depending on the services and amenities provided, and whether the hunt will be on land prepared by the landowner as a dove food plot or simply a harvested corn or wheat field.

Hunter Expectations

When paying to enter a dove field, hunters should expect the following:

- ✔ Everyone entering the field will practice safe hunting conditions. You won't know this unless all other hunters are friends who you know are experienced and ethical hunters.
- ✔ The landowner, or someone in charge of the hunt, should provide ground rules that include what the field size is limited to and where the property lines are.
- ✔ Alcoholic beverages are prohibited from the field during the hunt.
- ✔ All hunters have been informed not to shoot at low-flying birds or birds alighting in the field because of risk of shooting another hunter.
- ✔ Legal shooting hours will be adhered to.
- ✔ All hunters will make every possible effort to find all downed birds.
- ✔ Bag limits will be strictly adhered to.
- ✔ Harvested doves will not be cleaned in the field.
- ✔ Hunters will collect and take spent shells out of the field for proper disposal when they are finished shooting.
- ✔ Hunters will stay within the general area of their stations except to find downed birds.
- ✔ Hunters are expected to leave the field when they have taken their bag limit of birds, when they tire of shooting, or at a set time (when hunting in the morning – 9:30 to 10:00 a.m., no later than 15 minutes before sun set if hunting in the afternoon).
- ✔ If water or cold drinks are provided, how often will such beverages be provided.
- ✔ Everyone will be required to plug repeating shotguns to prevent their holding more than two shells in the magazine.

Mississippi State University Extension Service

MSUcares.com

Photo Credits: Photo on page 3 is by Janelle Midtbo, former associate, Extension Wildlife and Fisheries Department; photo on page 5 is compliments of Bon Terra Consulting; photo on back page is compliments of US Forestry and Wildlife Service.

Acknowledgements: We greatly appreciate the formal reviews of this publication and helpful suggestions provided by Dr. Greg K. Yarrow, Associate Professor of Wildlife, Clemson University; Dr. James Armstrong, Associate Professor & Extension Wildlife Specialist, Auburn University; and Dr. Rebecca Stout-McPeake, Extension Wildlife Specialist, University of Arkansas.

By **James E. Miller**, MSU Extension Outreach/Research Professor, and **David K. Godwin**, MDWFP Research and Small Game Coordinator.

Publication 2335
Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. JOE H. MCGILBERRY, Director (5M-06-04)

NRCS Natural Resources Conservation Service
Wildlife Habitat Management Institute

WILDLIFE HABITAT COUNCIL™ © 1988 WHC

Mourning Dove (Zenaida macroura)

May 2005 *Fish and Wildlife Habitat Management Leaflet* *Number 31*

General information

The mourning dove (*Zenaida macroura*) is one of the most widely distributed and abundant birds in North America. Fall populations of this game bird in the United States are estimated to be slightly more than 400 million birds. In recent years, the annual harvest by hunting in the United States has been estimated at 18 to 25 million birds, similar to the harvest of all other migratory game birds combined. Mourning doves are highly adaptable, occurring in most ecological types except marshes and heavily forested areas.

The mourning dove is a medium-sized member of the Columbidae family. While this family consists of approximately 300 species of doves and pigeons, only 8 species, including the mourning dove, are native to the United States. The mourning dove is approximately 11 to 13 inches in length, with a 17– to 19–inch wingspan, weighing on average 4.4 ounces. Mourning doves have delicate bills and long, pointed tails. They are grayish-brown and buff in color, with black spots on wing coverts and near ears. The tail and wing feathers are gray, except for black-bordered white tips on the tail. Their eyes are brown and bordered by light blue bare skin, while legs and feet are a dull red. Males are slightly larger than females, and slightly more brightly colored. Males have more of a pinkish wash on the breast and a brighter blue-gray coloration on top of the head. Juveniles have light buff tips to their feathers, giving a scaly appearance.

Mourning doves are monogamous and form strong pair bonds that persist during at least one nesting season. The breeding season is among the longest of all North American birds, with peak nesting activity occurring in late spring/early summer and a decline beginning in July. At the beginning of the breeding season, unpaired males devote considerable time to perch cooing and performing displays such as flapping/gliding flight to attract females. When performing the flapping/gliding flights, a male leaves his cooing perch with a vigorous and noisy flapping of his wings, rising up to 100 feet in the air. He then extends his wings and begins a long spiraling glide back down. The perch coo is one of the few vocalizations

U. S. Fish and Wildlife Service

Mourning dove (Zenaida macroura)

that mourning doves make. It consists of one note followed by a higher one, then three to five notes held at great length, and it is used by males to court females. A female will respond to the perch coo in one of three ways: she will fly away, initiating a pursuit chase; she will ignore the male and continue preening or feeding; or she will permit copulation and formation of the pair bond.

Once the pair bond is made, the male takes the initiative in nest-site selection. He selects small twigs and delivers them to the female, who arranges them in a nesting platform. Clutch size is small, usually two eggs per nest. Sometimes three or four eggs are found in a nest, due to “dump nesting” where a female lays her eggs in another’s nest. Eggs are white and nests are usually open, making them easy targets for predators, including blue jays, grackles, crows, housecats, red squirrels, and rat snakes. Both parents incubate the eggs; eggs hatch in 14 to 15 days. Repeated nesting in a season is necessary to maintain population levels, as average mortality rates can be as high as 58 percent per year for adults and 69 percent per year for juveniles. Generally, mourning doves can successfully raise two to three clutches per season in northern areas and five to six clutches per season in warmer areas.

This leaflet provides an introduction to the habitat requirements of the mourning dove and is intended to assist landowners and managers develop mourning dove management plans. The success of any species-specific management plan depends on targeting the needs of the desired species and analyzing existing habitat conditions to ensure that all required habitat elements are present. This leaflet provides a number of practical habitat management practices that can be used to improve and manage mourning dove habitat. Landowners and managers are encouraged to enlist the expertise of wildlife and natural resource professionals to help identify additional habitat management needs and actions.

Distribution

The mourning dove is indigenous to North America and is widespread throughout the continent. Its breeding distribution includes southern Canada, all of the continental United States, northern Mexico, and the Caribbean Islands. The winter distribution extends from northern California across the central United States to Iowa, southern Michigan, southern Ontario, New York, and New England, extending south through the breeding distribution over most of Mexico and Central America.

Mourning doves are migratory in the northern part of their distribution. Those that breed farther north winter farther south. Each migratory location receives doves from divergent breeding locations. For the most part, birds living in New England and the mid-Atlantic over winter in the Carolinas; birds living in eastern and mid-central United States over winter in southeastern United States (including LA, MS, AL, GA, FL); and birds living in central United States over winter in Mexico and Central America. Texas, California, and Arizona serve as resting points for more southern migrants. Spring migration begins in March, progresses slowly through April, and ends in mid to late May. Autumn migration begins at the end of August and ends in November. Most migration routes are overland.

As a result of environmental factors, mourning doves exhibit geographical morphological variations. For example, plumage varies from darker in the east to paler in the west; wings vary from shorter in southern areas to longer in northern areas; and toe length decreases from east to west. These geographical variations have led to the classification of mourning dove subspecies (table 1).

Habitat requirements

General

Mourning doves are adapted to a wide variety of habitat conditions, but depend particularly on edge cover and mixed successional stages throughout their range. They primarily inhabit woodland/grassland edges. They prefer open or semi-open lands and are primarily farm game birds that thrive where grain crops are grown. Mourning doves generally do not feed in areas containing heavy, densely-matted vegetation; bare ground on which seeds are available and visible is preferred.

Breeding and wintering distribution of the mourning dove (adapted from Mirarchi and Baskett 1994).

There has been a dramatic increase in the number of mourning doves inhabiting the Canadian prairies over the past several decades, due to an increase in their preferred habitat. This is attributed to the establishment of trees in windbreaks and shelterbelts, the advent of agriculture with plentiful grain seeds as a stable food supply, the creation of small water supplies for livestock, and the erection of telephone lines and power lines used for perching. Likewise, in the Great Plains, the conversion of large tracts of treeless prairie to domestic grains and farmsteads has created an excellent combination of food and nesting cover for mourning doves.

Food

Seeds obtained from native or cultivated plants make up more than 99 percent of a mourning dove's diet. Many of the most favored foods are seeds produced

on herbaceous plants found in early successional habitats. Mourning doves are selective foragers and their feeding habits depend on what seeds are available in a given region. Choice foods are those that are readily eaten when encountered, whereas fair foods are eaten only rarely when choice foods are present. Table 2 offers guidelines for mourning dove choice and fair foods.

Mourning doves eat what is visible and readily accessible in light ground cover. They do not scratch or use their bill to dig for food. Rather, food is eaten directly off the ground. They locate food by sight or by observing other birds feeding. Mourning doves will often return repeatedly to the same feeding site until the food source is exhausted. Most agricultural seeds consumed are from spillage after harvest, from livestock feeding, or located around storage buildings.

Grit (sand and gravel) is ingested and retained in the mourning dove's gizzard to help grind and pulverize hard foods. Grit is available along gravel or mud flats, road edges, or in sandy soil.

Nesting cover

Mourning doves are best adapted to and most closely associated with agricultural habitats, but will nest in many different habitat types. They typically nest along the edges of fields, pastures, or clearings; nests are seldom found in densely wooded areas. Nests are built in both coniferous and deciduous trees, shrubs, and vines. Tree nesting is most common, but they will nest on building ledges, chimneys, and the ground in the absence of trees or shrubs. Nesting habitat is not usually a limiting factor for mourning doves. However, it is important to have an interspersion of vegetation types for nest site selection.

Mourning doves are notoriously poor nest constructers. Nests are often no more than a platform of small twigs, grasses, pine needles, or similar materials found around nest sites. They will frequently use previously constructed nests (of mourning doves, other birds, or squirrels).

Table 1 Mourning dove subspecies

Common name (Scientific name)	Characteristics	Range
Eastern mourning dove (Z. m. carolinensis)	longer wings, longer toes, shorter bill, darker in color	Eastern U.S., Bermuda, Bahamas
Western mourning dove (Z. m. marginella)	longer wings, longer bill, shorter toes, paler in color	Western U.S. including prairie grasslands, southern Canada, Mexico
Panama mourning dove (Z. m. turturilla)	shorter wings, shorter legs, longer bill, pale grayish in color	Western Panama
West Indian mourning dove (Z. m. macroura)	shorter wings, dark-to-medium toned, deep buff-colored belly	Western West Indies, Florida keys
Clarion Island mourning dove (Z. m. clarionensis)	larger feet, larger bill, very dark brownish	Clarion Island (off the west coast of Mexico)

Table 2 Mourning dove food [1]

	Choice foods	Fair foods
Agriculturally Produced	Bread wheat, corn, grain sorghum, millets, oats (pieces), peanuts (hulled), sesame, sudangrass, sunflower (oil varieties)	Barley, buckwheat, cowpea, rice, rye, soybean
Trees	Pines, sweetgum	
Grasses	Bristlegrasses, broadleaf signalgrass, canary grasses, panicums, paspalums, switchgrasses	Goosegrass, Johnsongrass
Forbs	Amaranths, crotons, various euphorbs, hemp, pokeberry, sunflower (common)	Smartweed

[1]Some of these plants are considered to be invasive species in some areas. While their seeds may benefit mourning doves, these plants should be avoided in favor of native species. Landowners should consult with local NRCS offcials to find out which preferred mourning dove foods are native in their area.

Did you know?

Both parents nourish young mourning doves with crop milk, a milk-like substance consisting of cells sloughed from the parent's crop wall. The crop gland is located at the base of the neck in front of the breastbone and it functions as part of the digestive system as a food storage organ. After a few days, crop milk is gradually supplemented by seeds, and at fledging (11-15 days), young mourning doves' diets are the same as their parents'.

Roosting cover

Like nesting cover, roosting cover is provided by various habitat types. These include coniferous and deciduous trees, brushy thickets, dead snags, and power-line right-of-ways. Hedgerows and shelterbelts also provide excellent roosting sites for mourning doves. Mourning doves will often sit in roosting sites before flying down into a field to feed.

Water

Mourning doves require fresh surface water for drinking on a regular basis. Puddles, ponds, and stream edges are suitable water sources. Doves will alight on unvegetated or lightly vegetated spots where visibility is good and where predators cannot easily hide, and where they can walk easily to the water's edge. Sandbars, gravel bars, and mud flats provide such drinking sites.

Limiting factors

Table 3 provides a summary of mourning dove habitat requirements. For planning purposes, use table 4 to subjectively rate the availability and quantity of mourning dove habitat within a planning area, based on habitat requirement descriptions listed in table 3. Habitat communities and components that are absent or given a low rating are likely limiting mourning dove habitat quality. Management actions should be taken to address these limiting factors. Land uses on adjacent properties may need to be considered to accurately rate the quality of a habitat management area for mourning doves.

U. S. Fish and Wildlife Service

Both parents care for the young by nourishing them with crop milk.

Habitat management recommendations

Maintenance of mourning doves in a healthy, productive state is a primary management goal. To this end, management of mourning doves includes assessment of population status, regulation of harvest, and habitat management. In general, the primary management tool is through hunting regulations, including season length, bag limits, and shooting hours. The regulations generally remain the same year-to-year, but have been changed in response to population trends in an attempt to alter the number of doves harvested in a given year. While these regulations are in place at the federal and state levels, there are concrete actions that landowners can take to increase the numbers of mourning doves on their properties. Ultimately, a landowner's goal should be to provide a continuous supply of diverse and highly preferred foods throughout the year, not just during hunting season.

Feeding fields are created to attract mourning doves, primarily for hunting purposes. Fields that are most used by mourning doves are characterized by an abundance of small seeds scattered on the surface of relatively bare ground with little horizontal cover. Seeds that will attract mourning doves include wheat, millet, sunflowers, corn or grain sorghum, peanuts, buckwheat, barley, and annual rye. Fields may be varied in shape, but should be at least 2 acres in size. For hunting, larger fields of 20 to 60 acres are recommended for safety and to allow hunters to spot the doves to prepare the shot. A general rule of thumb is to provide at least 1 acre for each gun on the field. By regulating hunter pressure, landowners can extend quality dove hunting on a feeding field well into the season. To keep doves coming into a field, it is important to limit hunting to two to three times per week. If the property is large enough, the fields that are hunted can be rotated, which will allow more frequent hunting. For maximum effectiveness, a given field should be hunted only a half-day per week and hunters should stay on the outside of the field.

Feeding fields can be agricultural fields managed in such a way as to provide habitat for mourning doves, or they can be fields maintained specifically for mourning dove habitat. Table 5 outlines the vari-

ous management practices that can be used for either kind of feeding field. Fields with natural vegetation (those not used for agricultural purposes) can be managed for improved mourning dove habitat. Soil disturbance, such as light discing, mowing, or burning, prior to or early in the growing season will stimulate seed-producing annuals and attract mourning doves. In areas of extensive crop and grasslands, coniferous trees can be planted for nesting and roosting sites.

Table 3 Summary of mourning dove habitat requirements

Habitat component	Habitat requirements
Food	Seeds from native or cultivated plants; seed must be visible and readily accessible on the ground; sand or gravel must be available
Nesting cover	Trees or shrubs on the edges of fields, pastures, or clearings
Roosting cover	Trees, shrubs, or power lines on the edges of fields, pastures, or clearing.
Water	Fresh surface water in puddles, ponds, or streams; must have unvegetated area around water source on which to alight

Table 4 Factors that can limit habitat quality/quantity

Habitat component	Availability/quality			
	High	Medium	Low	Absent
Food				
Nesting cover				
Roosting cover				
Water				

Table 5 Mourning dove field management options[1]

Seed crop	Special dove planting	Agricultural crop residue
Corn	Mow, burn, disc	Combine, cut silage, “hog”, mow, disc, or burn stalks
Peanuts		Mechanical harvest, “hog”
Wheat	Fresh seed and mow, burn or disc when mature	Combine, burn residue, hay, lightly disc
Browntop, proso, and other millet	Clean cultivate in rows, mow or lightly disc if broadcast	Hay, combine
Milo, higera, sorghum	Clean cultivate, mow, disc	Combine, hay, cut silage, shred or burn stalks
Sunflowers	Clean cultivate, mow, lightly disc	Combine
Watermelon		Leave broken melons, mow, disc
Soybeans	Clean cultivate, mow, lightly disc	Combine, hay
Hemp		Bale for rope
Sesame	Clean cultivate, mow	Harvest
Barley	Mow, lightly disc	Harvest, hay
Annual rye	Mow, lightly disc	Harvest, hay

[1]Baskett, R. K. 1993. Table 59: Mourning dove shooting field management options with special plantings or manipulation or agricultural crop residues. Page 498 in T. S. Baskett, M. W. Sayre, R. Tomlinson, and R. E. Mirarchi, editors. Ecology and management of the mourning dove. Stackpole Books, Harrisburg, PA, USA.

When planting seed crops for mourning dove habitat, it is important to pay attention to planting dates and seed maturation dates to ensure the grain crop will be available during the dove-hunting season. Crop harvesting should be done a week or two prior to the opening of dove season to allow time for doves to find and begin using the field. Most harvesting methods, including silage chopping, conventional combining, picking, hogging, and haying, all involve provisions for open or bare ground with scattered seeds on the surface. Light discing, hogging, or shredding stalks and remaining ears of corn, bean pods, peanut hulls, or milled heads improves the field's potential for attracting doves. For seeds to be visible to mourning doves, landowners should avoid fall plowing of agricultural fields following harvest, leave some areas of small grains unharvested, and leave waste grain on the field.

In brush or timbered areas, it is necessary to control understory vegetation so that mourning doves may move freely on the ground and easily locate seeds. Livestock grazing can be beneficial to doves by opening understory and encouraging weed seed production. However, landowners must be cautious as overgrazing may cause long-term soil deterioration and a loss of grass and forb seeds. Seed tree, shelterwood, and clearcuts are all appropriate timber harvest methods for dove management. Frequent thinning of pine stands stimulates the production of herbaceous plants valuable as dove foods. Prescribed burning in park-like stands is an inexpensive and effective technique for managing dove habitat, especially when used in association with openings, cultivated grain fields, and water sources. Burning of crop residues provides the bare ground necessary to attract doves to feeding fields. Doves readily feed in burned areas where desirable seeds are abundant and exposed.

Diseases and parasites

A number of known diseases and parasites affect mourning doves. Parasites include intestinal parasites (nematodes, flukes, tapeworms), ectoparasites (mites, lice), and blood parasites, none of which are linked to mortality. *Haemoproteus columbae* is an example of a common blood parasite; it lives within red blood cells and is transmitted by hippoboscid flies, biting midges, louse flies, or nest mites. Trichomonas gallinae, caused by a single-celled flagellate that resides in the mouth, esophagus, and crop, is one of the most dangerous pathogens in mourning doves. It can exist peacefully in the host but can also cause cheesy, yellowish growths in the mouth and esophagus, making it difficult for the mourning dove to eat and eventually leading to death by starvation. Avian pox is a virus that causes lesions on the skin and/or mucous membranes of the mouth and upper respiratory tract. These lesions can also make it difficult for the mourning dove to see and eat and lead to death by starvation. Avian pox is highly contagious and transmitted by mosquitoes, hippoboscid flies, biting midges, or by direct or indirect contact with an infected bird.

Baiting laws

When preparing a feeding field, landowners should be aware of the laws protecting mourning doves under the Migratory Bird Treaty Act. Federal regulations concerning the baiting of migratory birds prohibit the shooting of doves over areas where grains, salt, or other foods are placed (carried to an area, not grown) for the purpose of attracting birds. Doves may be hunted over a standing crop or any field where grain or feed has been distributed or scattered as a result of normal agricultural operations. Standing crops may be manipulated by any methods to attract doves, such as mowing, discing, or burning, so long as the grain is not harvested and then redistributed to the field. It is recommended that state and/or federal wildlife officers be consulted concerning plans for dove feeding fields and hunting. For more information on the laws surrounding mourning dove baiting, visit *http://www.le.fws.gov/dove-baiting.htm*

References

Online Sources

Conservation Commission of Missouri. 2004. The mourning dove in Missouri. *http://www.mdc.missouri.gov/nathis/birds/doves/index.htm* [Accessed 22 November 2004].

Georgia Department of Natural Resources, Wildlife Resources Division. n.d. Small game management in Georgia. *http://georgiawildlife.dnr.state.ga.us/content/displaycontent.asp?txtDocument=228&txtPage=5* [Accessed 22 November 2004].

U. S. Fish and Wildlife Service. 2002. Dovebaiting. *http://www.le.fws.gov/dovebaiting.htm* [Accessed 15 February 2005].

Printed sources

Alabama Department of Conservation and Natural Resources. n.d. Management and hunting of mourning doves in Alabama. Wildlife and Freshwater Fisheries Division, Alabama Department of Natural Resources and Conservation, Montgomery, AL, USA.

Atkinson, R.D., T.S. Baskett, K.C. Sadler. 1982. Populations dynamics of mourning doves banded in Missouri. Special Scientific Report – Wildlife No. 250, Fish and Wildlife Service, U. S. Department of the Interior, Washington, DC, USA.

Baskett, T.S., M.W. Sayre, R. Tomlinson, and R.E. Mirarchi, editors. 1993. Ecology and management of the mourning dove. Stackpole Books, Harrisburg, PA, USA.

Dolton, D.D., and R.D. Rau. 2004. Mourning dove population status, 2004. U. S. Fish and Wildlife Service, Laurel, MD. Updated yearly and available at *http://migratorybirds.fws.gov/reports/reports.html*.

Dunks, J.H., R.E. Tomlinson, H.M. Reeves, D.D. Dolton, C.E. Braun, and T.P. Zapatka. 1982. Mourning dove banding analysis, Central Management Unit, 1967-77. Special Scientific Report –Wildlife No. 249. U. S. Fish and Wildlife Service, Washington, DC, USA.

Hanson, H.C., and C.W. Kossack. 1962. The mourning dove in Illinois. Southern Illinois University Press, Carbondale, IL, USA.

Hayslette, S.E., and R.E. Mirarchi. 2001. Patterns of food preferences in mourning doves. Journal of Wildlife Management 65: 816-827.

Mirarchi, R.E., and T.S. Baskett. 1994. Mourning dove (*Zenaida macroura*). In A. Poole and F. Gill, editors. The Birds of North America, No. 117. The Academy of Natural Sciences, Philadelphia, PA, USA and The American Ornithologists' Union, Washington, DC, USA.

South Carolina Department of Natural Resources. n.d. Wildlife management guide: mourning dove. Wildlife Management Section, South Carolina Department of Natural Resources, Columbia, SC, USA.

Tomlinson, R.E., D.D. Dolton, H.M. Reeves, J.D. Nichols, L.A. McKibben. 1988. Migration, harvest, and population characteristics of mourning doves banded in the Western Management Unit 1964-1977. Fish and Wildlife Technical Report 13, Fish and Wildlife Service, US Fish and Wildlife Service, Washington, DC, USA.

Natural Resources Conservation Service

Check your local telephone directory for a field office near you.

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

NRCS Natural Resources Conservation Service

www.nrcs.usda.gov

Wildlife Habitat Council
8737 Colesville Road, Suite 800
Silver Spring, Maryland 20910
(301) 588-8994

The mission of the Wildlife Habitat Council is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, non-profit organizations on a voluntary basis for the recovery, development, and preservation of wildlife habitat worldwide.

WILDLIFE HABITAT COUNCIL℠

www.wildlifehc.org

Primary author: Raissa Marks, Wildlife Habitat Council. Drafts reviewed by: Rob Pauline, Wildlife Habitat Council; Charlie Rewa, Natural Resources Conservation Service; Ralph E. Mirarchi, Auburn University; David D. Dolton, U. S. Fish and Wildlife Service; and Steven E. Hayslette, Tennessee Tech University.

LANDSCAPING TO ATTRACT BIRDS

INTRODUCTION

Among the fondest and most memorable moments of childhood are the discoveries of songbirds nesting in the backyard. The distinctive, mud-lined nests of robins and their beautiful blue eggs captivate people of all ages. Likewise, the nesting activities of house wrens, cardinals, chickadees, and other common birds can stimulate a lifelong interest in nature.

As people learn to enjoy the beauty of birdlife around their home, they may wish to improve the "habitat" in their yard so that more birds will visit their property. You can attract birds by placing bird feeders, nest boxes, and bird baths in your yard, and by planting a variety of trees, shrubs, and flowers. These can provide good nesting sites, winter shelter, places to hide from predators, and natural food supplies that are available year-round.

BENEFITS OF LANDSCAPING FOR BIRDS

At least ten benefits can be derived from landscaping to attract birds to your yard:

Increased Wildlife Populations

You can probably double the number of bird species using your property with a good landscaping plan.

Energy Conservation

By carefully arranging your conifer and hardwood trees, you can lower winter heating and summer cooling bills for your house.

Soil Conservation

Certain landscape plants can prevent soil erosion.

Natural Beauty

A good landscaping plan will contribute to a beautiful, natural setting around your home that is pleasing to people as well as birds.

Wildlife Photography

Wildlife photography is a wonderful hobby for people of all ages.

Birdwatching

A fun hobby is to keep a list of all the birds seen in your yard or from your yard. Some people have counted over 190 species of birds in their yard!

Natural Insect Control

Birds such as tree swallows, house wrens, brown thrashers, and orioles eat a variety of insects.

Food Production

Some plants that attract wildlife are also appealing to people. Cherries, chokecherries, strawberries, and crabapples can be shared by people and wildlife.

Property Value

A good landscaping plan can greatly increase the value of your property by adding natural beauty and an abundance of wildlife.

Habitat for Kids

Some of the best wildlife habitats are the best "habitats" for young people to discover the wonders of nature. A backyard habitat can stimulate young people to develop a lifelong interest in wildlife and conservation.

BASICS OF LANDSCAPING FOR BIRDS
Landscaping for birds involves nine basic principles:

Food
Every bird species has its own unique food requirements, and these may change as the bird matures and as the seasons change. Learn the food habits of the birds you wish to attract. Then plant the appropriate trees, shrubs, or flowers that will provide the fruits, berries, grains, seeds, acorns, nuts, or nectar.

Water
You can probably double the number of bird species in your yard by providing a source of water. A frog pond, water garden, or bird bath will get lots of bird use, especially if the water is dripping, splashing, or moving.

Shelter
Birds need places where they can hide from predators and escape from severe weather. Trees (including hollow ones), shrubs, tall grass, and bird houses provide excellent shelter.

Diversity
The best landscaping plan is one that includes a wide variety of plants. This helps attract a greater number of bird species.

Four Seasons
It is necessary to provide birds with food and shelter during all four seasons of the year. Plant trees, shrubs, and flowers that will provide year-round food and shelter.

Arrangement
Habitat components need to be properly arranged. Consider the effects of prevailing winds (and snow drifting) so your yard will be protected from harsh winter weather.

Protection
Birds should be protected from unnecessary mortality. When choosing the placement of bird feeders and nest boxes, consider their accessibility to predators.

Picture windows can be death traps for birds. A network of parallel, vertical strings spaced 4 inches apart can be placed on the outside of windows to prevent this problem.
You also should be cautious about the kinds of herbicides and pesticides used in your yard. They should be applied only when necessary and strictly according to label instructions.

Hardiness Zones
When considering plants not native to your area, consult a plant hardiness zone map (they are in most garden catalogues). Make sure the plants you want are rated for the winter hardiness zone classification of your area.

Soils and Topography
Consult with your local garden center, university, or county extension office to have a soil test done for your yard. Plant species are often adapted to certain types of soils. By knowing what type of soil you have, you can identify the types of plants that should grow best in your yard.

PLANTS FOR WILD BIRDS

Seven types of plants are important for bird habitat:

Conifers

Conifers are evergreen trees and shrubs that include pines, spruces, firs, arborvitae, junipers, cedars, and yews. These plants are important as escape cover, winter shelter, and summer nesting sites. Some also provide sap, buds, and seeds.

Grasses and Legumes

Grasses and legumes can provide cover for ground nesting birds--especially if the area is not mowed during the nesting season. Some grasses and legumes provide seeds as well. Native prairie grasses are becoming increasingly popular for landscaping purposes.

Nectar-Producing Plants

Nectar-producing plants are very popular for attracting hummingbirds and orioles. Flowers with tubular red corollas are especially attractive to hummingbirds. Other trees, shrubs, vines and flowers can also provide nectar for hummingbirds.

Summer-Fruiting Plants

This category includes plants that produce fruits or berries from May through August. Among birds that can be attracted in the summer are brown thrashers, catbirds, robins, thrushes, waxwings, woodpeckers, orioles, cardinals, towhees, and grosbeaks. Examples of summer-fruiting plants are various species of cherry, chokecherry, honeysuckle, raspberry, serviceberry, blackberry, blueberry, grape, mulberry, plum, and elderberry.

Fall-Fruiting Plants

This landscape component includes shrubs and vines whose fruits are ripe in the fall. These foods are important both for migratory birds which build up fat reserves prior to migration and as a food source for non-migratory species that need to enter the winter season in good physical condition. Fall-fruiting plants include dogwoods, mountain ash, winter-berries, cottoneasters, and buffalo-berries.

Winter-Fruiting Plants

Winter-fruiting plants are those whose fruits remain attached to the plants long after they first become ripe in the fall. Many are not palatable until they have frozen and thawed numerous times. Examples are glossy black chokecherry, Siberian and “red splendor” crabapple, snowberry, bittersweet, sumacs, American highbush cranberry, eastern and European wahoo, Virginia creeper, and Chinaberry.

Nut and Acorn Plants

These include oaks, hickories, buckeyes, chestnuts, butternuts, walnuts, and hazels. The meats of broken nuts and acorns are eaten by a variety of birds. These plants also provide good nesting habitat.

HOW TO GET STARTED

Think of this project as “landscaping for birds.” Your goal will be to plant an assortment of trees, shrubs, and flowers that will attract birds. If you plan carefully it can be inexpensive and fun for the whole family. The best way to get started is to follow these guidelines:

Set Your Priorities

Decide what types of birds you wish to attract, then build your plan around the needs of those species. Talk to friends and neighbors to find out what kinds of birds frequent your area. Attend a local bird club meeting and talk to local birdwatchers about how they have attracted birds to their yards.

Use Native Plants When Possible

Check with the botany department of a nearby college or university or with your Natural Heritage Pro-

gram for lists of trees, shrubs, and wildflowers native to your area. Use this list as a starting point for your landscape plan. These plants are naturally adapted to the climate of your area and are a good long-term investment. Many native plants are beautiful for landscaping purposes and are excellent for birds. If you include non-native plant species in your plan, be sure they are not considered "invasive pests" by plant experts.

Draw a Map of Your Property
Draw a map of your property to scale using graph paper. Identify buildings, sidewalks, powerlines, buried cables, fences, septic tank fields, trees, shrubs, and patios. Consider how your plan relates to your neighbor's property (will the tree you plant shade out the neighbor's vegetable garden?) Identify and map sunny or shady sites, low or wet sites, sandy sites, and native plants that will be left in place. Also identify special views that you wish to enhance--areas for pets, benches, picnics, storage, playing, sledding, vegetable gardens, and paths.

Get Your Soil Tested
Get your soil tested by your local garden center, university, or soil conservation service. Find out what kinds of soil you have, and then find out if your soils have nutrient or organic deficiencies that can be corrected by fertilization or addition of compost. The soils you have will help determine the plants which can be included in your landscaping plan.

Review the Seven Plant Habitat Components
Review the seven plant components that were described previously. Which components are already present? Which ones are missing? Remember that you are trying to provide food and cover through all four seasons. Develop a list of plants that you think will provide the missing habitat components.

Confer With Resource Experts
Review this plant list with landscaping resource experts who can match your ideas with your soil types, soil drainage, and the plants available through state or private nurseries. People at the nearby arboretum may be able to help with your selections. At an arboretum you can also see what many plants look like.

Develop Your Planting Plan
Sketch on your map the plants you wish to add. Trees should be drawn to a scale that represents three-fourths of their mature width and shrubs at their full mature width. This will help you calculate how many trees and shrubs you need. There is a tendency to include so many trees that eventually your yard will be mostly shaded. Be sure to leave open sunny sites where flowers and shrubs can thrive. Decide how much money you can spend and the time span of your project. Don't try to do too much at once. Perhaps you should try a five year development plan.

Implement Your Plan
Finally, go to it! Begin your plantings and be sure to include your family so they can all feel they are helping wildlife. Document your plantings on paper and by photographs. Try taking pictures of your yard from the same spots every year to document the growth of your plants.

Maintain Your Plan
Keep your new trees, shrubs, and flowers adequately watered, and keep your planting areas weed-free by use of landscaping film and wood chips or shredded bark mulch. This avoids the use of herbicides for weed control. If problems develop with your plants, consult a local nursery or garden center.

And Finally...
Most of all, take the time to enjoy the wildlife that will eventually respond to your efforts at landscaping for birds.

READING LIST

Dennis, John V. 1985. The Wildlife Gardener. Alfred A. Knopf. New York, 293 pp.

Diekelmann, J. and C. 1982. Natural Landscaping. Designing with native plant communities. McGraw Hill. New York. 276 pp.

Gill, J. D. and W. M. Healy. 1974. Shrubs and Vines for Northeastern Wildlife. NE Forest Expt. Station. Upper Darby, PA 180 pp.

Henderson, Carol L 1987. Landscaping for Wildlife. Minnesota Department of Natural Resources. St. Paul. 145 pp.

McKinley, Michael. 1983. How to Attract Birds. Ortho books. San Francisco. 96 pp.

Martin, A. C., H. S. Zim and A. L. Nelson. 1961. American Wildlife and Plants. A Guide to wildlife and plants. Dover ed. New York. 500 pp.

Smyser, Carol A. 1982. Nature's Design. Rodale Press. Emmaus, PA. 390 pp.

Stokes, Donald W. 1989. The Natural History of Wild Shrubs and Vines. The Globe Pequot Press. Chester, Conn. 246 pp.

Terres, John K. 1987. Songbirds in Your Garden. Harper and Row Publ. New York. 306 pp.

Produced by the U.S. Fish and Wildlife Service

Purdue University
Forestry and Natural Resources

FNR-246-W

EXPERT REVIEWED

Size Does Matter–Nest Boxes for Wildlife

Brian J. MacGowan, and Brian K. Miller, Extension Wildlife Specialists
Department of Forestry and Natural Resources
Purdue University, West Lafayette, IN 47907

Many people enjoy viewing wildlife on their property. The first step in attracting wildlife to your backyard is to provide the specific habitat elements of food, water, cover, and space that your desired wildlife species require.

Suitable cover is often one of the most limited habitat elements in backyard habitats. Over 50 wildlife species in the Midwest use cavities in live trees (den trees) or dead, standing trees (called snags) for nesting and denning cover. Unfortunately, yard management practiced by many of us does not encourage either of these critical habitat features needed by cavity nesting wildlife. New developments often lack an abundance of trees. Even when planted, many of the tree species selected for landscaping such as Bradford pear, flowering crabapple, or ash, do not favor development of natural cavities. Native hardwoods such as oak, sycamore, and beech trees readily form natural cavities, but may take many years to do so. While nest boxes are not a replacement for these species or wildlife habitat management, they are a great way to supplement natural cavities, make your backyard more attractive to cavity nesting species, and complement your landscape design at the same time.

Whether you purchase nest boxes or build them yourself, a properly maintained nest box can last for years. You can maximize their value by installing them at the proper heights and in the proper locations. They should be located near food, water, and other cover needed by your desired species. There are a few basic "rules of thumb" that will help you select and install nesting structures most beneficial for the wildlife species you wish to attract in your backyard.

Live den tree.

Size and Location Matters

Each wildlife species has specific requirements for the dimensions and location of a nest cavity. Some of these requirements overlap among species. Bookstores and the Internet contain a myriad of nesting box plans and designs for most cavity-nesting wildlife species. While the outward appearance may vary widely for these structures, the basic function of a nest box is to attract a backyard resident.

The size of the entrance hole is a major factor in determining what species can use the box and what species can be excluded from the box. This has been well documented in the Eastern bluebird. Now bluebird specialists are promoting a box design with a long, narrow slit at top rather than a round opening. These are preferred by bluebirds, but are unattractive to house sparrows.

The size of the internal cavity is arguably more important than the entrance hole diameter. Be aware of typical nest cavity dimension and placement characteristics for your target species. If you purchase or build a nest box, make sure the dimensions and entrance hole are the right size for the species you wish to attract. Recommendations for some common Indiana backyard wildlife species are listed in the following table. See the References Section for specific designs and detailed information resources.

Species	Entrance hole diameter (in)	Hole height Above Floor (in)	Floor dimensions inside box (in)	Total height of box (in)	Height above ground (ft)	Average start of nesting season	Location tips
Birds							
American kestrel	3	10-12	8 x 8 to 9 x 9	14-16	10-30	mid-March to April	Place in orchards, pastures, or relatively open areas near grassy habitats (hunting areas). Facing south or west and space at least ½ mile apart. Place 2-3" of wood chips in bottom of box.
Bluebird	1½ or 1⅛ vertical slit	6-7	4 x 4	11-12	3-6	March to early-April	Face north or east, spaced 100 yards apart in open fields, orchards, and meadows.
Chickadees	1⅛	6-7	4 x 4 to 5 x 5	9-12	5-15	late-April to early-May	In hardwood forests, woodlots, or yards with mature trees; need 40-60% sunlight on box; one box per 10 acres. Place 1" of sawdust on nest box floor.
House wren	1⅛	6-7	4 x 4 to 5 x 5	9-12	5-10	late-April to May	Locate under an eave of a building or in a tree. Can be free hanging.
Carolina wren	1½	6-7	4 x 4 to 5 x 5	9-12	5-10	mid-March to April	In mature hardwood forests, forest edges, yards with mature trees.
Tree swallow	1⅜	6-7	4 x 4 to 5 x 5	9-12	4	late-April to May	In open fields near water, marshes, meadows, wooded swamps; on a post in open areas near tree or fence, 30-100 feet apart; face entrance hole eastward.

Species	Entrance hole diameter (in)	Hole height Above Floor (in)	Floor dimensions inside box (in)	Total height of box (in)	Height above ground (ft)	Average start of nesting season	Location tips
Wood duck	4 wide x 3 tall	18	7 x 8	24-26	>20 for trees >3 feet above high water mark for posts in water	late-April to early-May	In forested wetlands or near marshes, swamps, and ponds; place in deciduous trees, 30-100 feet from the nearest water; place 4" of wood shavings in box bottom.
Purple martin	2⅛	1	6 x 6	6	8-20	late-April to May	In open areas at least 40ft from trees near utility wires and open water; paint white.
Screech owl	2½ - 4	10-12	6 x 6 to 8 x 8	15-18	10-30	late-March to April (will use year round)	Edge of mature hardwood forest; wooded parks or stream edges. Place 2-3" of wood chips in box bottom.
Mourning dove	Shallow cones or nest baskets	-	12	-	6-16	February to March	In moderate shade in the crotch of a horizontal tree limb.
American robin	On shelves	-	7 x 7 to 8 x 8	-	6-10	late-April to May	In sheltered sites under eaves or soffits, or on tree trunks.
Mammals							
Bats	1 (between dividers)	-	Variable	Variable	12-15	Early April	Attach to tree trunk, side of building, post. Face east on sites protected from the wind.
Southern flying squirrel	1¼	6	4 x 4 to 5 x 5	9-12	10-30	February to March (will use year round)	In heavily wooded sites. Locate hole on side of house close to tree trunk.
Gray and fox squirrel	3 (located on the side, 2½" from tree)	10-12	8 x 8 to 9 x 9	14-16	>15		Locate in woodlots, backyards with mature trees in trees > 10" diameter. Face east or south and fill half full of dry leaves.
Red (pine) squirrel	2½ - 4	10-12	6 x 6 to 8 x 8	15-18	10-30		Locate in coniferous woods or yards with conifer trees.

Data for table adapted from Mumford and Keller (1984), Henderson (1992), and Cornell Lab of Ornithology (http://birds.cornell.edu).

Once basic cavity dimensions are met, you need to choose a location based on the requirements of your target species. Review recommended locations in the table above and the resources at the end of the publication. Ask yourself these questions.

- Is it at the height the animal feels comfortable?
- Is the cavity protected from predators?
- Does the nest structure get the proper amount of sun or shade to provide comfortable temperatures?
- Is the nest structure near required food, water, and escape cover?

Choosing and placing nest structures that favorably meet these criteria will increase their use. Arrangement can also be important. Purple martins need their boxes clustered into groups. Apartment houses or groups of gourd nests work well for purple martins.

Basic Design Tips

Follow these basic design tips, maintenance suggestions, and predator reduction advice to make your nest structures more useful to your backyard visitors.

- Use quality materials that are weather resistant. Exterior grade plywood and lumber are good choices. Cedar and other rot-resistant woods are best. Avoid using treated lumber and metal.
- Avoid painting or staining inside nest boxes. Painting the outside can prolong its life and may be attractive for some species (white for purple martins, for example).
- The roof should be sloped to allow water runoff and should hang over the sides.
- Drill at least four 3/8-inch drainage holes on the floor.
- The roof or one side should open to allow easy access for cleaning.
- Avoid perches. Natural cavities don't have them and neither should your nest box. Perches also allow European starlings and English house sparrows, non-native invasive species, to harass native cavity-nesters and take over a nest box.
- Near the top of each side, leave gaps or drill 5/8 inch holes (at least 2 per side)
- Erect your nest box well before the average start of the nesting season. Some species will set up their nesting territory 3 to 4 weeks prior to egg laying.

Maintenance

After the nesting season, clean out the old nesting materials. While there are some species that like to build a new nest on top of old nests, most experts agree that cleaning out boxes is the best practice. This will minimize parasite infestations and will make the box less attractive for deer mice which can exclude birds the following spring. If unexpected residents occupy a nest box, you may need to erect additional houses. Nest boxes for year round residents, such as screech owls, gray squirrel, and fox squirrel may be used throughout the winter.

Bluebird box.

Problem Species

Monitor your nest boxes for use by house sparrows and European starlings. Competition by these species has been a leading factor in the decline of eastern bluebirds. Proper entrance hole diameter will exclude starlings (1.5 inches or less) and house sparrows (1.25 inches or less) from nest boxes. If you find a starling or house sparrow in your nest box, remove the nest and all of its contents so the house is available for your target species. However, this is just a temporary solution since they will simply rebuild their nest, although persistence may produce results. House sparrows have abandoned a site after repeated (3-4 times) destruction of their nests. You may also close the box entrance until the expected arrival time of your target species, although this would not work for year-round residents. Trapping and humanely dispatching starlings and house sparrows is another method of reducing nest box competition.

WARNING! House sparrows and European starlings are exotic species to North America. They are not protected by law and can be legally trapped or killed using safe and approved methods. Most other species are protected by federal and state laws so be sure you properly identify your visitor before taking action. Boxes for some species may be utilized by native species other than your target species. For more information on laws and regulations protecting Indiana wildlife, see *Animal Damage Management – Rules and Regulations in Indiana* listed in the reference section.

Predation by raccoons and house cats are serious problems in most areas of Indiana. Many nest box designs have predator guards that prevent nest predators from enlarging the entrance hole or from reaching into the box. For additional protection, install structures that prevent predators from climbing to the nest box. Generally, nest boxes on trees are easier targets than those mounted on poles. Using a cone or metal band can inhibit cats and raccoons from ascending trees or poles. When mounting inverted cones or other predator guards, locate them high enough on the pole or tree so predators can't jump over them.

When placing a predator guard on a tree or pole, look around. If a predator can gain access to the nest box from adjacent trees or buildings, you will have to prevent access to all of them or select an appropriate location that is easier to prevent predator access.

Last, But Not Least

One of the best reasons to put up a nest box is for you. Place it in an area that is easily viewed from an area you spend some quiet time like a reading area, the chair you sit in when enjoying your morning cup of coffee, or a screened porch or deck. Then, sit back and enjoy the show!

Acknowledgements

The authors would like to thank J. B. Dunning, Jr. and J. Castrale for providing many helpful comments that contributed greatly to this publication.

Tree squirrel.

References

Barquest, G, S. Craven, and R. Ellarson. *Shelves, Houses and Feeders for Birds and Mammals*, North Central Regional Extension Publication, No.338 <www.agriculture.purdue.edu/fnr/wildlife//PDFfiles/NCR338.pdf>

Henderson, C. L. 1992. *Woodworking for Wildlife: Homes for Birds and Mammals,*2nd ed., St. Paul, Minnesota, Minnesota Department of Natural Resources, Section of Wildlife, Nongame Wildlife Program. <www.dnr.state.mn.us/publications/books/index.html>

MacGowan, B.J., J. Loven, and F. Whitford. 2000. *Animal damage management – rules and regulations in Indiana*. Department of Forestry and Natural Resources, Purdue University, FNR-FAQ-16W. <www.fnr.purdue.edu/PubsOnLine/Faq16w.PDF>

Mumford, R. E. and C. E. Keller. 1984. *Birds of Indiana*. Indiana University Press, Bloomington, Indiana, 400 pages.

Cornell Lab of Ornithology Bird House Network <http://birds.cornell.edu/birdhouse/>

Purdue Extension
Knowledge to Go
1-888-EXT-INFO

5/04

Purdue University
Forestry and Natural Resources

FNR-249-W

EXPERT REVIEWED

Attracting Hummingbirds to Your Yard

Brian K. Miller and Brian J. MacGowan, Extension Wildlife Specialists
Department of Forestry and Natural Resources
Purdue University, West Lafayette, IN 47907

Hummingbirds are a popular attraction in any backyard. The ruby-throated hummingbird is the only species of hummingbird that nests in the Hoosier state. These colorful visitors are migratory and arrive from their wintering grounds around mid-April. Ruby-throated hummingbirds remain throughout the summer and can begin fall migration as early as late-July. Migrating ruby-throated hummingbirds can be observed in Indiana throughout the fall. It is possible to observe migrating hummingbirds at your feeder from late-July through October and occasionally later. In fact, during late autumn, rufous hummingbirds can be observed at feeders in Indiana. Some believe it is only a matter of time that other western species such as the black-chinned hummingbird are found in the state.

Ruby-throated hummingbird.

Ruby-throated hummingbirds have a few simple habitat requirements that can be easily met in most neighborhoods and backyard habitats. Hummingbirds need an ample supply of insects and nectar for food. Trees are required for nesting, resting, and escape cover. Landscapes that provide a mixture of mature hardwood forests with meadows, gardens, wetlands, shrub patches, and riparian areas provide ideal habitat conditions for the ruby-throated hummingbird. This mixture of habitat components describes many subdivisions and residential and rural areas throughout Indiana. Following a few of the tips described below can make your yard and neighborhood even more attractive for hummingbirds this summer.

Food – Insects

Meeting the food requirements of the ruby-throated hummingbird is the greatest secret to attracting them. Despite common belief, hummingbirds are not strictly nectar feeders. Insects and other invertebrates are the primary source of protein for adult hummingbirds and their young. An adult female can consume up to 2,000 insects per day. Small invertebrates including mosquitoes, gnats, small bees, fruit flies, spiders, caterpillars, aphids, and insect eggs make up a portion of the hummingbird's diet.

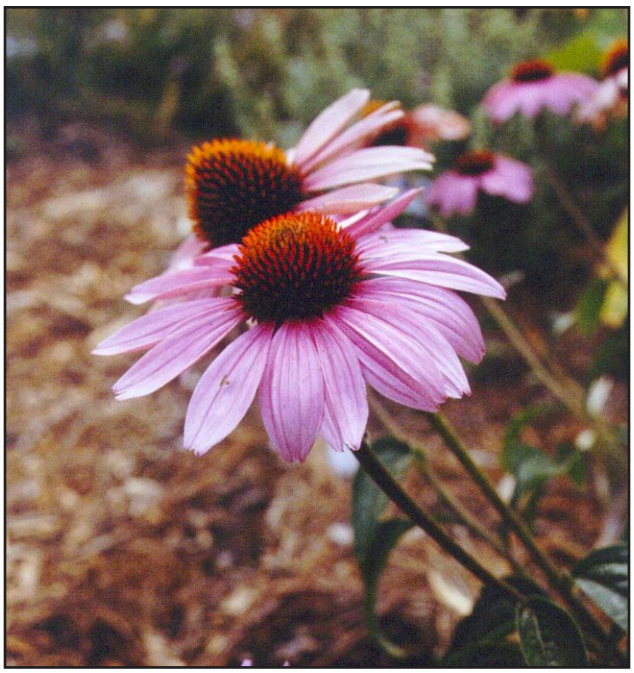
In natural settings, insects are attracted to "weedy patches" that have a mixture of taller grasses and forbs (non-woody, broadleaf plants). Some wildflower garden designs provide the required structure for ample insect populations, but naturalized areas containing a rich mixture

of native forbs and grasses are excellent insect habitats. Hummingbirds will forage for insects in naturalized areas, but will also search rock walls, bricks, cliffs, and other structures for insects, often stealing small insects from spider webs.

If you live in rural areas or if your yard is more secluded, simply tilling small areas in the spring and leaving them fallow for 3-5 years is one simple low cost approach to developing these "weedy patches" for insects. Leaving borders or selected areas of lawn un-mowed is another cost effective way to provide insect habitat for hummingbirds. However, local ordinances and weed laws in some neighborhoods may preclude such practices. Check your local codes and ordinances prior to initiating these practices.

For backyard landscaping, it is critical to present these naturalized areas in a manner that is pleasing to you and your neighbor. Integrate them with other landscape features so they don't stand out. Naturalized areas can be made more attractive and acceptable to neighbors by giving them some limits and defining their boundaries. Mow definite borders around them, pave a path through them, place a small segment of fence in front of them, or plant a few brightly colored flowers around their borders. Applying a few of these suggested practices will enhance the aesthetics of insect-producing areas in your backyard.

Native wildflower gardens and flowering trees and shrubs can provide abundant insects. These areas can be attractive additions to any yard and provide the needed structure insects require. The recommended practices above can be used to demarcate definite boundaries around flower beds. Species such as purple coneflower (*Echinacea purpurea*) or bee balm (*Monarda didyma*) attract insects and can visually enhance any garden. Careful selection of additional flower species (discussed below) will not only help to attract insects for hummingbirds, but can also provide nectar for both hummingbirds and butterflies.



Purple coneflower.

Food – Nectar

Hummingbirds have a very high metabolism. They can fly about 27 miles per hour and their wings beat 53 times per second. It takes a lot of high-energy food to support this level of activity. A hummingbird must eat its own body weight (about 3 grams) in nectar every day. Hummingbirds feed throughout the day at 5-minute to 1-hour intervals.

Nectar, an essential part of the hummingbird's diet, is obtained from one of two sources: flowers or nectar feeders. Flowers planted in your gardens and around your yard provide a valuable source of nectar for hummingbirds.

About 150 species of plants are pollinated by hummingbirds rather than bees. Flower color and structure in these species are less attractive to bees and other pollen feeding insects. Red is one color that bees do not see as well; therefore, many of the flowers that are pollinated by hummingbirds tend to be red. Flowers designed to favor hummingbirds usually don't offer perching platforms like many other flowers. These flowers often point downward and have long corolla tubes that exclude most insects.

By selecting a mixture of flower and shrub species that have overlapping blooming seasons you will provide an available nectar source to hummingbirds visiting your yard throughout the growing season. Extensive lists of plants for hummingbirds are available in several of the publications listed in the References section. The following species are provided as a guide to getting started.

Trees

The Ohio buckeye (*Aesculus glabra*) is a native tree with flowers that provide nectar for hummingbirds. Other nectar trees include horsechestnut (*Aesculus hippocastanum*) and tulip poplar (*Liriodendron tulipifera*).

Shrubs

Common shrub species providing nectar for hummingbirds include rhododendrons (*Rhododendron* spp.), deciduous azaleas (*Rhododendron* spp.), rose mallow (*Hibiscus moscheustos*), and pepperbush (*Clethra* spp.).

Perennials

Copper or red iris (*Iris fulva*), columbine (*Aquilegia canadensis*), phlox (*Phlox* spp.), beardtongue (*Penstemon* spp.), red morning glory (*Ipomoea coccinea*), bee-balm, bergamot (*Monarda* spp.), lilies (*Lilium* spp.), cardinal flower (*Lobelia cardinalis*), fire-pink (*Silene virginica*) , skullcap (*Scutellaria* spp.), foxglove (*Agalinas* spp.), gayfeather (*Liatris* spp.), royal catchfly (*Silene regia*), and scarlet sage (*Salvia splendens*) are perennials that will add beauty to your gardens and will ensure that some nectar is being provided throughout the growing season.

Royal catchfly.

Annuals

Annual flower species most attractive to hummingbirds include: pinks (*Dianthus* spp.), zinnia (*Zinnia elegans*), snapdragons (*Antirrhinum* spp.), Mexican sunflowers (*Tithonia* spp.), scarlet sage (*Salvia coccinea*), flowering tobacco (*Nicotania* spp.), and jewelweed (*Impatiens capensis*).

Vines

Adding some native vines like trumpet creeper (*Campis radicans*), coral or trumpet honeysuckle (*Lonicera sempivirens*), crossvine (*Bignonia capreolata*), or passionflower (*Passiflora* spp.) on trellises around garden edges or yard borders can also provide a source of nectar for hummingbirds.

Trumpet creeper.

Feeders

Nectar can also be made available by providing artificial feeders. Feeders can provide the nectar equivalent of 2,000-5,000 flowers. Nectar feeders also provide a common focal point in your yard where these colorful visitors can be readily observed throughout the day. Feeders provide a steady and valuable food source in early spring when most flowers are not yet in bloom. This food availability is

important in providing energy for hummingbirds that are preparing to reproduce. In addition, they can supplement natural sources of nectar throughout the summer and fall when plants in flower gardens are between flowering stages. In the fall, feeders are important in helping hummingbirds gain weight for the long migration. Prior to migration, hummingbirds will "balloon" from their normal 0.1-0.12 ounces to 0.19-0.22 ounces. This additional .07 ounces will sustain them for their non-stop trans-gulf migration of 18-22 hours.

When selecting a nectar feeder for your yard, look for feeders that are easy to disassemble and clean. Red feeders will more effectively attract hummingbirds, but are less attractive to insects. The wasp and hornet guards (honey bees seldom, if ever, come to feeders) on the feeder should be red (not yellow).

Selecting the proper site for your feeder is also an important consideration. Look for a shady area that is open enough to allow hummingbirds to freely fly around the feeder. The shade cools the nectar and delays spoiling on hot summer days.

Photo by Chip Morrison

Make sure the insect guards are red (not yellow).

Remember that hummingbirds are territorial. One dominant male can keep other males away from "his" feeder. As a result, you will attract a larger number of hummingbirds by providing multiple feeders. Feeders should be spaced 10-15 feet apart. When you see more than four birds using a single feeder, or when you see a male chasing off other males, add another feeder. As you keep adding feeders, you may be surprised at the number of hummingbirds you attract.

Hummingbirds need to rest between feedings. Locate your feeders near trees or perching areas so they don't have to move long distances between feeding and resting locations. Nearby perches also give them a place to wait their turn.

Ripe fruit next to feeders increases its attractiveness and also attracts gnats and other insects eaten by the hummingbirds.

If you do not have a large number of hummingbirds that drain your feeders regularly, change the nectar every 3-4 days. This will ensure that the nectar doesn't ferment or become rancid, cloudy, or moldy. Feeders should be cleaned every week or so with soap and water, rinsed with vinegar, and finally rinsed thoroughly with water. This will help keep your birds healthy. If ants become a problem on your feeder, water filled ant guards can be installed to keep ants out. Don't use insecticides; they may be harmful to hummingbirds.

Nectar solution for hummingbirds can be made by simply mixing four parts water to one part sugar. Boil the solution for 2 minutes to slow fermentation. Do not microwave the solution because it can cause a breakdown in the sugar molecule, thus changing its nutritional value. The mixture can be refrigerated until needed to replenish feeders. Sugar water is a perfectly acceptable if the feeder has a lot of red on it. Don't add honey, artificial sweeteners, or food coloring to the mixture. These items may pose some health problems for the hummingbirds.

Photo by Chip Morrison

Leave the feeder up as long as birds are coming to it in the fall. This will not stop or delay their migration. Leaving feeders up through October will make them available to other migrant ruby-throated hummingbirds passing through even after "your" resident hummingbirds have left. By leaving a feeder up later in the fall, you might attract another species of hummingbird that has been visiting Indiana the past few years. Two of the *Selasphorus* species of hummingbirds (Rufous and Allen's) have been seen at various locations in Indiana over the past several years.

Other Habitat Components

Ruby-throated hummingbirds are primarily a woodland species and require some woodland component nearby to fulfill their habitat requirements. Trees are used for resting and for nesting cover. Landscapes that have some patches of woodlands or mature hardwood trees interspersed with yards, gardens and meadows provides the additional food source of insects and nectar hummingbirds require. Wetlands, ponds, and streams, can enhance hummingbird habitat due to the greater insect abundance in some of these areas.

Ruby-throated hummingbird nests are usually located 10-20 feet above the ground in deciduous trees on small horizontal branches. They prefer isolated or undisturbed forest areas for nesting. Hummingbirds will return to the same nest each year and will rebuild if necessary. Nests are made with down from dandelion, thistle, and milkweed, and portions of ferns, mosses, and young leaves. These materials are attached to the limb with several yards of sticky spider webs and droplets of tree sap. The nest is camouflaged with lichens usually found in the nest tree or surrounding trees. Some of these nest materials can be provided in your flower beds and surrounding yard plantings.

Predators

Like most small birds, hummingbirds have their share of predators including the praying mantis, snakes, blue jays, crows (nest predators) and occasionally toads and frogs. The number one predator of hummingbirds is probably the domestic cat. By providing food at a centralized location such as flowerbeds and feeders, we often make it easy for cats to kill hummingbirds. Cats should never be allowed to roam freely, as they kill many species of wildlife including birds, amphibians, small reptiles, and mammals.

Photo by Chip Morrison

Add additional feeders if overcrowding becomes an issue.

References

Barnes T.G., 2000. *Hummingbirds: An Attractive Asset to Your Garden.* University of Kentucky, Cooperative Extension Service, FOR-97.
www.ca.uky.edu/agc/pubs/for/for97/for97.htm

Gardening for Hummingbirds and Butterflies. Land Between the Lakes, Golden Pond, Kentucky.
www.lbl.org

Sargent, R. 1999. *Ruby-throated Hummingbird.* Stackpole Books, Mechanicsburg, Pennsylvania.

USDA Natural Resource Conservation Service. 1999. Ruby-throated Hummingbird (*Archilochus colubris*). Wildlife Habitat Management Fact Sheet, No.1. Wildlife Habitat Management Institute, Madison, Mississippi.
www.whmi.nrcs.usda.gov/technical/leaflet.htm

Additional Resources

Williamson, S. 2002. A field guide to hummingbirds of North America. Houghton Mifflin Co.

Cornell Lab of Ornithology http://birds.cornell.edu

National Plants Database http://plants.usda.gov

Purdue Extension
Knowledge to Go
1-888-EXT-INFO

5/04

Revised August 2004

Eastern Cottontail Rabbit

(Silvilagus floridanus)

The Eastern Cottontail rabbit is one of the most popular game animals in the country. It is found in many parts of the United States, and in parts of the Northeast and Midwest, it is the number one game species.

Interest in managing rabbits, which changes with the number of hunters and rabbit-dog trials, has generally been high in the Southeast. Although hunter numbers and rabbit harvests in Mississippi have declined over the last decade, around 60,000 rabbit hunters have harvested about one-half million rabbits annually over the past few years.

Populations

Late winter populations are mainly rabbits born the previous summer. About 20 percent are 2 years old, and about 8 percent are 3 years and older. The chance that wild rabbits will live to be 4 years old is slight.

Predators such as bobcats, foxes, hawks, and owls are probably the rabbit's worst enemies. Other population controls include bad weather and disease. Hunter harvest removes animals that would normally be taken by predators or some other deadly factor.

Many forces work against the rabbit, but populations are strong. Although rabbit populations are often greatly reduced, rabbits can reproduce prolifically. This lets populations build rapidly when you provide the right food and cover.

Nesting

During the February-September reproductive season, rabbits produce an average of four young per nest, though the number in a nest may range from one to more than seven. Female rabbits dig cup-shaped holes in which to bear young.

Nests have been found in diverse locations from open ground under tall pines to corners of lawns, with the only hiding thing being soft grass and fur from the mother's breast. Generally, however, rabbits prefer to nest along the edges of fields, ditch banks, and other areas of low cover where the nest is hidden, while the mother feeds and rests nearby. She returns to the nest only to nurse her young, usually in early morning and late afternoon.

Young rabbits begin to make short trips from the nest when they are about 10 days old. When they are about 2 weeks old, they leave the nest for good.

Range

Cottontails seldom range more than one-half mile and usually spend their lives on 10 acres or less.

Food Habits

Rabbits eat most plants and eat nearly anything that grows above ground. In the growing season, they eat lots of grasses, sedges, sprouts, and leaves. They also eat fruits, branch tips, buds, and bark, along with waste grain around farmed areas.

Management

The cottontail rabbit is mainly a farm animal and does best on fairly small cropland areas. Usually, grown-up fence rows, ditch banks, and turnrows on farms provide adequate cover. For the past several decades, farm sizes have increased and "clean farming" has increased, as a result of better equipment. Also, much farmland that was once suitable for cottontails has been changed to improved pasture or loblolly-pine plantations. These enterprises are important, but they do not produce

Mississippi State University Extension Service

as many rabbits as when rows were being plowed with mules.

Generally, varying habitats for cottontail rabbits is important, such as mixing cover areas with feeding areas. Good cover is probably the greatest one factor affecting rabbit populations. Cover provides areas for rabbits to escape from predators, nest, feed, and avoid bad weather. You can usually develop and maintain cover, depending on the type of landscape involved. Where natural cover is lacking, such as in large, clean agricultural fields, you can increase cover by letting natural vegetation along fencerows and ditchbanks grow up into thickets. You can also plant 15-foot-wide strips of Kobe or Korean Lespedeza.

Rabbits are helpless at birth, so it is important that you avoid bush-hogging, disking, and burning during the nesting season, particularly in areas of suitable nesting habitat. But strip disking, bush-hogging, and burning fields on a 4- to 5-year rotation can increase food production and woody winter cover. You can break up thick broom sedge fields of several acres by planting evergreens, and around field edges and in the forest, fell trees to the ground carefully, leaving trees attached at the stumps and still alive.

With forestland areas, it is important to keep stands open, so you can keep early successional stages at ground level. Young pine plantations provide excellent cover, and later on, burning these stands can produce excellent quality forage.

Keeping different ages of various timber stands, mixed with open fields, areas of thick cover, and succulent green forage helps produce more woodland rabbits.

In winter, rabbits eat oats, winter wheat, clovers, and other green foods planted next to ground cover. These plantings reduce the distances rabbits have to move to find food and reduce predation.

General Tips for Improving Rabbit Habitat

- Create small stands (10 to 20 acres) close to fields, swamps, and streams.
- Thin pine stands frequently (3 to 5 years) to stimulate understory growth.
- Use prescribed burning in pine types in winter.
- Control predators where trapping and game laws allow.
- Keep pets (cats and dogs) confined, especially during nesting.

Revised by **Dr. Ben West**, Extension Assistant Professor, Wildlife and Fisheries.

Information Sheet 624
Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. JOE H. MCGILBERRY, Director
(POD-01-05)

USDA NRCS Natural Resources Conservation Service
Wildlife Habitat Management Institute

WILDLIFE HABITAT COUNCIL℠

Eastern Cottontail

(Sylvilagus floridanus)

June 1999 *Fish and Wildlife Habitat Management Leaflet* *Number 4*

Hal S. Korber

General Information

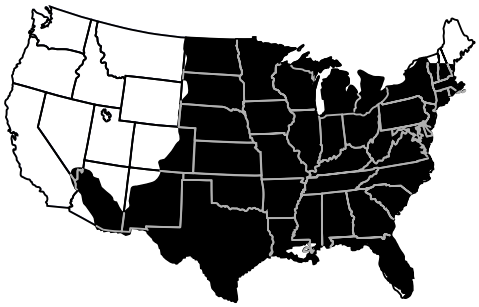
The eastern cottontail has long been a common inhabitant of backyards and open farmlands throughout the eastern and mid-western United States. This rabbit's elusive nature and palatability have made it a popular small game mammal as well. The presence of cottontails in rural settings has come to symbolize healthy plant and wildlife communities throughout its range. The cottontail's genus name, *Sylvilagus*, combines the Latin word *silva*, meaning "forest," and the Greek word *lagos*, meaning "hare," as the rabbit historically inhabited swamps and hardwood and boreal forests. However, because the eastern cottontail has the ability to reproduce prolifically, it has adapted over time to inhabit the open, grassy habitat where it is most commonly found today. A non-social animal, the cottontail is mostly nocturnal but can commonly be seen foraging alone in the periods between sunset and dark and in the early morning before sunrise. Cottontails frequently emerge after summer rain showers to feed on lush vegetation.

Although abundant in some locations, the eastern cottontail is sensitive to change in habitat composition. This has caused significant rabbit population declines in parts of its range. The clearing of fence rows, hedgerows, and grassy buffers along woodland edges and field borders, as well as habitat loss to urban development, has had a significant effect on eastern cottontail populations. The cottontail's presence and success in an area is largely dependent upon the availability of dense cover and old field habitat.

This pamphlet is designed to serve as an introduction to the habitat requirements of the eastern cottontail and to assist land managers in the development of a comprehensive cottontail management plan. The success of any individual species management plan depends on targeting the specific needs of the desired species and analyzing the designated habitat area as a whole to ensure that all required habitat elements are present. This leaflet also provides monitoring guidelines to document success and to identify additional management actions needed over time.

Range

The range of the eastern cottontail spans from southern Canada south to Central America. Within the United States, the cottontail is an eastern, central, and southwestern species—primarily found in the eastern two-thirds of the United States with the exception of Maine, a majority of New Hampshire and Vermont, and northeastern New York. The rabbit is absent from parts of Louisiana's coastal marsh as well. The cottontail's western limits reach as far as the Rocky Mountains in the Great Plains region, New Mexico, and Arizona.



United States Distribution

Habitat Requirements

General

The eastern cottontail prefers dense vegetation growing as edge between woody vegetation and open grasslands. Dense grasses and forbs growing along open fields, meadows, orchards, farmlands, fence rows, stands of deciduous trees, low-growing brush, shrubs, vines, windbreaks, and hedgerow thickets are preferred cottontail habitats. Open grasslands provide the rabbit with areas to forage, nest, and sun while nearby habitats of piled brush, shrubs, vines, and tangled thickets provide essential escape and resting cover, offering refuges from predators and adverse weather. Thickets are widely used for feeding and nesting as well. Cottontails will inhabit lawns and frequent vegetable gardens that contain adequate nesting and foraging cover nearby and lack the threat of predation. Adequate cover is crucial for an area to support a rabbit population, and the continued loss of nesting, escape, and resting cover remains the largest threat to the cottontail's future. Preserving brushy cover and properly managing open areas can assist landowners in boosting local eastern cottontail populations, as well as populations of other species that rely on similar habitat.

Food

The eastern cottontail's diet consists of a wide variety of green vegetation and woody plants. Spring, summer, and autumn foods consist primarily of native and introduced grasses such as orchard grass, timothy, redtop, bluegrasses, wheatgrasses, Indian ricegrass, cheatgrass brome, squirreltail, common chess, Korean lespedeza, small and common crabgrass, and common lawn grasses. White clover, wild strawberry, dandelion, sedges, and various fruits are eaten in these seasons as well. Given the opportunity, rabbits will feed on garden vegetables such as green beans, peas, lettuce, cabbage, and others. Winter food sources include woody plant items such as buds, branch tips, and bark of blackberry, raspberry, sumac, witch-hazel, apple, black cherry, oak, dogwood, maple, birch, willow, and sagebrush. Oats, winter wheat, clover, and other green foods are eaten in winter months when available. Rabbits inhabiting farmland and agricultural areas feed on rye grasses, vetch, chufa, oats, alfalfa, corn, soybeans, and various other crops and available waste grains.

Important eastern cottontail food items. The following species are known to be important food items in the diet of eastern cottontails. Those species in bold print are of particular value for their usefulness as a winter food source.

Grasses and forbs:

orchard grass	timothy	redtop	bluegrasses	wheatgrasses	Indian ricegrass	
cheatgrass	brome	squirreltail	lawn grasses	sedges	clover	
wild strawberry	dandelion	globemallow	fruits			

Woody vegetation:

tree buds branch tips

Bark of :

blackberry	raspberry	sumac	witch-hazel	apple	dogwood	oak
birch	black cherry	maple	willow	sagebrush		

Cultivated food items:

rye grasses	vetch	chufa	oats	alfalfa	corn	soybeans
winter wheat	other crops	and waste grains				

Where appropriate, these species may be used to enhance vegetation that already exists in and around open field areas and brushy cover. Adding the appropriate above species to those currently existing will enhance food availability for eastern cottontails.

Cover – Nesting

The eastern cottontail is a ground-nesting mammal, raising its young in a shallow grass and fur-lined depression, or form. Forms are dug under the cover of felled trees, shrubs, woodpiles, briar thickets, hedgerows, brush piles, and in overgrown fence rows. Tall grass and weedy patches are used as nesting habitat, as is low cover growing along field edges and ditch banks. Ideal nesting cover lies adjacent to dense grassy cover. To reduce predation, females rest and feed in nearby grass habitat during daylight hours and return to the nest at dawn and dusk to nurse the young. Nesting cover is vital to the young for protection until they are weaned and permanently leave the nest at approximately 16 to 21 days after birth. In areas lacking dense vegetation, allowing natural vegetation to grow into thickets along fence rows, ditch banks, windbreaks, and field edges can help increase nesting cover for cottontail rabbits.

Cover – Winter

Winter habitat requirements for eastern cottontails differ very little from nesting and summer cover types, as the cottontail is active year-round throughout its range. Dense grasses and other vegetation growing as edge habitat, fields, meadows, orchards, farmlands, wind breaks, and hedgerows, as well as thickets of low-growing brush, shrubs, vines, and deciduous trees provide required winter cover elements for eastern cottontails. Due to the varying temperatures between the cooler northern and eastern reaches and the warmer southern and western reaches of the cottontail's range availability of common food sources may differ, but cover requirements remain constant.

Water

Daily foraging activities and the types of foods eaten by the eastern cottontail generally provide it with an adequate amount of water.

Preserving nesting cover, Brush pile construction. – Preservation and maintenance of nesting and escape cover is an important element of cottontail habitat management. Preserving hedgerows, dense grasslands, low-growing shrub and briar thickets, field border grasslands, and brushy cover along open field habitat is essential for an area to support a rabbit population. Disturbances such as mowing, burning, or clearing of vegetation within these habitats should be kept to a minimum. Where possible, allow vegetation to grow freely and avoid mowing, burning, and chemical application during the peak nesting season (February to September). Occasional mowing, disking, and burning are beneficial management practices as they promote regeneration of succulent grasses and other preferred forage vegetation. However, such disturbance should be conducted on a rotational basis and be implemented outside the nesting season. Brush piles can also improve an area's habitat composition by providing nesting and escape cover. Brush piles are constructed by piling brush and loose branches on top of a base frame comprised of large logs or tree trunks (see fig. 1). The base is constructed by stacking logs perpendicular to and on top of one another to create a sturdy crisscross log structure with a height of 12 to 20 inches. A four-foot long piece of drainage tile can be placed under the base to enable cottontails to easily enter the pile. Tile diameter should not exceed six inches to preclude foxes and other predators from entering the pile. Cinder blocks can also be used to elevate the base up to eight inches off the ground to prevent the acceleration of weather rot and enable cottontails to enter the pile. The crown is constructed by piling loose branches on top of the base to create a tangled pile of brush. Brush piles can be constructed of various sizes according to the habitats in which they are placed. However, piles 12 to 18 feet in diameter and three to six feet in height are best in order to enable multiple individuals and species to occupy a single pile. Well constructed brush piles can have a life span of more than 10 years, and proper placement can promote use by eastern cottontails as well as many different species of songbirds, insects, and other small mammals. Placement: Brush piles should be placed along hedgerows, briar thickets, windbreaks, and within dense grasslands when additional brushy cover is nearby. Properly locating brush piles within an area is important. Improper placement of a brush pile (e.g., isolated and distant from tall grass and other forms of escape cover) can potentially create a "death trap" for cottontails and other prey species due to increased access by predators. Brush piles help to establish a balance between predator and prey species within an area, but improper placement can cause a brush pile project to be counterproductive. Lands managed for timber can benefit rabbits when slash from harvested trees is left as brush piles. Tree tops and branches assembled into windrow slash piles following harvest can provide excellent cottontail cover for several years.

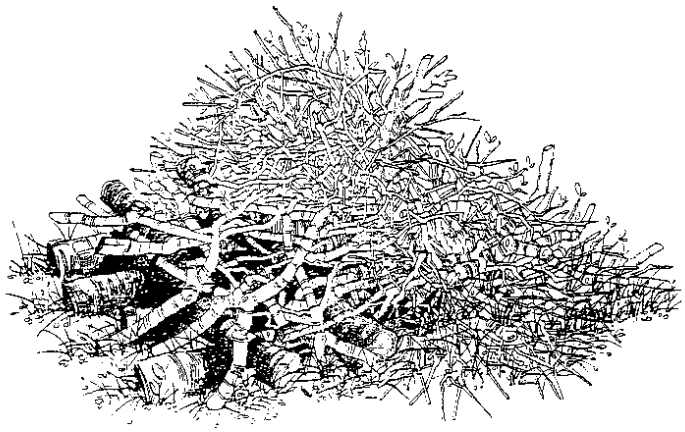
Interspersion of Habitat Components

Ideal interspersion of eastern cottontail habitat components consists of a complex of open grassy fields, meadows, orchards, and hedgerows, dense grass along field and woodland edges, briar thickets, and low-growing brushy areas. In order for successful cottontail reproduction and survival to occur, all required habitat components must be available in relative proximity to one another. Because cottontails experience high mortality each year (up to 80 percent) and therefore reproduce as many as seven times in one season, the most critical aspect of habitat interspersion, or the mix of different habitat types, is the proximity of suitable foraging habitat to nesting habitat. The highest quality nesting habitat is of little use if the nearest open foraging and resting habitat is not within close proximity. Likewise, the best foraging habitat will not support nesting cottontails if adequate brushy cover is not present.

Minimum Habitat Area

The eastern cottontail seldom travels more than a half mile in a day and usually spends its entire life on an area no larger than 10 acres in size. Although cottontails tend to display a lack of tolerance for other individuals inhabiting an immediate area, no reasonable estimate of minimum habitat size throughout its range exists. Distribution and interspersion of food and cover within an area determines whether or not the area can support a rabbit population and the number of individuals present. A small area with an abundance of edge brush and open field habitat may support a large number of cottontails, whereas a large area lacking one component or the other may have few or no rabbits. Thus, cottontails will inhabit areas of suitable habitat in numbers that individual territoriality will allow and that the area can naturally support, regardless of its size.

Figure 1 Brush pile construction



Eastern Cottontail Habitat Requirements Summary Table.

Habitat Component	Habitat Requirements
Food – Young	• Milk nursed from mother until weaned at approximately 16-21 days (weaning may not occur for up to five weeks). Forage on succulent grasses and other green and woody vegetation after weaned.
Food – Adult	• Green vegetation — orchard grass, timothy, redtop, bluegrasses, common lawn grasses, wheatgrasses, Indian ricegrass, cheatgrass brome, spuirreltail, globemallow, clover, wild strawberry, dandelion, sedges, various fruits, and garden vegetables. All are eaten in spring, summer, and autumn months. • Woody plants — buds, branch tips, and bark of blackberry, raspberry, sumac, witch-hazel, apple, black cherry, oak, dogwood, maple, willow, sagebrush, and birch. All are eaten primarily in winter months. • Cultivated crops — oats, winter wheat, ryegrasses, vetch, chufa, soybeans, corn, alfalfa, and various other crops and waste grains.
Nesting and Litter-rearing Cover	• Beneath cover of felled trees, shrubs, woodpiles, briar thickets, hedgerows, overgrown fence rows, and brush piles lying adjacent to dense grassy cover. Within tall grass, and low cover growing along field edges and ditch banks.
Winter Cover	• Dense grasses and other vegetation growing as edge habitat, fields, meadows, orchards, and hedgerows. Thickets of low-growing brush, shrubs, vines, and deciduous trees.
Water	• Water requirements for cottontails are met through daily food intake.
Interspersion	• Prefer a complex of open grassy fields, meadows, orchards, hedgerows, dense grass along field and woodland edges, briar thickets, and low-growing brushy areas.
Minimum Habitat Size	• No reasonable estimate of minimum habitat size exists for eastern cottontails. A cottontail's home range is 10 acres or less, and an individual seldom travels a total of more than a half mile in a day.

Limiting Factors

For planning purposes, use the following table to inventory the site to determine the availability of each of the basic habitat components, based on the above habitat requirement descriptions. Habitat components that are absent or rated low are limiting habitat quality for eastern cottontails.

Inventory of Limiting Factors	**Availability/Quality**			
Habitat Component	**High**	**Medium**	**Low**	**Absent**
Food				
Nesting and litter-rearing cover				
Winter cover				
Interspersion of habitat components				

Management Prescriptions

Management treatments should address the habitat components that are determined to be limiting eastern cottontail habitat potential. For planning purposes, select among the possible action items listed below to raise the quality or availability of each habitat component determined to be limiting. A list of programs that may provide financial or technical assistance to carry out specific management practices is given, when applicable.

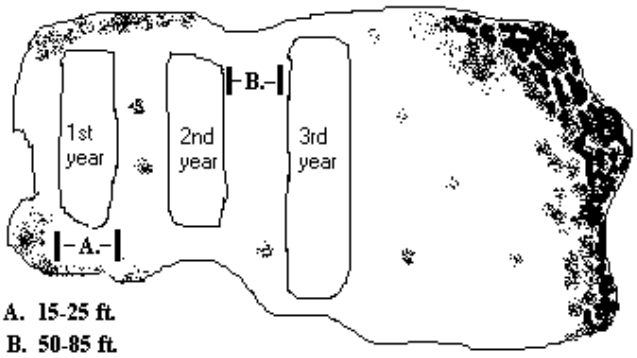
Habitat Component	**Management options for increasing habitat quality or availability**	**Assistance Programs**
Food	• Maintain grassy and open field areas by conducting rotational mowing, strip disking, and managed grazing where appropriate.	WHIP, EQIP, PFW, CRP
	• Preserve and plant, when practical, blackberry, raspberry, sumac, witch-hazel, apple, wild black cherry, oak, dogwood, maple, willow, sagebrush, and birch trees, shrubs, and vines.	N/A
	• Establish food plots such as alfalfa, wheat, corn, and other grain crops, or soybeans within 250 feet of existing rabbit resting/escape cover.	WHIP, EQIP, PFW, CRP
Nesting and young-rearing cover	• Preserve hedgerows, overgrown fencerows, dense grasslands, low-growing shrub and briar thickets, field border grasslands, and dense grass and brushy cover along open field habitat.	WHIP, EQIP, CRP
	• Construct brush piles along hedgerows, briar thickets, windbreaks, and within dense grasslands containing a brushy component.	N/A
Winter cover	• Maintain grassy and open field areas by conducting rotational mowing, strip disking, and managed grazing where appropriate.	WHIP, EQIP, PFW, CRP
	• Preserve hedgerows, grown-up fence rows, dense grasslands, low-growing shrub and briar thickets, field border grasslands, and dense grass and brushy cover along open field habitat.	WHIP, EQIP, CRP
	• Construct brush piles along hedgerows, briar thickets, windbreaks, and within dense grasslands containing a brushy component.	N/A
Interspersion of habitats	• Combine above prescriptions to increase interspersion of habitat components or amount of suitable cottontail habitat.	N/A

Landowners interested in sharing their individual efforts with the community can work with WHC and NRCS to involve school, scout, and community groups and their families in habitat projects. A cottontail management project is an easy way to provide fun, hands-on learning opportunities, especially for children. If the land is corporate owned, encourage interested employees to become involved. Involve students or scouts in building and maintaining brush piles. The educational benefits can greatly increase the value of your cottontail management project for community members and wildlife alike.

Parasites and Disease. Parasites and disease are a natural occurrence in many species of wildlife. The eastern cottontail may harbor fleas, ticks, botfly larvae, and tapeworms. However, rarely is the rabbit negatively affected by these parasites. Bacterial tularemia is recognized as occurring in cottontails more often than in any other species of wildlife. Although tularemia is transmitted primarily by tick bites, humans can become infected by contact with diseased rabbits. Lethargic rabbits should not be handled and should be avoided. Tularemia does not pose significant threat to humans when treated appropriately with antibiotics.

Grassland management – Maintaining open grassy areas is important to the nesting and foraging activities of eastern cottontails. Rotational mowing, strip disking, and controlled burning in meadows and grasslands promote new growth of important forage grasses, legumes, and forbs. Controlled burning is a highly regulated technique and should only be conducted in cooperation with fish and wildlife agencies and with assistance from licensed burners. Rotational mowing and strip disking can be conducted by landowners and maintenance contractors with beneficial results. Both practices are conducted by dividing an area into 15- to 25-foot wide strips (depending on the area's size) that are separated from one another by 50 to 85 feet (see fig. 2). A single strip is mown to a height of four to six inches, or disked to a depth of six to eight inches, twice a year. Smaller areas can be divided into three strips; mow or disk one strip in early spring (mid-March to mid-April, depending on the region) before grassland nesting birds and mammals commence nesting activities, and again in late fall after nesting activities are completed. The following year, the second strip would be mowed or disked in the same months. The third strip would be mowed or disked in year three, and the process begins again in year four. Larger areas evenly divided into six or more strips can be rotationally disked or mown in pairs, so that strip one is worked with strip three, strip two with strip four, strip three with strip six, and so forth. Managing a grassland in this manner produces vegetation growing at various ages, providing resident cottontails with nesting, foraging, and resting cover.

Figure 2 Rotational mowing and strip disking regime.



Programs that provide technical and financial assistance to develop fish and wildlife habitat on private lands.

Program	Land Eligibility	Type of Assistance	Contact
Conservation Reserve Program (CRP)	Highly erodible land, wetland, and certain other lands with cropping history. Stream-side areas in pasture land	50% cost-share for establishing permanent cover and conservation practices, and annual rental payments for land enrolled in 10- to 15-year contracts. Additional financial incentives are available for some practices	NRCS or FSA state or local office
Environmental Quality Incentives Program (EQIP)	Cropland, range, grazing land and other agricultural land in need of treatment	Up to 75% cost-share for conservation practices in accordance with 5- to 10-year contracts. Incentive payments for certain management practices	NRCS state or local office
Partners for Fish and Wildlife Program (PFW)	Most degraded fish and/or wildlife habitat	Up to 100% financial and technical assistance to restore wildlife habitat under minimum 10-year cooperative agreements	Local office of the U.S. Fish and Wildlife Service
Waterways for Wildlife	Private land	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals	Wildlife Habitat Council (301-588-8994)
Wildlife at Work	Corporate land	Technical assistance on developing habitat projects into a program that will allow companies to involve employees and the community	Wildlife Habitat Council (301-588-8994)
Wildlife Habitat Incentives Program (WHIP)	High-priority fish and wildlife habitats	Up to 75% cost-share for conservation practices under 5- to 10-year contracts	NRCS state or local office
State fish and wildlife agencies and private groups may have assistance programs or other useful tools in your state.			State or local contacts

References

Bookhout, T.A. 1996. Research and management techniques for wildlife and habitats. The Wildlife Society. Allen Press, Inc., Lawrence, KS. 740 pp.

Burt, W.B., and R.P. Grossenheider. 1980. Mammals. Houghton Mifflin Company, New York, New York. 289 pp.

Merritt, J.F. 1987. Guide to the Mammals of Pennsylvania. University of Pittsburgh Press, Pittsburgh, PA. 408 pp.

Merritt, J.F. 1987. photograph. Guide to the Mammals of Pennsylvania. University of Pittsburgh Press, Pittsburgh, PA. 408 pp.

Mississippi State University Extension Service, 1998, Eastern Cottontail Rabbit, *in* http://www.ext.msstate.edu/pubs/is624.htm.

Ohio State University Extension, 1998, Controlling Rabbits in the Landscape, *in* http://www.ag.ohio-state.edu/~ohioline/hyg-fact/1000/1031.html.

University of Michigan – Museum of Zoology, 1996, Sylvilagus Floridanus, *in* http://www.oit.itd.umich.edu/bio/doc.cgi/Chordata/Mammalia/Lagomorpha/Leporidae/Sylvilagus_floridanus.ftl.

Wasowski, A., and S. Wasowski. 1988. photograph. Native Texas Plants. Texas Monthly Press, Austin, TX. 406 pp.

NRCS
Wildlife Habitat Management Institute
100 Webster Circle, Suite 3
Madison, MS 39110
(601) 607-3131

In cooperation with partners, the mission of the Wildlife Habitat Management Institute is to develop and disseminate scientifically based technical materials that will assist NRCS field staffs and others to promote conservation stewardship of fish and wildlife and deliver sound habitat management principles and practices to America's land users.

www.ms.nrcs.usda.gov/whmi

Wildlife
Habitat Council
1010 Wayne Avenue, Suite 920
Silver Spring, MD 20910
(301) 588-8994

The Wildlife Habitat Council's mission is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, non-profit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.

www.wildlifehc.org

PRIVATE LAND PARTNERSHIPS
WORKING TOGETHER FOR WILDLIFE

SQUIRRELS

Squirrels are wonderful subjects for nature study, photography, wildlife observation, and a favorite pursuit of small game hunters. They also inadvertently help plant forests because the nuts they bury in fall often sprout into seedlings the following spring. There are six species of squirrels in Michigan. The red and eastern gray squirrels can be found in both Michigan Peninsulas, whereas the southern flying, and eastern fox reside only in the Lower Peninsula. Lastly, the northern flying squirrel can found in the northern Lower Peninsula and entire Upper Peninsula. These squirrel species have a variety of habitats and are important parts of our natural heritage. However, this chapter will focus mainly on gray and fox squirrels.

Profiles of the Species

The **eastern gray squirrel** occupies most of eastern North America within mature mixed hard wood and conifer forests and was abundant in Michigan when the first settlers arrived. The gray squirrel has an overall silvery gray body, a generally white belly, and tail hairs that are white-tipped. Grays are eight to 10 inches long (minus the tail) and weigh up to one and a half pounds. Black squirrels are simply melanistic phases of the gray squirrels. The two commonly interbreed and litters may contain both color types. The gray squirrel lives most of its life in and around a single nest tree moving no more than 300 yards in a season and is the least social of all tree squirrels.

At one and a half to two and a half pounds, the **fox squirrel** is heavier than the gray and is also longer at 10 to 15 inches (minus the tail). The fox has a buff- to orange-colored belly, a back of tawny brown, and a long plumed tail of black-brown with rust-tipped guard hairs. Fox squirrels prefer small woodlots of mature trees throughout the Lower Peninsula. Before 1850, the fox squirrel was concentrated around grassland openings in oak forests of southwest Lower Michigan. As the forests were cleared for agriculture and timber, fox squirrels used fence rows as travel routes to expand their range. By 1925 the species was found throughout the Lower Peninsula.

Although both species eat the nuts and fruit of many trees and shrubs, rarely do fox and gray squirrels share the same habitat. Grays like dense stands of timber and will frequent river bottoms of sycamore, swamp white oak, black maple, pin oak, ironwood, and elm. Fox squirrels prefer farm country and are attracted to woodlands next to farm fields. Because of their habitat preferences, they are found in different parts of the state. Today, seventy percent of Michigan's fox squirrels live in the southern Lower Peninsula. By contrast, gray squirrels mainly live in the northern Lower Peninsula. Those that reside in southern Lower Michigan customarily do so in city parks and suburbs with mature trees.

The **red squirrel** lives throughout the state. This small species prefers a forest of conifers or conifers mixed with hardwoods, where it can find both hardwood mast (nuts) and pine seeds.

Few people have seen a **flying squirrel** because they are active only at night. Both northern and southern flying squirrels are found

Flying Squirrel

in Michigan. They are more common than many people think, especially in southern Michigan, and can be attracted to bird feeders placed in woodlots.

The northern flying squirrel thrives in heavily wooded areas containing mixed conifers and northern hardwoods having mature growth. The southern flying squirrel requires trees that produce fruit or nuts.

Life History

The life histories that follow are for fox and gray squirrels, which may live out their lives on only five to 10 acres of habitat if their needs are met. The management prescriptions below are keyed to these two species although red squirrels and flying squirrels may also benefit.

These squirrels mate from January to March and again from June to July, and the gestation period is 44 days. Females, two years of age and older, may bear two litters each year. Males begin to reproduce at 18 months old. In a typical year, about 60 percent of the fall population will be young that were born that year.

Litter size and frequency depend on available food supplies -- the less food, the fewer and smaller the litter. A typical litter contains three or four offspring. Nesting dens are found in tree cavities, which the female lines with feathers, moss, shredded bark, and other soft plant materials.

The young are born hairless with closed eyes and ears. Hair begins to grow on their back in about one week and the eyes open at 35 days. At about two months old, the young may begin exploring outside the den. At this time if the weather is warm, the female may build a leaf nest high in the tree canopy among forked branches. At three months of age, young squirrels can survive on their own, and at 18 weeks they begin building their own leaf nests. These circular leaf nests are compact and waterproof and may be built in both leaf-bearing and evergreen trees.

A Squirrel Nest of Leaves and Twigs

Squirrels forage in tree tops and on the ground. A social hierarchy determines which squirrels get the preferred foods, best nest sites, and mates. Each animal in the local population will have a rank, ranging from the dominant male and female, to the newborn. When food supplies are abundant, squirrels may feed together. During severe winter weather, some even share winter dens which means they can share body warmth. Normally, though, they gather in groups only during mating season.

Management Considerations

A consistent food supply and a selection of good den sites in mature trees will attract squirrels to your land. Although they are omnivorous and opportunistic, squirrels nevertheless have preferred foods. Important hard mast species include the nuts of white oak, red oak, black oak, beech, hickory, walnut, bur oak, pin oak, and butternut. Fox squirrels in particular like walnuts and hickory nuts. The gray squirrel's diet is more varied. Both species, however, also enjoy corn, sunflowers, and soybeans. Squirrels eat the seeds of maple, ash, and tuliptree. They like the soft mast of flowering dogwood, juneberries, thornapples, apples, seasonal mushrooms, the buds and catkins of various shrubs, green grasses, and the leaves of legumes in spring. Sometimes they will eat beetles, salamanders, bird eggs, and nestlings. When very hungry, they will consume the bark and sap of sugar maple.

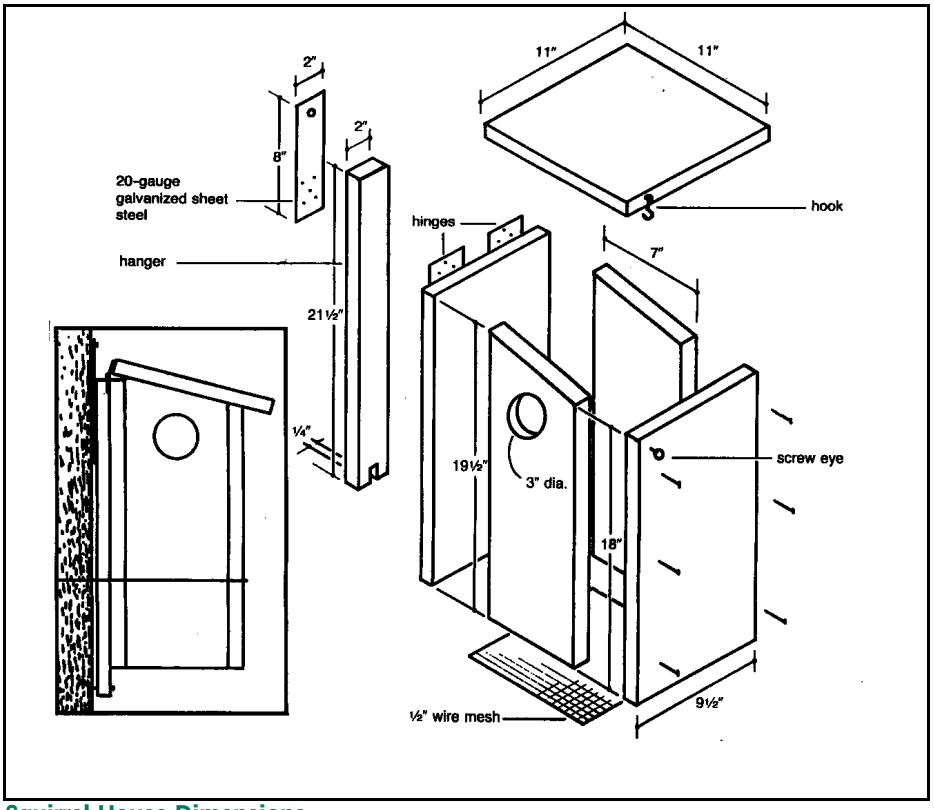
Michigan is at the squirrels' northern range, and it is not unusual for squirrels to die during especially severe winters. About 60 percent live less than one year, but this high mortality rate is also due to predation. Leaving standing corn or soybeans next to woodlots, where they can escape if danger appears, will help them get through lean times. Planting persistent fruit-bearing trees and shrubs along the sunny edge of forest openings or in woodlots will not only help squirrels but other wildlife too, such as grouse, deer, rabbits, raccoons and certain kinds of songbirds. Migrating songbirds, especially thrushes, some vireos and warblers, and finches, will feed extensively on these trees and shrubs. In a similar manner, cutting all trees greater than one inch in diameter in a 30 foot wide strip along the south or west side of a woodlot will lead to the regenera-

tion of shrubs, brush, and brambles which make outstanding habitat.

A healthy forest contains old mast-bearing trees, and younger trees just starting mast production. Older trees are more likely to provide den sites; those with cavities should be spared at the rate of one to three trees per acre. The best den sites are found in ash, beech, basswood, oak, and maple. Den trees can be created by cutting a limb six inches from the trunk or by drilling a two inch wide hole, three inches deep. If you have a choice between leaving a nut-producing den tree (oak or beech, for example) and a tree that does not produce nuts (basswood or maple), leave the nut-bearing tree and cut the non-producing tree.

If you do not have enough trees with cavities, consider building nest boxes, which squirrels will readily occupy. Use cedar, but do not use lumber that has been treated with creosote or some other decay preventive. Build the box as illustrated in the figure below. Attach the box with two aluminum nails to a healthy non-cavity tree that you don't intend to harvest. Insert one nail in the hole at the top of the galvanized strip, and insert the other in the niche at the bottom of the wooden hanger. For gray squirrels, place the box 18 to 20 feet from the ground on the east or south side of the tree. For maximum use by female fox squirrels, anchor the box under a limb high in the canopy of the tree and locate it close to a field edge.

Before cutting trees on your property, it is important to identify them and weigh their value to



Squirrel House Dimensions

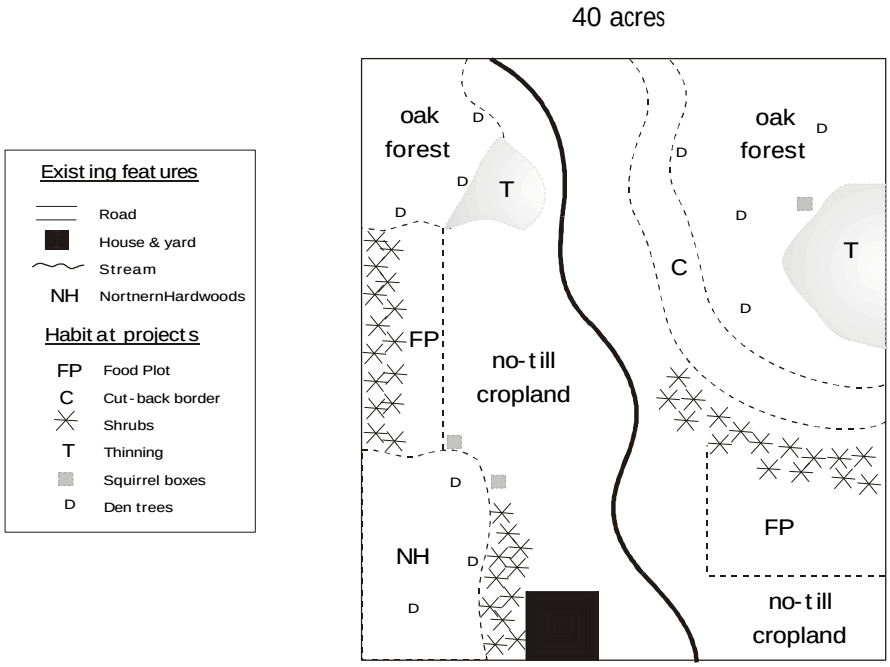
A Variety of Squirrel Foods

squirrels and other wildlife. It is possible to increase mast production if you manage any mast-bearing trees as crops. The idea is not to develop a forest where all the trees are the same age. Instead, periodic selective thinning will diversify homes for squirrels and ensure a steady food supply. A professional forester or wildlife biologist can help you make decisions that benefit wildlife on your property. Also, refer to the section on **Forest Management**.

Oak and hickory are trees that regenerate following a fire. Before the arrival of settlers to Michigan, wild fires swept across large areas, which helped promote oak and hickory regeneration. Removing 30 to 70 percent of the mature trees through selective cutting, mimics natural disturbances. However, because of the perception that fire and timber harvesting are harmful to wildlife these activities have been restricted. But in the long run we have learned that the restriction of their use has reduced the acres of oak and hickory in our state.

By removing about half of the mature trees, you will get increased regeneration of oaks and hickories, healthier trees, and earlier and more consistent seed production. Removing some weak, deformed low quality, low priority, and competing trees can produce more mast. The remaining of these trees should be left for potential den sites. If possible hard mast

SQUIRRELS



This map is an example that demonstrates the many management options discussed throughout this chapter. The option(s) you choose should depend not only on your goals, but the location, condition, and present use of your land.

(nuts and acorns) producing trees should be left to provide valuable mast for wildlife. Leave trees with grape vines and/or cavities for wildlife at the rate of one to three per acre. Also, establishing brush-piles will provide cover; use materials removed during improvement work. Brush piles should be at least 15 feet wide and five feet high. More information is available in the **Eastern Cottontail Rabbit** chapter.

Concerns

No matter how we manage our property for wildlife, our decisions will always have impacts. When squirrels enter homes and garages, they tend to annoy homeowners and can create health and safety problems. In farming areas, they sometimes cause damage to corn and other grain crops. Encouraging squirrels may also result in more predation of bird nests or create problems at bird feeders. Lovers of corn and sunflower seeds, squirrels will travel over a quarter-mile from den sites to backyard bird feeders. Here, they can dominate smaller wildlife and sometimes damage feeding structures and frighten away songbirds. One solution is to install squirrel guards (baffles) on the feeders; another is to offer alternative food sources.

When managing your land for squirrels will deter such species as deer and grouse, which could be considered positive or negative. However, some bird species will benefit from squirrel management -- such as pileated, red-bellied, and red-headed woodpeckers, thrushes, many species of warblers and vireos, and wild turkeys.

Because these potential problems are usually limited, most landowners welcome the squirrel as an important part of the wildlife community. They add hours of viewing pleasure to ones backyard or woodlot.

FOR ADDITIONAL CHAPTERS CONTACT:
Michigan United Conservation Clubs
PO Box 30235
Lansing, MI 48909
517/371-1041
MUCC

Private Land Partnerships: This partnership was formed between both private and public organizations in order to address private lands wildlife issues. Individuals share resources, information and expertise. This landowner's guide has been a combined effort between these groups working towards one goal: Natural Resources Education. We hope this guide provides you with the knowledge and the motivation to make positive changes for our environment.

FOR ADDITIONAL ASSISTANCE: *CONTACT YOUR LOCAL CONSERVATION DISTRICT*

United States Department of Agriculture
NRCS Natural Resources Conservation Service

WILDLIFE HABITAT COUNCIL

Wild Turkey

(*Meleagris gallopavo*)

November 1999 *Fish and Wildlife Habitat Management Leaflet* *Number 12*

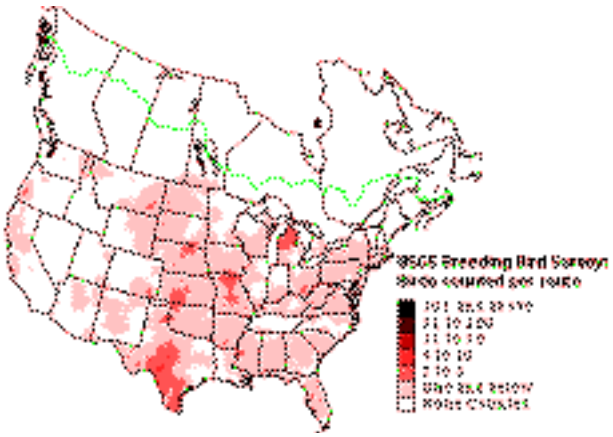
Wildlife Habitat Council

General Information

The wild turkey is a large, gallinaceous game bird represented by five subspecies throughout the United States. Its large size, iridescent body feathers and gregarious behavior has made the wild turkey a popular symbol of American wildlife for centuries. The wild turkey's reputation as a keen and wary game bird of exceptional table fare, its fascinating courting behavior, and its photogenic qualities have made it one of the most desirable species of native wildlife among hunters and other wildlife enthusiasts. The wild turkey's popularity prompted one of the most successful wildlife management recovery efforts ever conducted in the United States.

Wild turkey populations experienced heavy pressure from unregulated hunting following the arrival of Europeans in North America. Loss of habitat associated with forest clearing further impacted turkey populations, beginning in the late 1600s. By 1920, wild turkeys remained in only 21 of 39 states that historically supported healthy populations. Fortunately, regeneration of harvested forests and intensive habitat management efforts have greatly improved wild turkey populations in areas within its traditional range. Turkeys have been introduced to areas outside their historical range and, due to their adaptability, have thrived. As a result, wild turkeys are present today in all states except Alaska. Continued efforts to increase wild turkey populations on private lands may help to further secure a stable future for this valued game bird.

This leaflet is designed to serve as an introduction to the habitat requirements of the wild turkey in the United States and to assist landowners and managers in the development of a comprehensive wild turkey management plan. The success of any species management plan depends on considering the specific needs of the desired species and analyzing the designated habitat area as a whole to ensure that all required habitat elements are present. This leaflet provides a number of practical habitat management activities that can be conducted on private lands to boost local wild turkey populations and encourages involving fish and wildlife professionals in management planning to identify additional management actions needed over time.



Wild Turkey Range

Range

The wild turkey can today be found in suitable habitat in each of the lower 48 United States and Hawaii. Populations are the most numerous in Texas at more than 600,000 birds, followed in descending order by Missouri, Alabama, Georgia, Mississippi, New York, Pennsylvania, West Virginia, Wisconsin, California, Iowa, Florida, Tennessee, Ohio, Arkansas, Louisiana, and Virginia with populations between 145,000 and 600,000 birds; the remaining 32 states host smaller populations. Wild turkeys are non-migratory, year-round residents. Habitat composition and local weather patterns dictate where turkeys are found within each state.

The wild turkey in the United States

Common Name	Scientific Name	Range
Eastern wild turkey	*Meleagris gallopavo silvestris*	ND to TX and east, except FL peninsula; WA
Rio Grande wild turkey	*Meleagris gallopavo intermedia*	Primarily the central plains states and drier regions of the west (SD, NE, KS, OK, TX, NM, CO, UT, NV, ID, OR, WA, CA, HI
Merriam's wild turkey	*Meleagris gallopavo merriami*	ND to west TX and west
Florida wild turkey	*Meleagris gallopavo osceola*	Florida peninsula
Gould's wild turkey	*Meleagris gallopavo mexicana*	Southwestern corner of NM and southeastern corner of AZ

*Wild turkey subspecies are listed in descending order according to population sizes.

Habitat Requirements

General

The five wild turkey subspecies occupy a variety of habitats throughout their ranges. The following table lists the primary habitats occupied by wild turkeys in their respective regions.

Primary habitats occupied by wild turkey subspecies

Species	Primary Habitats Occupied
Eastern wild turkey	open, mature hardwood and mixed forests; open fields
Rio Grande wild turkey	brushy areas near streams and rivers; mesquite, pine and scrub oak forests
Merriam's wild turkey	ponderosa pine forests; pinyon-juniper woodlands; foothills and other mountain forest habitats
Florida wild turkey	pine flatwoods, oak and palmetto hammocks; wooded swamp habitats; prairies adjacent to roosting trees
Gould's wild turkey	mountainous regions characterized by steep, rocky canyons and brushy chaparral; pinyon pine and juniper forest; oak savanna

Careful planning to maintain adequate roosting trees and mid-to late-successional forest communities is necessary to provide suitable habitat for woodland wild turkeys. Development, overgrazing by livestock, lack of mature forest or roost trees, and a lack of brood habitat (open areas with herbaceous cover) can all limit wild turkey populations. Properly managing woodlands, grazed pasturelands, and

open areas can help landowners boost local wild turkey populations as well as populations of other species that rely on similar habitat.

Food

Wild turkeys forage throughout the day, but most feeding activity occurs during the first two to three hours after leaving the roost at daybreak and two to three hours before sunset. Wild turkey diets are composed mostly of plant foods. Ten to 20 percent of the diet consists of animal matter, primarily in the form of insects. Insects are of critical importance to young wild turkeys (poults), and poult survival will be low in habitats that do not support insects. Food items consumed are diverse as a result of the wild turkey's extensive range, and availability of food items is dependent on season and geographic region. Being opportunistic feeders, wild turkey diets are largely a function of the acceptable food items available.

Wild turkey food items

Important wild turkey food items. The following items are important foods in the diet of the wild turkey.

Eastern wild turkey:
- acorns of red, white, chestnut, and black oaks; American beech nuts
- fruits of black cherry, wild grape, spicebush
- seeds of white ash, ironwood, water beech, hawthorne, witch hazel, flowering dogwood
- seeds of native grasses and sedges; leaves of Carex spp., Lycopodium spp., evergreen ferns; winter buds of hemlock and hardwoods; fronds of sensitive fern, burdock; chufa
- beetles, other insects, salamanders, snails

Rio Grande wild turkey:
- acorns; skunkberry, doveweed, hackberry, cedar elm, pecan, prickly pear cactus
- paspalum and other grasses
- insects and other invertebrates

Merriam's wild turkey:
- grasses, forbs, alfalfa, sweetclover, sunflowers, vetch
- fruits and seeds of Ponderosa pine, oaks, manzanita, skunkbush, sedges; oats
- insects and other invertebrates

Florida wild turkey:
- live oak acorns, black gum fruits, berries of cabbage palm, pine seeds
- panic grasses, carpet grass, chufa
- dragonflies, grasshoppers, caterpillars, snails

Gould's wild turkey:
- acorns, pinon nuts, juniper berries, fruits of manzanita, onion, skunkbush, wild grape
- mustard forbs; grasses
- insects and other invertebrates

*Grit (course seeds and small pebbles) from spring seeps and ground foraging is a critical digestive component of the diet.
*Frogs, salamanders, toads, lizards, snakes, fiddler crabs and other small vertebrates and invertebrates are occasionally consumed.

Nesting Cover

General nesting requirements of each wild turkey subspecies are listed in the following table. Shallow nest depressions in the soil surface are either scratched by the female or formed through egg laying activity at the nest site. Forest-nesting turkeys commonly nest in close proximity to openings and edges

where poults have access to insect foods shortly after hatching. Each subspecies generally prefers dense ground vegetation (14 to 16 inches in height) next to nesting cover. Because topography and vegetation structure vary greatly throughout the wild turkey's range, habitat not typically associated with a subspecies' nesting activities may occasionally be used. Therefore, the table below only lists preferred habitat and cover types commonly used by each subspecies for nesting; other site conditions may also provide suitable nesting habitat.

Nesting cover for wild turkeys

Species	Nesting cover
Eastern wild turkey	Nests on ground in hardwood or mixed-forested stand, at base of sizable trees within dense understory, under a brush or slash pile, in thickets of greenbrier or downed trees and branches
Rio Grande wild turkey	Nests on ground amidst mesquite, prickly pear, lantana, native bluestems and muhly grasses.
Merriam's wild turkey	Nests on ground in mixed conifer stands (usually containing Ponderosa pine), blue spruce/bluegrass communities, and on moderately steep east or northeast slopes.
Florida wild turkey	Nests on ground in prairies, cypress, palmetto, and wire grass stands and under brushy cover.
Gould's wild turkey	Nests on ground in forests at base of trees (oaks) and yucca plants. Tends to nest on steep slopes with a northeastern exposure.

Roosting Cover

Wild turkeys roost on the ground and in trees. Tom and hen turkeys without broods roost overnight in trees to avoid predators. Tree roost habitat is found within continuous stands of timber. It is ideally comprised of mature, open-crowned trees with branches spaced at least 18 inches apart that run parallel to the ground, having trunk diameters of 14 inches or greater, and located within one-half mile of a food source. Mature pine, cypress, cottonwood and oak trees can provide good roosting cover. Ground roosting is most critical to hen turkeys during the first three to four weeks of brood-rearing, after which time poults are able to roost in trees with the hen. Hens with young roost under large trees within forests containing a dense understory of young trees and shrubs, downed trees, rock outcrops, and brushy vegetation. Various types of dense vegetation that adequately conceal the birds are commonly used as ground roosting cover.

John Mueller

Forests with mature mast-producing trees and a diversity of understory vegetation provide nesting, roosting, and foraging opportunities for wild turkeys.

Brood-rearing cover

A lack of suitable brood habitat can severely affect wild turkey population recruitment, as brood habitat plays a key role in the survival of poults during the first eight weeks of life. Open riparian woodlands, savannas, and forest openings of one-half to three acres in size provide good brood habitat. These habitats best suit wild turkeys when they contain a multitude of nutritive, herbaceous forage that supports insects (especially legumes), permits efficient poult foraging throughout the day, and provides cover that enables poults and hens to see and hide from oncoming predators.

Forest Cover

Common to each of the subspecies is their use of trees and forest habitat to fulfill various food and cover needs. The table below lists the preferred tree species and other habitat types and vegetation communities used by each subspecies of wild turkey. However, because wild turkeys are very adaptable and will use a wide variety of available habitats and tree species, the table does not provide a complete list of all habitat types used by each subspecies.

Tree species and habitat communities used by wild turkeys

Subspecies	Tree species	Habitat communities
Eastern wild turkey	Hardwood species: oak, hickory, beech, black cherry, white ash, southern magnolia, blackgum, sourwood, willow, water tupelo, water ash. Conifer species: pines, bald cypress.	Mature oak-hickory forests with understory species of sourwood, huckleberry, blueberry, mountain laurel, and greenbrier; clearings, farmlands, and plantations with mature riparian areas; bald cypress, tupelo, and water ash swamps with understory of rose, wisteria, buttonbush, and willow; oak, gum, and bald cypress bottomlands; oak/pine-mixed forest on south and west facing slopes
Rio Grande wild turkey	Hardwood species: cottonwood, live oak, pecan, American elm, cedar elm, sugar hackberry, netleaf hackberry.	Mesquite-grassland communities; pine-oak woodlands, riparian areas
Merriam's wild turkey	Hardwood species: cottonwood. Conifer species: junipers, pinyon pine, Ponderosa pine.	Found within Ponderosa pine and pinyon-juniper zone
Florida wild turkey	Hardwood species: oaks. Conifer species: pond cypress, slash pine, longleaf pine.	Cypress/hardwood swamps; hardwood hammocks; short grass communities with live oak; prairies
Gould's wild turkey	Hardwood species: oaks. Conifer species: pinyon pine, junipers.	Open grassy/oak savanna; mountains of brushy chaparral, pinyon pine, and juniper

Water

Wild turkeys drink water from spring seeps, streams, ponds, lakes, and livestock watering sources. A source of open water is necessary to support a wild turkey population.

Interspersion of Habitat Components

The most critical aspect of wild turkey management is creating good interspersion or mixture of different habitat types. Suitable foraging, nesting, brood-rearing, and roosting cover and a water source each located within close proximity to one another is essential to attract wild turkeys to and maintain existing populations in an area. Depending upon the area, combinations of open, mature, mast-producing hardwood forests; hardwood/conifer-mixed forests; understory tree and shrub species of varying ages and sizes; hardwood hammocks; high elevation pinyon-juniper habitat; and cypress and tupelo swamps interspersed with open clearings in the form of glades of grasslands, prairies, savanna and mature riparian bottomlands can create ideal interspersion of habitats. Lack of diversity of these habitat types within an area could reduce the area's value to wild turkeys.

Minimum Habitat Area

The home range of a wild turkey flock ranges between 350 acres to over 60,000 acres. However, a smaller tract of land that contains a mixture of the necessary habitat components may support wild turkeys better than a larger area that lacks one or more of the needed habitat components. Landowners owning as few as 10 acres can manage for wild turkeys if one or more of the habitat requirements (e.g., nesting cover, brood range, roosting cover) is present on the property and adjacent lands provide other habitat components needed to sustain turkeys. Therefore, lands outside the immediate planning area

should be considered in determining whether minimum habitat requirements for wild turkeys can be met for the planning area.

Avian Diseases - Disease is a natural occurrence in many species of wildlife. Although not common, wild turkeys can suffer from diseases including avian pox and blackhead. Avian pox can affect nearly any bird species and mostly affects the unfeathered parts of the wild turkey. Physical characteristics of avian pox in wild turkeys include wart-like lesions on the head, feet, and legs. Emaciated turkeys, or individuals displaying weakness, respiratory distress, or blindness may be suffering from avian pox. Although unsightly, avian pox does not pose a threat to humans and animals infected can be safely cleaned and consumed if harvested. Blackhead disease causes similar characteristics in wild turkeys along with lethargy, drooping wings, and head held close to the body. Yellowish-colored droppings and necrosis of the liver are other characteristics of blackhead disease. Blackhead disease is transmitted through roundworms that host *Histomonas* protozoa. Chickens and wild pheasants act as hosts for *Histomonas* protozoa. Wild turkeys should be kept from contact with domestic chickens, and chicken manure from poultry operations should not be used as fertilizer in fields frequented by wild turkeys. Pen-raised pheasants may spread *Histomonas* if introduced into wild turkey range. As a precaution, lethargic wild turkeys should be avoided.

Limiting Factors

For planning purposes, assess the site to subjectively rate the availability and quality of wild turkey habitat within a planning area, based on descriptions of the above habitat requirements. Habitat communities and components that are absent or rated low are likely limiting wild turkey habitat quality. Small landowners are more likely to have limiting factors on their property. However, this should not discourage them from managing for wild turkeys. Land uses on adjacent properties should be considered to accurately rate the quality of one's property as wild turkey habitat, and management goals should focus on improving habitat components not found nearby.

Habitat Component	Availability/Quality			
	High	**Medium**	**Low**	**Absent**
Food				
Nesting cover				
Brood-rearing cover				
Forest cover				
Roosting cover				
Water				
Interspersion of habitat components				

Wild Turkey Habitat Management

Management practices to create, enhance, or maintain wild turkey habitat are listed below. More than one practice may be beneficial in an area depending on the primary land use. The area's size, management goals, vegetation composition, and geographic region may dictate which management practices are most appropriate. Consultation with and assistance from federal, state or local fish and wildlife and land management agencies can be helpful in identifying appropriate management actions.

Plantings - When planted in open fields and along field borders, within woodlands and corridors connecting existing habitat patches, and in streamside riparian areas and utility line rights-of-way, the following plant species may improve wild turkey food and cover habitat components. However, care should be taken when selecting species to plant to ensure that plantings are compatible with native ecosystems. For example, establishing trees in historically grassland areas may decrease habitat quality for grassland-nesting birds and other wildlife associated with native grassland communities. Topography and climate also influence which species are appropriate for planting; the assistance of local

land management personnel can be helpful in determining where plantings would be most beneficial. Various agencies may be able to provide seed, planting equipment, and technical advice on planting.

Regional plantings for wild turkeys

Region	Herbaceous plants	Shrubs	Trees
Northeast --ME, NH, VT, MA, RI, CT, NJ, NY, PA	big and little bluestems, Indiangrass, Kentucky bluegrass, switchgrass perennial ryegrass, clovers, corn, oats buckwheat, sorghum, millet, wheat, winter rye	dogwoods, hawthorn, Viburnums, bittersweet, blackberry, elderberry, honeysuckle, hophornbeam, juniper, spicebush, wild grape, winterberry, witch hazel, crabapple	oaks, beech, black cherry, white ash, basswood, black gum, black locust, hemlock, hickory, Norway spruce, white pine, white spruce, wild apple
Midwest --MI, OH, IN, WI, IL, MN, IA, MO	big and little bluestems, Indiangrass, switchgrass, alfalfa, birdsfoot trefoil, buckwheat, clovers, corn, oats, sorghum, timothy, browntop millet, lespedeza, perennial ryegrass, sunflower, black-eyed susan	crabapple, dogwood, hawthorn, mountain ash, sumac, Viburnum, wild grape, wild plum, chokeberry, serviceberry, wild rose, bittersweet, buckthorn, elderberry, greenbrier, ninebark, spicebush, winterberry	beech, black cherry, hickory, oaks, black walnut, white pine, black gum, black locust, cottonwood, hackberry, sugar maple, white ash, white cedar, wild apple
Southeast --DE, MD, WV, DC, VA, KY, NC, TN, SC, GA, FL, AL, MS, AR, LA, TX	switchgrass, ryegrass, orchardgrass, chufa, millets, buckwheat, corn cowpeas, lespedeza sorghum, alfalfa, deer tongue, wheat, rye, clovers	dogwoods, hawthorns, huckleberry, deerberry, sparkleberry, blackberry, crabapple, sumacs, Viburnums, wild grape, wild plum, American holly, chokecherry, dwarf live oak, greenbrier, mountain ash, mulberry, myrtle oak, running oak, redbud	blackgum, oaks, sawtooth oak, beech, black cherry, persimmon, American elm, ash, bald cypress, black locust, hackberry, hickory, longleaf pine, magnolia, red maple, sweet pecan, tupelo
West --ND, SD, NE, KS, OK, MT, WY, CO, NM, ID, UT, AZ, WA, OR, NV, CA	big bluestem, smooth bromes, orchardgrass, vetch, wheatgrass, watercress, wildrye, clovers, dropseed, geranium, Mexican hat, mountain mahogany clovers, Lewis flax, panic grass, timothy, wheat, chufa	buffaloberry, chokecherry, hawthorn, serviceberry, wild rose, currant, elderberry, kinnikinnik, mountain ash, snowberry, sumac, wild plum, California buckwheat, dogwood, gooseberry, Indian squawbush, Oregon grape, quail bush, Rubus, thimbleberry, toyon	oaks, Ponderosa pine, blue spruce cottonwood, junipers, pinyon pine, douglas fir, green ash, wild apple, willow

Timber Management – Properties managed for timber can be enhanced for wild turkeys by managing tracts to contain trees of various ages (uneven-aged management) and creating travel corridors between wooded tracts. Even-aged management can also provide a variety of food and cover resources where timber stands are divided into smaller stands and a variety of age classes occur in close proximity to one another. Clearcutting small blocks, selective tree harvesting, stand thinning, and prescribed burning can be used within a forested tract to create a mosaic of habitats. Areas in which clearcutting is the most feasible harvesting technique can be made more conducive to wild turkeys by dividing a harvest tract into separate stands and conducting rotational clearcuts (5-7 years for pines and 10-15 years for hardwoods) among stands. Where possible, selective harvesting of trees can open the forest canopy enough to stimulate growth of understory forbs and shrubs. Mast-producing trees such as oaks and black cherry should be left during selective harvesting. Prescribed burning can clear slash and downed trees from the understory of coniferous forests and open the forest floor to promote new growth of valuable shrub and forb species. Burning should be conducted with assistance from local

forest and wildlife agency personnel and licensed burners. Thinning of stands can open a forest canopy and encourage new growth of understory forbs, grasses, and mast-producing and other food plants.

Connecting forested habitat patches is essential to enable wildlife to travel from one stand to another. Timber harvest activities should leave travel corridors of standing trees at least 100 feet wide between unharvested stands. Properties not managed for timber should connect fragmented turkey habitat when possible with tree plantings.

Riparian zones **-** Riparian zones (streamside woody habitat) provide wild turkeys with roosting and brood-rearing cover, food, and water resources. Riparian zones within a managed forest can be maintained by leaving a buffer of undisturbed trees and vegetation at least 100 feet on either side of streams or seeps. Harvest of mature, mast-producing trees should not occur in riparian zones. Trees in riparian zones should be left undisturbed, and these areas should be protected from cattle grazing until July to allow for brood-rearing to conclude. Prescribed fire can be used cautiously in riparian zones when vegetation is dormant.

Rights-of-way **–** Powerline and gasline rights-of-way (ROWs) provide open areas within wooded and other habitats in which wild turkeys can court, rear young, forage and travel. While most ROWs are maintained by utility companies, private landowners can work in cooperation with these companies to manage ROWs for wildlife. ROWs can be enhanced by planting grass/legume mixtures, native forbs, and other food plants such as lespedezas and sunflowers. Disking strips along ROW edges or across dense ROWs to a depth of four to six inches can promote growth of native forbs such as smartweeds, ragweeds, and milkweed when done on a two to three year rotational basis in early spring and late summer. Spot herbicide application can help open ROWs by removing individual trees and shrubs of little value to wild turkeys while preserving mast-producing species. Delaying mowing until after August 1 will minimize the number of poults killed by mowing activities. Contact the utility company to coordinate development of a ROW vegetation management plan for turkeys and other wildlife.

Spring seeps **–** In many forested areas, wild turkeys use spring seeps as a reliable source of surface water. Immature trees lining seeps can be thinned to open the area surrounding the seep and promote growth of grasses and increase vegetative diversity. Mature mast-producing trees along seeps should not be disturbed, and a buffer of undisturbed vegetation of at least 50 feet wide should be maintained around seeps in areas where farming practices, livestock grazing, or timber harvesting occurs. Fencing of livestock may be necessary to protect seeps and riparian zones in pasturelands. Oaks, serviceberry, and other fruit and seed-producing trees and shrubs can be planted around open or old field seeps to provide food, and immature or less-valuable tree species can be girdled to create snags and maintain the area in an early developmental stage.

John Mueller

Native grasses provide good wild turkey brood-rearing habitat.

Management Prescriptions

Management treatments should address the habitat components that are determined to be limiting wild turkey habitat potential. For planning purposes, select among the possible action items listed below to raise the quality or availability of each habitat component determined to be limiting. NRCS conserva-

tion practices and various programs that may provide financial or technical assistance to carry out specific management practices are listed where applicable.

Habitat Component	**Management options for increasing Habitat quality or availability**	**Cons. Practices and Assistance Programs**
Food	· Plant legumes, clovers, and native forbs and warm season grasses such as big bluestem, little bluestem, switchgrass, sideoats grama and Indiangrass.	327, 386, 390, 645, 647 WHIP, EQIP, PFW, CRP
	· Preserve and maintain grassland/forb communities and utility and gasline ROWs by conducting strip disking, prescribed burning, and rotational mowing after August 1 where appropriate.	338, 645, 647 WHIP, EQIP, PFW, CRP
	· Plant oak species within forested tracts, along riparian areas and field borders and around spring seeps. · Restore hydrology and vegetation in bottomland hardwood wetlands. · Plant chufa between April and June according to region. · Plant partridge pea, trefoils, clovers, and other legumes in ROWs and open fields bordering woods. · Plant and preserve native tree, shrub, and herbaceous plant species listed in the table on page 7.	380, 391, 612, 645, 650, 657 WHIP, WRP, EQIP, PFW, CRP
	· Thin low-value, immature trees (less than 5 inches DBH) from oak and other mast-producing trees and shrubs within forested stands.	WHIP
	· Leave oaks and other mast-producing trees and shrubs undisturbed around spring seeps and within riparian zones and mixed oak-pine forests.	
Nesting and forest cover	· Selectively cut immature/pole-sized timber to create openings and encourage herbaceous, understory growth.	WHIP
	· Restore hydrology and vegetation in bottomland hardwood wetlands.	657 WRP
	· Plant a mixture of native warm season grasses consisting of big bluestem, little bluestem, switchgrass, sideoats grama, Indiangrass. Preserve mesquite, latana, and prickly pear within grasslands.	327, 386, 390, 645 WHIP, EQIP, PFW, CRP
	· Preserve and maintain grassland/forb communities by conducting strip disking, prescribed rotational burning and rotational mowing after August 1 where appropriate.	338, 645, 647 WHIP, EQIP, PFW, CRP
	· Preserve prairies, cypress, palmetto, and wire grass stands.	
	· Preserve brush heaps, thickets and brush piles adjacent to grassland brood habitat.	
Roosting cover	· Preserve mature ponderosa pine, oak, cottonwood, cypress and other large trees.	
Brood habitat	· Maintain scattered openings within mature stands of trees by selectively cutting less valuable or immature trees to create herbaceous understory growth.	WHIP
Interspersion of habitat components	· Combine above prescriptions to increase interspersion of habitat components and amount of suitable wild turkey habitat.	

NRCS Conservation Practices that may be useful in undertaking the above management actions.

Code	Conservation Practice	Code	Conservation Practice
327	Conservation Cover	422	Hedgerow Planting
338	Prescribed Burning	612	Tree/Shrub Establishment
380	Windbreak/Shelterbelt Establishment	645	Upland Wildlife Management
386	Field Border	647	Early Successional Habitat Development
390	Riparian Herbaceous Cover	650	Windbreak/Shelterbelt Renovation
391	Riparian Forest Buffer	657	Wetland Restoration

Available Assistance

Landowners interested in making their individual efforts more valuable to the community can work with the Wildlife Habitat Council and NRCS to involve school, scout, and community groups and their families, as well as state and federal fish and wildlife agency personnel, in habitat projects when possible. On-site education programs demonstrating wild turkey habitat management can greatly increase the value of an individual management project. Corporate landowners should encourage interested employees to become involved. Involving federal, state and non-profit conservation agencies and organizations in the planning and operation of a wild turkey management plan can greatly improve the project's success. Assistance programs available through various sources are listed below.

Programs that provide technical and financial assistance to develop fish and wildlife habitat on private lands.

Program	Land Eligibility	Type of Assistance	Contact
Conservation Reserve Program (CRP)	Highly erodible land, wetland, and certain other lands with cropping history. Stream-side areas in pasture land	50% cost-share for establishing permanent cover and conservation practices, and annual rental payments for land enrolled in 10 to 15-year contracts. Additional financial incentives are available for some practices.	NRCS or FSA State or local Office
Environmental Quality Incentives Program (EQIP)	Cropland, range, grazing land & other agricultural land in need of treatment	Up to 75% cost-share for conservation practices in accordance with 5 to 10-year contracts. Incentive payments for certain management practices.	NRCS State or local Office
Partners for Fish and Wildlife Program (PFW)	Most degraded fish and/or wildlife habitat	Up to 100% financial and technical assistance to restore wildlife habitat under minimum 10-year cooperative agreements.	Local office of the U.S. Fish and Wildlife Service
Waterways for Wildlife	Private land	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals.	Wildlife Habitat Council (301-588-8994)
Wetlands Reserve Program (WRP)	Previously degraded wetland and adjacent upland buffer, with limited amount of natural wetland, and existing or restorable riparian areas.	75% cost-share for wetland restoration under 10-year contracts and 30-year easements, and 100% cost share on restoration under permanent easements. Payments for purchase of 30-year or permanent conservation easements.	NRCS State or local Office
Wildlife at Work	Corporate land	Technical assistance on developing habitat projects into a program that will allow companies to involve employees and the community.	Wildlife Habitat Council (301-588-8994)
Wildlife Habitat Incentives Program (WHIP)	High-priority fish and wildlife habitats	Up to 75% cost-share for conservation practices under 5 to 10-year contracts.	NRCS State or local Office
State fish and wildlife agencies and private groups such as the National Wild Turkey Federation may have assistance programs, publications, or other useful tools in your state.			State or local contacts. NWTF: 1-800-THE-NWTF

References

Brenneman, R. Regional recommendations for planting for wild turkeys. NWTF Wildlife Bulletin No. 13. National Wild Turkey Federation. Edgefield, SC.

Brenneman, R., and H. Daniel. Chufa – "Turkey Gold." NWTF Wildlife Bulletin No. 7. National Wild Turkey Federation. Edgefield, SC.

Davidson, W. R., and G. L. Doster. Avian pox. NWTF Wildlife Bulletin No. 25. National Wild Turkey Federation. Edgefield, SC.

Davidson, W. R. and G. L. Doster. Blackhead disease. NWTF Wildlife Bulletin No. 26. National Wild Turkey Federation. Edgefield, SC.

Dickson, J. G. Managing streamside zones for wildlife. NWTF Wildlife Bulletin No. 18. National Wild Turkey Federation. Edgefield, SC.

Eaton, S. W. 1992. Wild turkey (*Meleagris gallopavo*). *In* The Birds of North America, No. 22 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA. *(see www.birdsofna.org for BNA information)*

Healy, W. M., and M. J. Casalena. Spring seep management for wild turkeys and other wildlife. NWTF Wildlife Bulletin No. 21. National Wild Turkey Federation. Edgefield, SC.

Hengel, D. Habitat needs and developments for wild turkeys. Habitat Extension Bulletin No. 24. Wyoming Fish and Game Department – Habitat Extension Service.

Hurst, G. A. Rights-of-way for wildlife. NWTF Wildlife Bulletin No. 20. National Wild Turkey Federation. Edgefield, SC.

Kennamer, J. E., M. C. Kennamer, and R. Brenneman. History of the wild turkey in North America. NWTF Wildlife Bulletin No. 15. National Wild Turkey Federation. Edgefield, SC.

Kennamer, J. E., and M. C. Kennamer. Wild turkey status and range. NWTF Wildlife Bulletin No. 22. National Wild Turkey Federation. Edgefield, SC.

Kennamer, M. C. Eastern wild turkey. NWTF Wildlife Bulletin No. 1. National Wild Turkey Federation. Edgefield, SC.

Kennamer, M. C. Florida wild turkey. NWTF Wildlife Bulletin No. 2. National Wild Turkey Federation. Edgefield, SC.

Kennamer, M. C. Rio Grande wild turkey. NWTF Wildlife Bulletin No. 3. National Wild Turkey Federation. Edgefield, SC.

Kennamer, M. C. Merriam's wild turkey. NWTF Wildlife Bulletin No. 4. National Wild Turkey Federation. Edgefield, SC.

Kennamer, M. C. Gould's wild turkey. NWTF Wildlife Bulletin No. 5. National Wild Turkey Federation. Edgefield, SC.

McGlincy, J. Managing for Timber and Wildlife Diversity. NWTF Wildlife Bulletin No. 16. National Wild Turkey Federation. Edgefield, SC.

Sauer, J. R., J. E. Hines, I. Thomas, J. Fallon, and G. Gough. 2000. The North American Breeding Bird Survey, results and analysis 1966 - 1999. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Terres, J. K. 1991. The Audubon Society Encyclopedia of North American Birds. Wings Books, New York. 1110 pp.

NRCS
Wildlife Habitat Management Institute
100 Webster Circle, Suite 3
Madison, MS 39110
(601) 607-3131

In cooperation with partners, the mission of the Wildlife Habitat Management Institute is to develop and disseminate scientifically based technical materials that will assist NRCS field staffs and others to promote conservation stewardship of fish and wildlife and deliver sound habitat management principles and practices to America's land users.

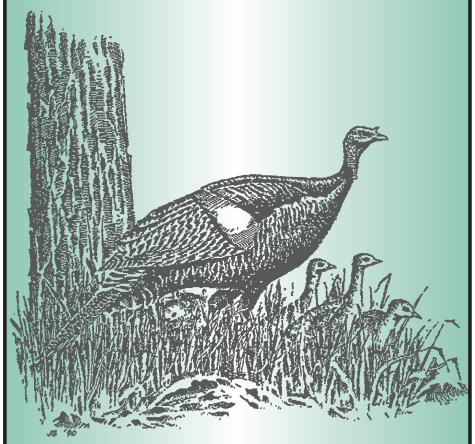
www.nrcs.usda.gov
www.ms.nrcs.usda.gov/whmi

Wildlife
Habitat Council
1010 Wayne Avenue, Suite 920
Silver Spring, MD 20910
(301) 588-8994

The Wildlife Habitat Council's mission is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, non-profit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.

www.wildlifehc.org

This document was developed in consultation with the National Wild Turkey Federation. Founded in 1973, the National Wild Turkey Federation (NWTF) is a national non-profit conservation and education organization dedicated to the conservation of the wild turkey and the preservation of the hunting tradition. With more than 219,000 members, the NWTF is one of the largest and fastest growing conservation organizations in the nation. Together, the NWTF's conservation partners and grassroots members have spent more than $100 million on projects benefiting wild turkeys and wildlife throughout North America. For more information on the National Wild Turkey Federation, contact NWTF, 770 Augusta Rd., P.O. Box 530, Edgefield, SC 29824; Telephone # 803-637-3106, Fax # 803-637-0034, email: nwtf@nwtf.net.



Planting Legumes for Wildlife

Written by Ron Brenneman & Henry Daniel

NWTF WILDLIFE BULLETIN NO. 9

NATIONAL WILD TURKEY FEDERATION

Legumes are a group of plants that are members of the *Fabaceae* plant family. Most legumes produce an abundance of high quality forage that is readily used by many species of wildlife. Turkeys utilize legumes by feeding on the leaves and flower heads, and insects and other invertebrates that live on the plants. Clovers are the most common legumes planted for wildlife purposes.

A unique characteristic of legumes is their ability to take nitrogen (N) from the air and fix it into a form that can be used for growth by the plant itself and other crops planted in association with it or after it. The nitrogen is stored in small nodules on the plant root. Clovers and alfalfa, for example, can produce from 50-200 pounds per acre per year of nitrogen, which is available to improve plant growth and quality.

PHOTO BY RON BENNEMAN

A gobbler strutting in a strip of ryegrass and ladino clover.

Legumes are able to take nitrogen from the air because of a *Rhizobium* bacteria that is present in their roots. The bacteria does not harm the plant but actually helps it by fixing the nitrogen. This is the reason why legume seed should be inoculated with *Rhizobium* bacteria before planting to be sure that an adequate number of the bacteria are present on the root of the legume. The procedure for inoculating legume seed is discussed later in this publication.

PLANTING PROCEDURES:

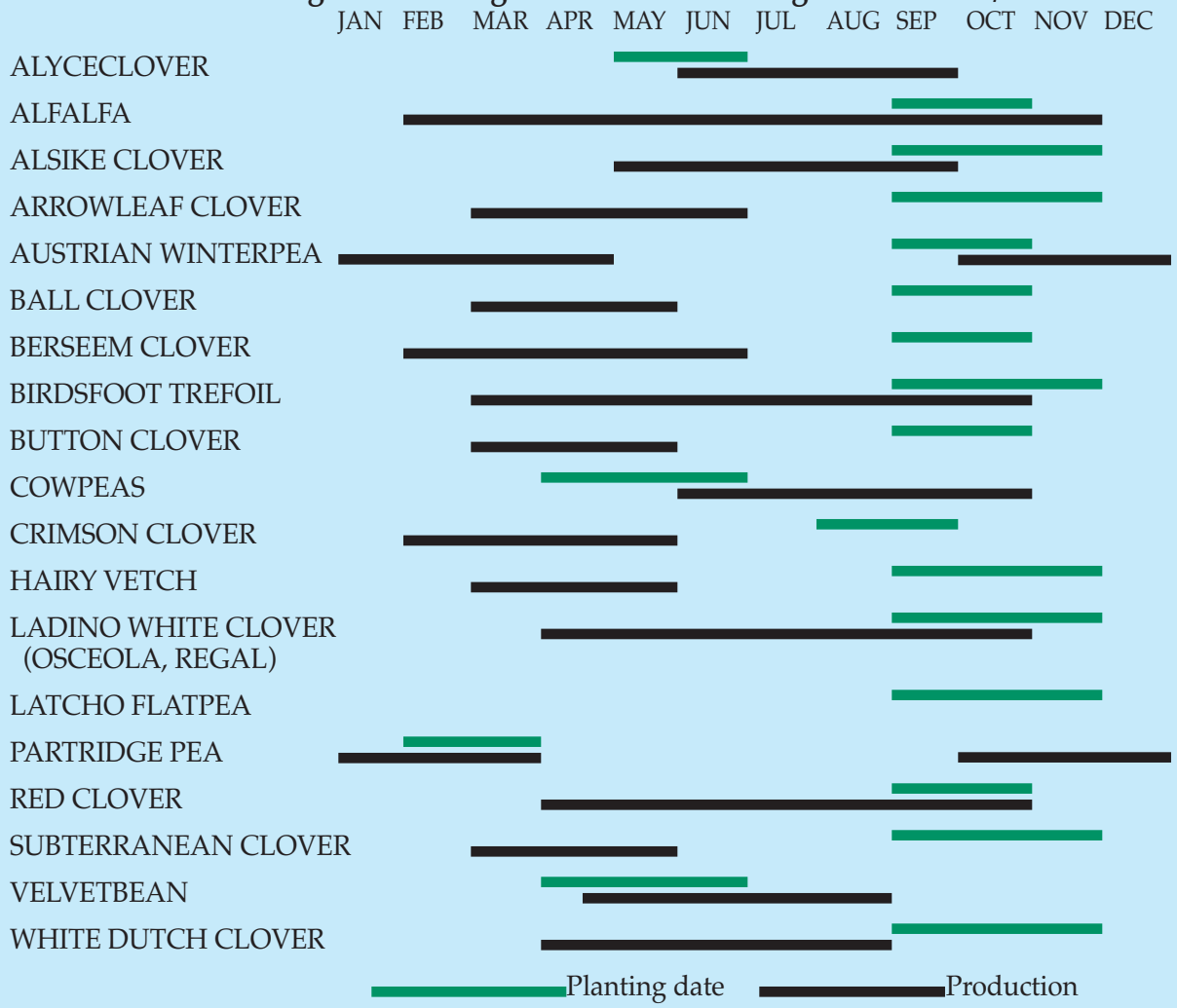
General Considerations

Warm season legumes are usually planted during the spring, February to June, and cool season legumes during the fall, September to November. Planting dates, however, vary with location, weather,

PHOTO BY RON BENNEMAN

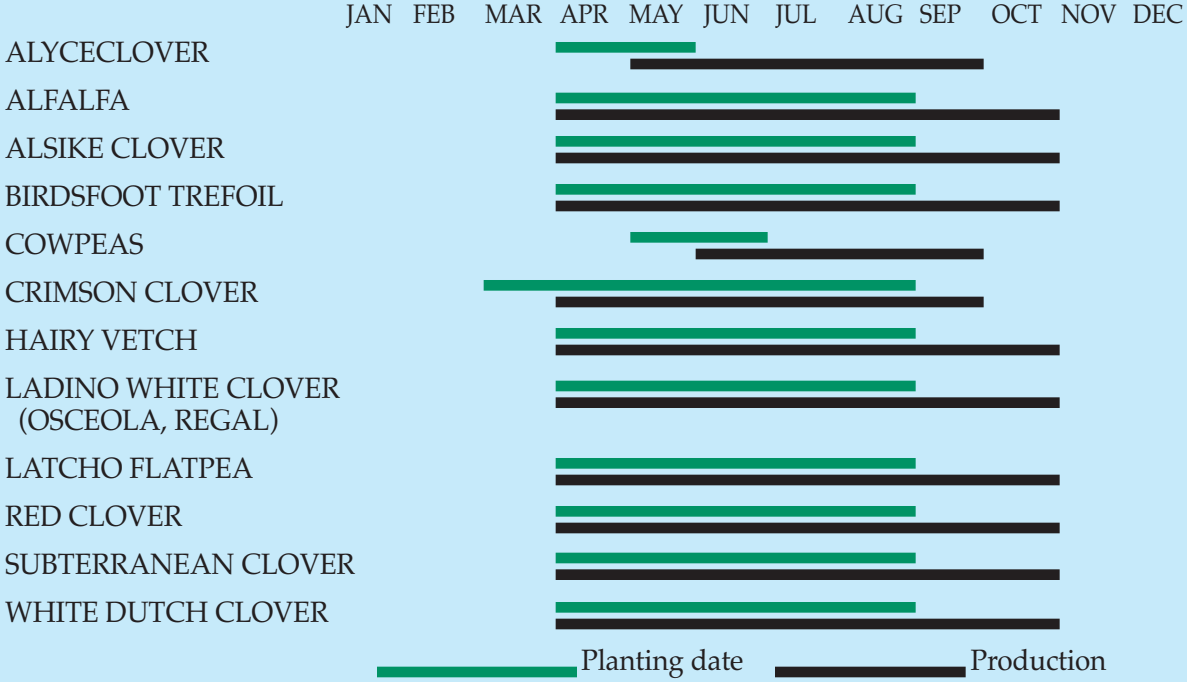
Partridge pea, a reseeding annual planted for wild turkey and quail.

FIGURE 1 - Legume Planting Dates and Peak Forage Production*/Southern Areas



* Planting dates and peak production periods vary somewhat with location, weather, and other factors. This figure provides general information only.

FIGURE 2 - Legume Planting Dates and Peak Forage Production*/Northern Areas



* Planting dates and peak production periods vary somewhat with location, weather, and other factors. This figure provides general information only.

Photo By Ron Brenneman

Birdsfoot trefoil and dutch white clover do well planted together in cooler areas.

elevation, and other factors. In some of the cooler areas legumes can be planted with success throughout much of the summer months. In this publication we have made two broad classifications, southern areas and northern areas, for planting dates and peak forage production, Figures 1 and 2. Even within these classifications there is much variation.

In northern areas peak forage production occurs during the spring and summer months. Forage is available, however, throughout much of the fall and into the early winter until snow cover makes in unavailable. Even in these areas, with short growing seasons and cool temperatures, legumes can be available to wildlife for eight months or more.

The timing of legume forage availability in the warmer, southern areas is different than the northern areas, but the length of time it is available is similar. During the hottest part of the summer many of the legumes are dormant with peak production occurring in the spring and fall.

Some types of legumes are annual and others are perennial. Annual legumes generally produce forage for one year and then must be replanted again. Particularly in warmer areas, however, many of the annuals will reseed and produce an adequate stand in succeeding years. For example, we know of a crimson

FIGURE 3 - GUIDE TO COMMONLY PLANTED LEGUMES

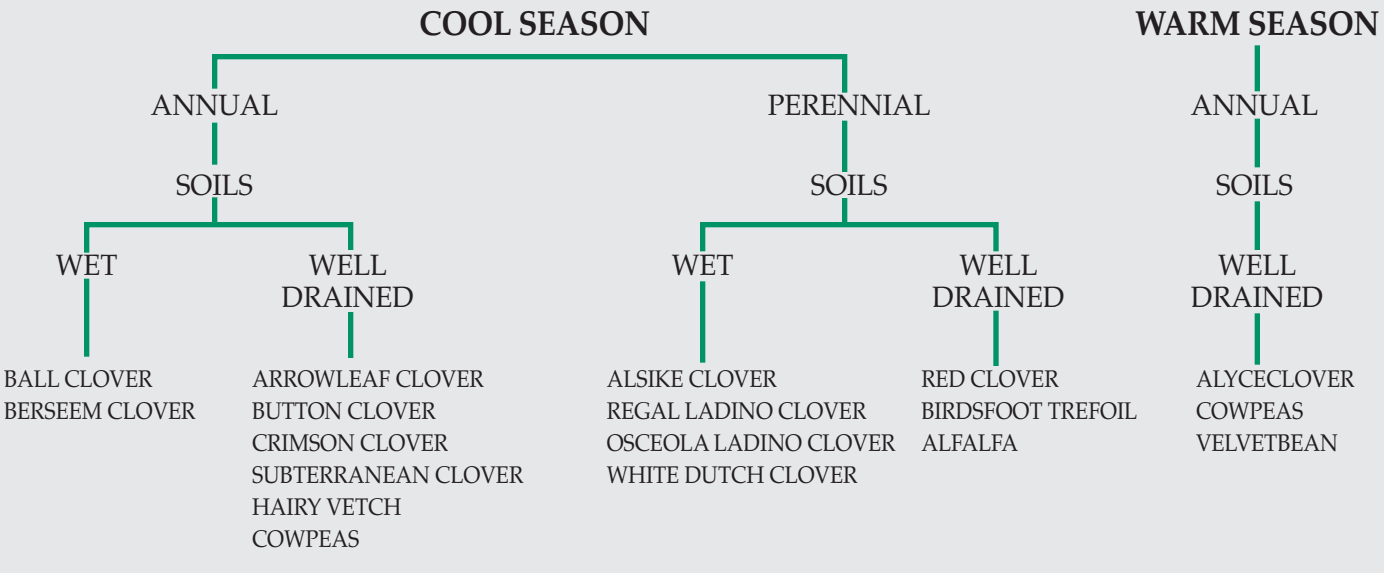


Photo By Ron Brenneman

Preparation of the seedbed is an important step in a successful legume planting.

clover stand in Georgia that is still producing excellent forage six years after the initial planting.

Perennial legumes will persist for more than on year and often for a much longer period of time. We have seen a clover and alfalfa mixture persist for more than seven years in northern Pennsylvania, with only occasional topdressing with lime and fertilizer.

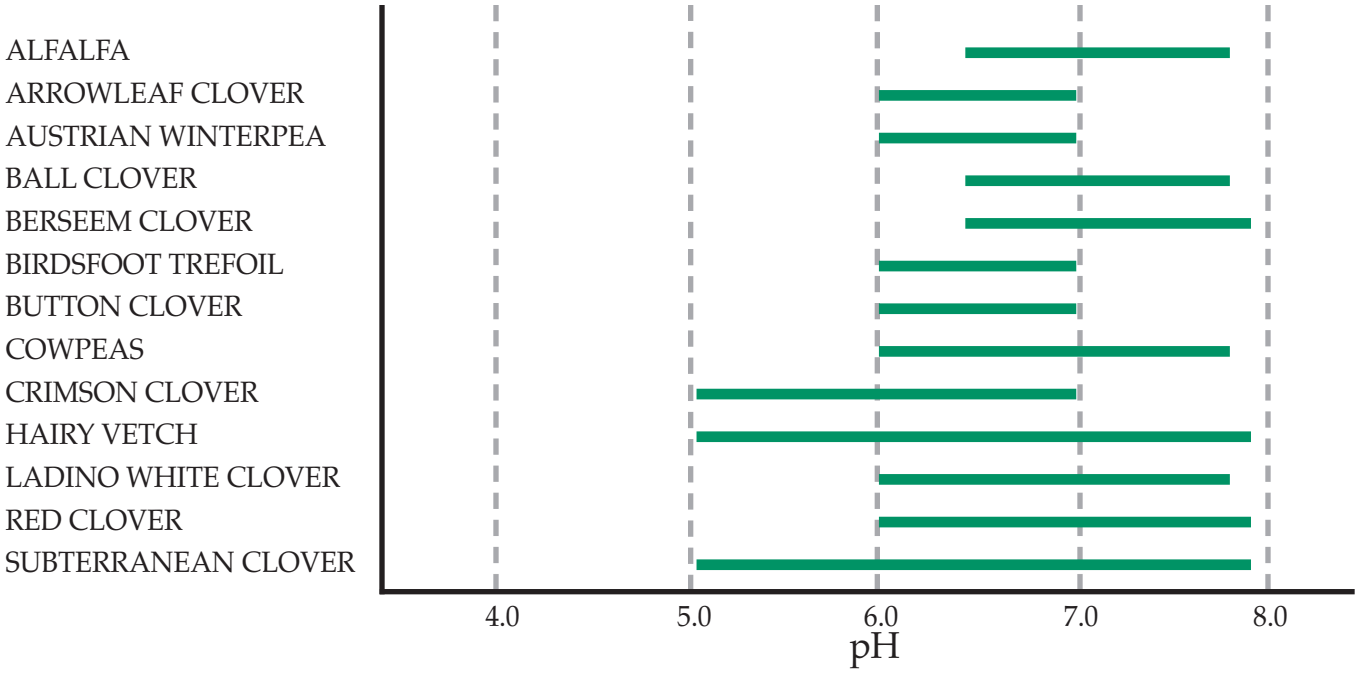
Soil Preparation

When preparing seedbeds two things should be considered, the size of the seed to be planted and moisture conditions.

Seedbeds for small seeded varieties, such as clovers, need to be as smooth and lump free as possible when planted at about 1/8 inch depth. Larger seed varieties like peas do not require as much precaution because they have the vigor to push through adverse soil conditions.

Preparing a seed bed when the soil is too wet will create a hard crust and a rough seed bed. Certain conditions will require tilling when the soil is wet, such as when a heavy weed growth is present and the only way to

FIGURE 4 - OPTIMUM SOIL pH FOR BEST LEGUME GROWTH



harrow it under is after a good rain. In these situations another harrowing a few days later will be required to smooth the soil out and planting can be done at that time.

When minimal soil moisture is present, preparing a seed bed will release the moisture needed to germinate the seed. If this is the case, the smaller seed varieties should be planted very shallow. The larger seed varieties can still be planted, but deeper to reach the existing moisture.

If the seedbed is too loose it will not hold moisture and there will not be good seed-soil contact. Before planting the seed compact the soil. You cannot overly compact a seedbed. Even running a 4-wheeler over the seedbed before planting will help.

Fertilizing and Liming

Legumes require fertilizer and lime for proper growth. For best results have your soil tested to determine the amount of fertilizer and lime needed. The cost of the fertilizer and lime will exceed that of the legume seed so you do not want to use any more than necessary for good growth.

It is not necessary to add nitrogen when planting legumes. If you cannot get the soil tested a general recommendation for fertilizer would be 250 pounds per acre of 5-10-15. Commercial fertilizer without any nitrogen is not readily available. Most forest soils, where many wildlife openings are planted, are acidic so lime is needed to increase the soil pH. In Figure 4 the optimum pH for some of the common

FIGURE 5 - LEGUME PLANTING GUIDE

SHADY AREAS
- LADINO WHITE CLOVER
- LATCHO FLATPEA
- SUBTERRANEAN CLOVER
- WHITE DUTCH CLOVER

BEST IN ACID SOILS
- ALYCECLOVER
- ARROWLEAF CLOVER
- BALL CLOVER
- BIRDSFOOT TREFOIL
- COWPEAS
- CRIMSON CLOVER
- HAIRY VETCH
- LADINO WHITE CLOVER
- SUBTERRANEAN CLOVER
- VELVETBEANS

TOLERATES WET SOILS
- ALSIKE CLOVER
- BALL CLOVER
- BERSEEM CLOVER
- LADINO WHITE CLOVER
- RED CLOVER
- WHITE DUTCH CLOVER

BEST IN LOW FERTILITY AREAS
- COWPEAS
- VELVETBEANS

GOOD COLD TOLERANCE
- ALFALFA
- AUSTRIAN WINTERPEA
- BIRDSFOOT TREFOIL
- LATCHO FLATPEA
- RED CLOVER
- REGAL LADINO CLOVER
- WHITE DUTCH CLOVER

Applying lime and fertilizer is one of the major costs of establishing a stand of legumes.

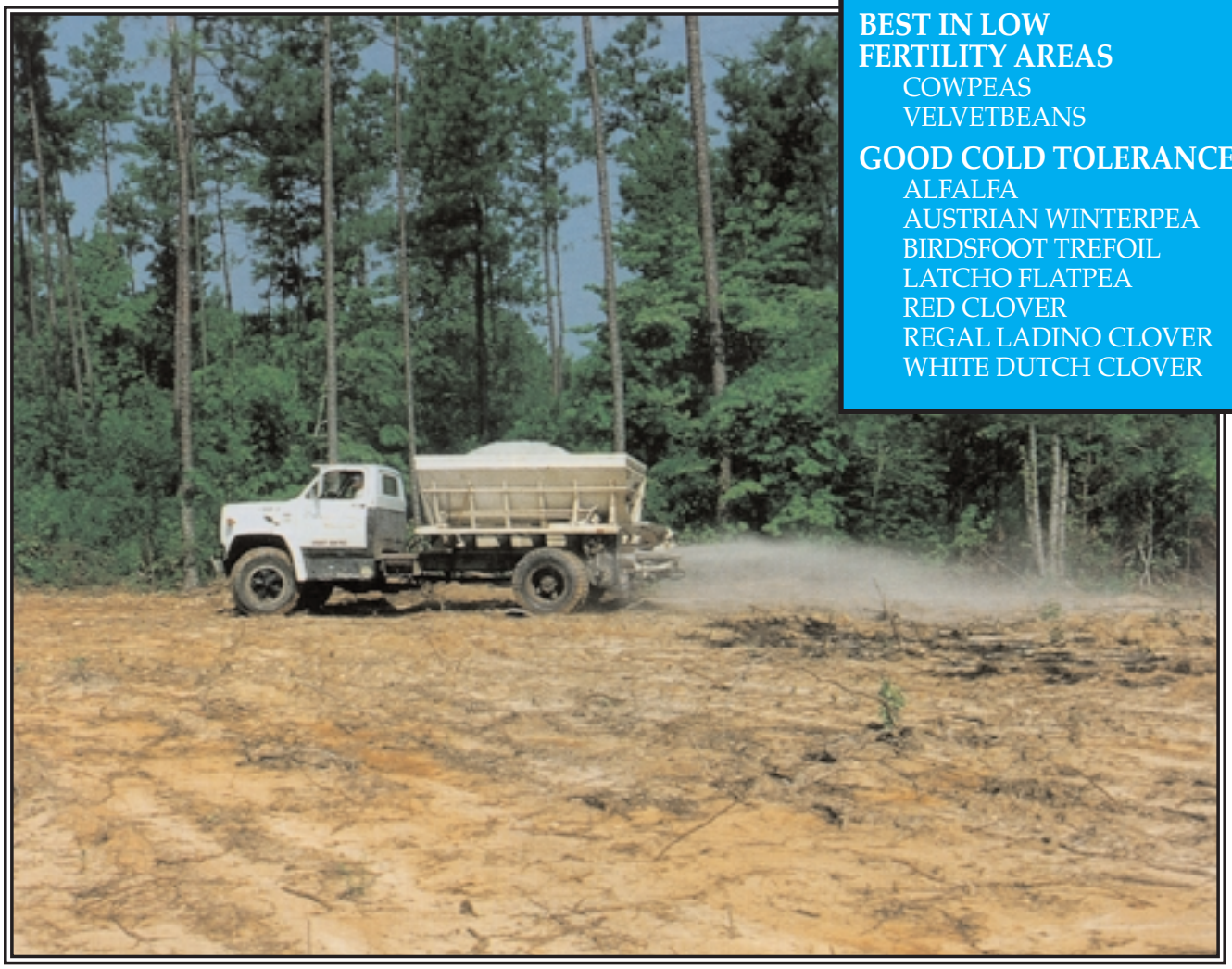


PHOTO BY GENE SMITH

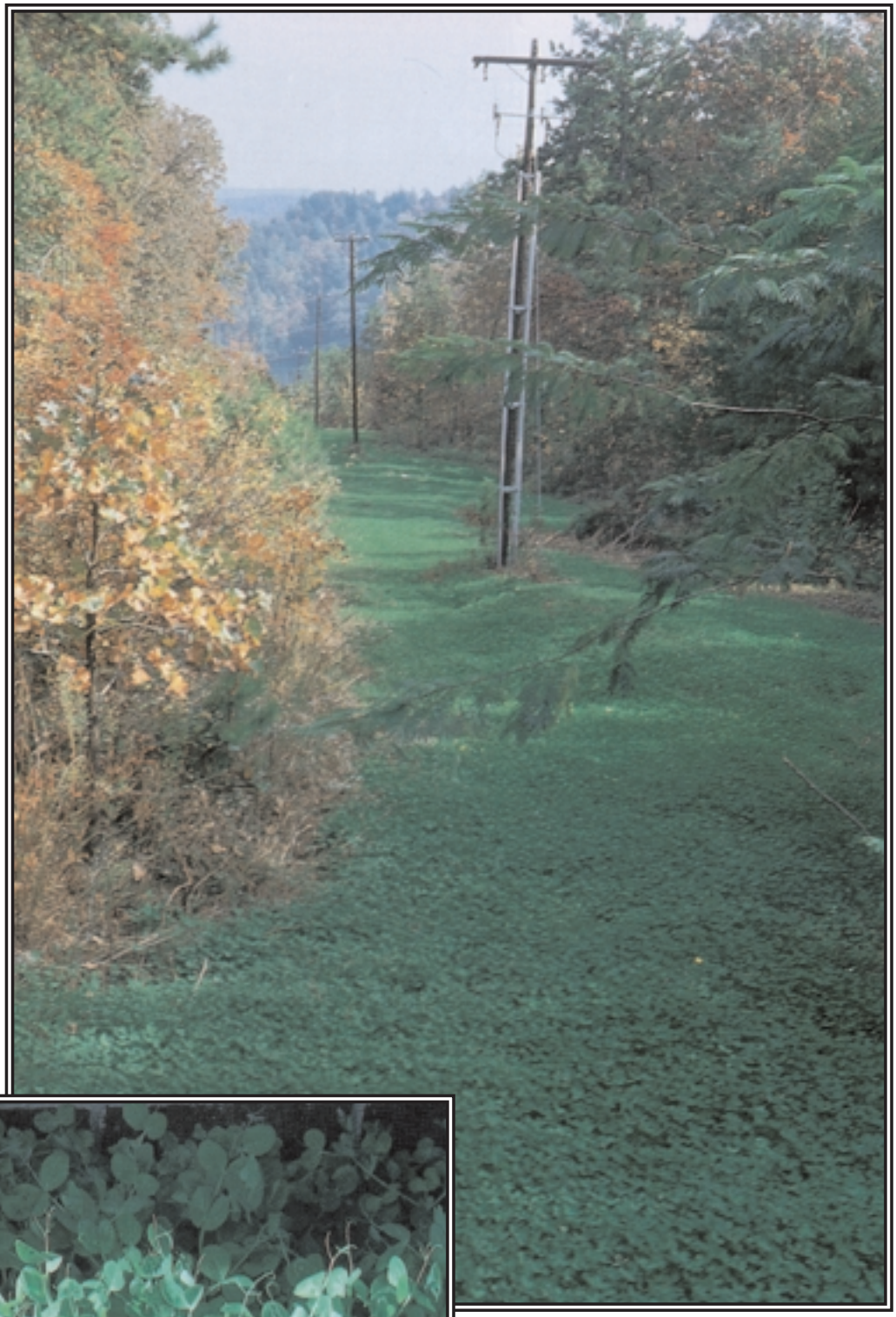


PHOTO BY RON BRENNEMAN

A right-of-way planted with clover makes an excellent wildllife opening.

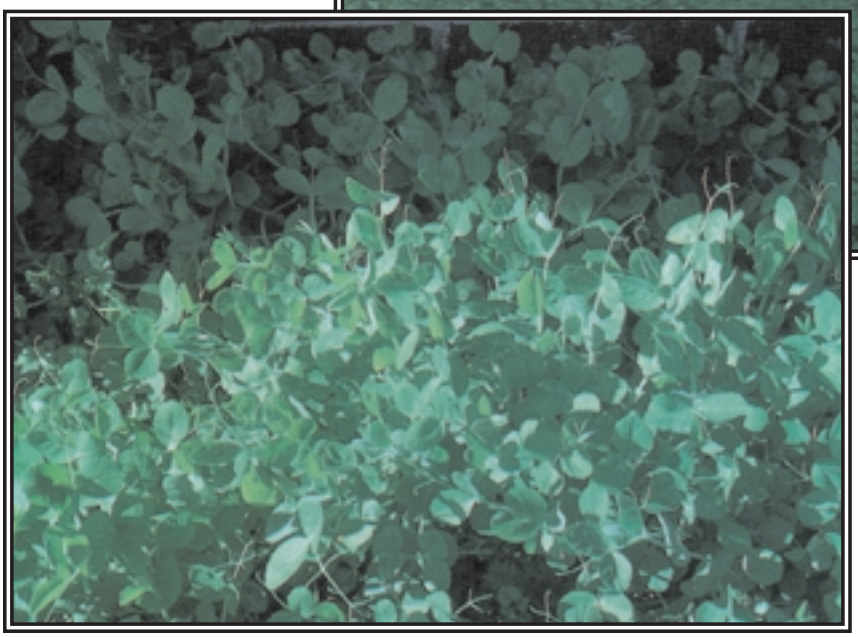


PHOTO BY RON BRENNEMAN

Austrian winterpea, a good soil builder and wildlife food.

legumes is listed. Generally a pH of 6.0 or higher is best for legumes. Again, a soil test is highly recommended, but if one is not taken apply 1-2 tons per acre of lime.

Fertilizer and lime can be applied either before or after the seed bed has been prepared. Ideally it should be applied prior to seed bed preparation and harrowed into the soil. If time, weather conditions, or late arrival of soil test results prevent this, lime and fertilizer can be applied after the seed bed has been prepared and planted.

Seed Inoculation

All legume seed should be mixed with the proper inoculant before it is planted. It is particularly important if the seed is being planted in an area where legumes have not been grown before.

Inoculant is very inexpensive. When buying it check the date on the package to make sure it is fresh. Also use the proper inoculant for the type of legume you are planting. Alfalfa, partridge pea and ladino clover, for example, each require a different type of inoculant.

If you do not use the inoculant immediately after buying it store it in a dry, relatively cool place out of the direct sunlight. Just prior to planting the seed inoculate it as follows:

- Place the seed in a container.
- In another container mix the required amount of water with the inoculant to form a slurry.
- Add a commercially available sticker or sticking agent to this slurry and mix it well.
- Add the slurry to the seed and mix well.
- If you get the seed too wet add a little lime to absorb the water.
- If possible let the seed dry for about an hour before planting.

Plant the seed as soon as possible after it has been inoculated. If it is not planted the day it is inoculated, reinoculate before planting.

PHOTO BY RON BRENNEMAN

A mixture of orchardgrass and subterranean clover.

Do not mix inoculated seed with fertilizer as the salts from the fertilizer can kill the bacteria in the inoculant.

Planting the Seed

Buy high quality legume seed. Make sure the bag has a complete analysis tag attached from a certified seed laboratory. The test date should be within the last 12 months. Legume seed can be planted by broadcasting or drilling. Most individuals who are planting for wildlife do not have drills, therefore, broadcasting is most common.

Because seeding rates for many legumes are relatively low and the seed is small, (Figure 6) care must be used when broadcasting the seed. It is easy to spread an acres worth of seed over a relatively small area.

Two ways of broadcasting legume seed are by using a bucket and your hand or mixing the seed with dry sand and using a hand-held spreader. Avoid dumping the seed alone in a hand held spreader. A few cranks of the handle and your seed will be gone.

FIGURE 6 - LEGUME SEEDING RATES

	BROADCAST LBS. PER ACRE
ALYCECLOVER	15-20
ALFALFA	15-18
ALSIKE CLOVER	4-6
ARROWLEAF CLOVER	5-10
AUSTRIAN WINTERPEA	30-40
BALL CLOVER	2-3
BERSEEM CLOVER	20
BIRDSFOOT TREFOIL	6-12
BUTTON CLOVER	10
COWPEAS	60
CRIMSON CLOVER	20-30
HAIRY VETCH	20-25
LATCHO FLATPEA	20-30
LADINO WHITE CLOVER	6-8
PARTRIDGE PEA	15-20
RED CLOVER	12-15
SUBTERRANEAN CLOVER	15
VELVETBEAN	25-30
WHITE DUTCH CLOVER	4

Covering the Seed

Legume seed should be covered lightly with soil after it has been broadcast. Covering it with too much soil can reduce germination and lead to a poor stand. Most legume seed should be covered to a depth of only 1/8 inch. Use extreme care when covering seed with a harrow, disk or drag to not cover too deep. Running over the seedbed with a 4-wheeler after planting will firm the seedbed and put the seed in good contact with the soil.

Legume/Grass Mixtures

Several species of legumes planted together or with grasses make a good mixture for wild turkeys and other wildlife. Some legume/grass mixtures can provide nearly a year-round source of food in the south. Most of these mixtures would be productive for many years with a minimum of annual maintenance.

Legume/grass mixtures can be established by planting the seed at the same time or no-till seeding the legumes into an existing stand of grass. Species of grass that are commonly planted in association with legumes include Kentucky bluegrass, orchardgrass, bahiagrass, bermudagrass, timothy and fescue.

Thanks to Donald M. Ball, Auburn University and Gerald A. Wunz, retired, Pennsylvania Game Commisssion, for reviewing the manuscript and providing helpful input.

Financial support for this publication was provided in part by the National Fish and Wildlife Foundation, Federal Cartridge and Wildlife Forever and published by the National Wild Turkey Federation.

13.4.6. Strategies for Water Level Manipulations in Moist-soil Systems

Leigh H. Fredrickson
Gaylord Memorial Laboratory
The School of Natural Resources
University of Missouri–Columbia
Puxico, MO 63960

Water level manipulations are one of the most effective tools in wetland management, provided fluctuations are well-timed and controlled. Manipulations are most effective on sites with (1) a dependable water supply, (2) an elevation gradient that permits complete water coverage at desired depths over a majority of the site, and (3) the proper type of water control structures that enable water to be supplied, distributed, and discharged effectively at desired rates. The size and location of structures are important, but timing, speed, and duration of drawdowns and flooding also have important effects on plant composition, plant production, and avian use. When optimum conditions are not present, effective moist-soil management is still possible, but limitations must be recognized. Such situations present special problems and require particularly astute and timely water level manipulations. For example, sometimes complete drainage is not possible, yet water is usually available for fall flooding. In such situations, management can capitalize on evapotranspiration during most growing seasons to promote the germination of valuable moist-soil plants.

Timing of Drawdowns

Drawdowns often are described in general terms such as early, midseason, or late. Obviously, calendar dates for a drawdown classed as early differ with both latitude and altitude. Thus the terms early, midseason, and late should be considered within the context of the length of the local growing season. Information on frost-free days or the average length of the growing season usually is available from agricultural extension specialists. Horticulturists often use maps depicting different zones of growing conditions (Fig. 1). Although not specifically developed for wetland management, these maps provide general guidelines for estimating an average growing season at a particular site.

In portions of the United States that have a growing season longer than 160 days, drawdowns normally are described as early, midseason, or late. In contrast, when the growing season is shorter than 140 days, drawdown dates are better described as either early or late. Early drawdowns are those that occur during the first 45 days of the growing season, whereas late drawdowns occur in the latter 90 days of the growing season. For example, the growing season extends from mid-April to late October (200 days) in southeastern Missouri. In this area, early drawdowns occur until 15 May, midseason drawdowns occur between 15 May and 1 July, and late drawdowns occur after 1 July (Table 1). The

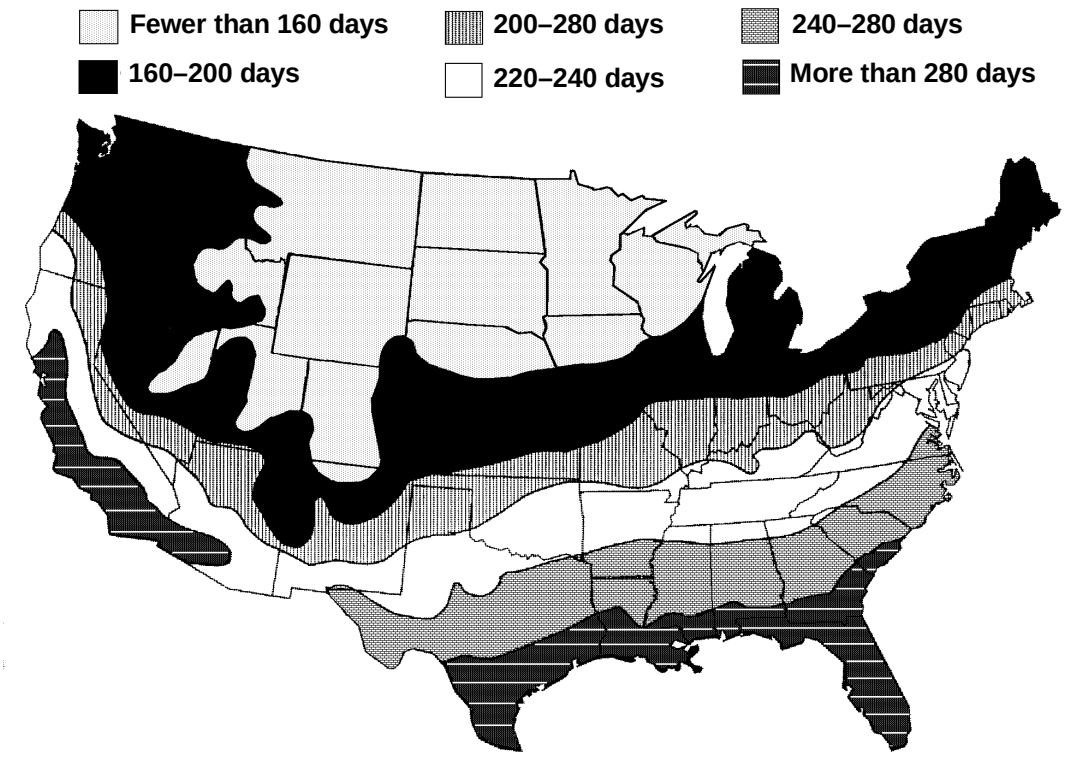


Fig. 1. Zones depicting general differences in the length of the growing season.

correct terminology for drawdown date can be determined for each area using these rules of thumb.

Moist-soil Vegetation

The timing of a drawdown has an important influence on the composition and production of moist-soil plants. Although the importance of specific factors resulting in these differences has not been well studied for moist-soil vegetation, factors such as seed banks, soil types, soil temperatures, soil moisture levels, soil–water salinities, day length, and residual herbicides undoubtedly influence the composition of developing vegetation.

Water manipulations will be effective and economical only if the site has been properly designed and developed (Table 2). Levees, type and dependability of water source (e.g., ground water, river, reservoir), type and placement of water control structures, water supply and drainage systems, and landform are among the most important elements that must be considered. Independent control and timing of water supply, distribution, depth, and discharge within and among units are essential (Table 2).

An independent water supply for each unit is required to optimize food production, maintain the potential to control problem vegetation, and make food resources available for wildlife (Table 2). Optimum management also requires that each unit have the capability of independent discharge. Stoplog water control structures that permit water level manipulations as small as 2 inches provide a level of fine tuning that facilitates control of problem vegetation or enhancement of desirable vegetation.

Table 1. *Environmental conditions associated with time of drawdown in southeastern Missouri.*

	Date	Temperature	Rainfall	Evapotranspiration
Early	1 April–15 May	Moderate	High	Low
Mid	15 May–1 July	Moderate–High	Moderate	Moderate
Late	1 July or later	High	Low	High

Table 2. *Important considerations in evaluating wetland management potential.*

Factors	Optimum condition
Water supply	Independent supply into each unit Water supply enters at highest elevation
Water discharge	Independent discharge from each unit Discharge at lowest elevation for complete drainage Floor of control structure set at correct elevation for complete drainage
Water control	Stoplog structure allowing 2-inch changes in water levels Adequate capacity to handle storm events
Optimum unit size	5 to 100 acres
Optimum number of units	At least 5 within a 10-mile radius of units

Wetland systems with high salinities can easily accumulate soil salts that affect plant vigor and species composition. Wetland unit configurations that allow flushing of salts by flowing sheet water across the gradient of a unit are essential in such areas. A fully functional discharge system is a necessity in arid environments to move water with high levels of dissolved salts away from intensively managed basins. Thus, successful management in arid environments requires units with an independent water supply and independent discharge as well as precise water-level control.

Scheduling Drawdowns

During most years, early and midseason drawdowns result in the greatest quantity of seeds produced (Table 3). However, there are exceptions, and in some cases, late drawdowns are very successful in stimulating seed production.

Table 3. *Response of common moist-soil plants to drawdown date.*

	Species		Drawdown date		
Family	Common name	Scientific name	Early[a]	Midseason[b]	Late[c]
Grass	Swamp timothy	*Heleochloa schoenoides*	+[d]	+++	+
	Rice cutgrass	*Leersia oryzoides*	+++	+	
	Sprangletop	*Leptochloa* sp.		+	+++
	Crabgrass	*Digitaria* sp.		+++	+++
	Panic grass	*Panicum* sp.		+++	++
	Wild millet	*Echinochloa crusgalli* var. *frumentacea*	+++	+	+
	Wild millet	*Echinochloa walteri*	+	+++	++
	Wild millet	*Echinochloa muricata*	+	+++	+
Sedge	Red-rooted sedge	*Cyperus erythrorhizos*		++	
	Chufa	*Cyperus esculentus*	+++	+	
	Spikerush	*Eleocharis* spp.	+++	+	+
Buckwheat	Pennsylvania smartweed	*Polygonum pensylvanicum*	+++		
	Curltop ladysthumb	*Polygonum lapathifolium*	+++		
	Dock	*Rumex* spp.		+++	+
Pea	Sweetclover	*Melilotus* sp.	+++		
	Sesbania	*Sesbania exalta*	+	++	
Composite	Cocklebur	*Xanthium strumarium*	++	+++	++
	Beggarticks	*Bidens* spp.	+	+++	+++
	Aster	*Aster* spp.	+++	++	+
Loosestrife	Purple loosestrife	*Lythrum salicaria*	++	++	+
	Toothcup	*Ammania coccinea*	+	++	++
Morning glory	Morning glory	*Ipomoea* spp.	++	++	
Goosefoot	Fat hen	*Atriplex* spp.	+++	++	

[a] Drawdown completed within the first 45 days of the growing season.
[b] Drawdown after first 45 days of growing season and before 1 July.
[c] Drawdown after 1 July.
[d] + = fair response; ++ = moderate response; +++ = excellent response.

In areas characterized by summer droughts, early drawdowns often result in good germination and newly established plants have time to establish adequate root systems before dry summer weather predominates. As a result, early drawdowns minimize plant mortality during the dry period. Growth is often slowed or halted during summer, but when typical late growing-season rains occur, plants often respond with renewed growth and good seed production. In contrast, midseason drawdowns conducted under similar environmental conditions often result in good germination, but poor root establishment. The ultimate result is high plant mortality or permanent stunting. If the capability for irrigation exists, the potential for good seed production following midseason or late drawdowns is enhanced.

Germination of each species or group of species is dependent on certain environmental conditions including soil temperature and moisture. These conditions change constantly and determine the timing and density of germination (Table 3). Smartweeds tend to respond best to early drawdowns, whereas sprangletop response is best following late drawdowns. Some species are capable of germination under a rather wide range of environmental conditions; thus, control of their establishment can be difficult. Classification of an entire genera into a certain germination response category often is misleading and inappropriate. For example, variation exists among members of the millet group (*Echinochloa* spp.). *Echinochloa frumentacea* germinates early, whereas *E. muricata* germinates late because of differences in soil temperature requirements. Such variation among members of the same genus indicates the need to identify plants to the species level.

Natural systems have flooding regimes that differ among seasons and years. Repetitive manipulations scheduled for specific calendar dates year after year often are associated with declining productivity. Management assuring good production over many years requires variability in drawdown and flooding dates among years. See *Fish and Wildlife Leaflet* 13.2.1 for an example of how drawdown dates might be varied among years.

Wildlife Use

Drawdowns serve as an important tool to attract a diversity of foraging birds to sites with abundant food resources. Drawdowns increase food availability by concentrating foods in smaller areas and at water depths within the foraging range of target wildlife. A general pattern commonly associated with drawdowns is an initial use by species adapted to exploiting resources in deeper water. As dewatering continues, these "deep water" species are gradually replaced by those that are adapted to exploit foods in

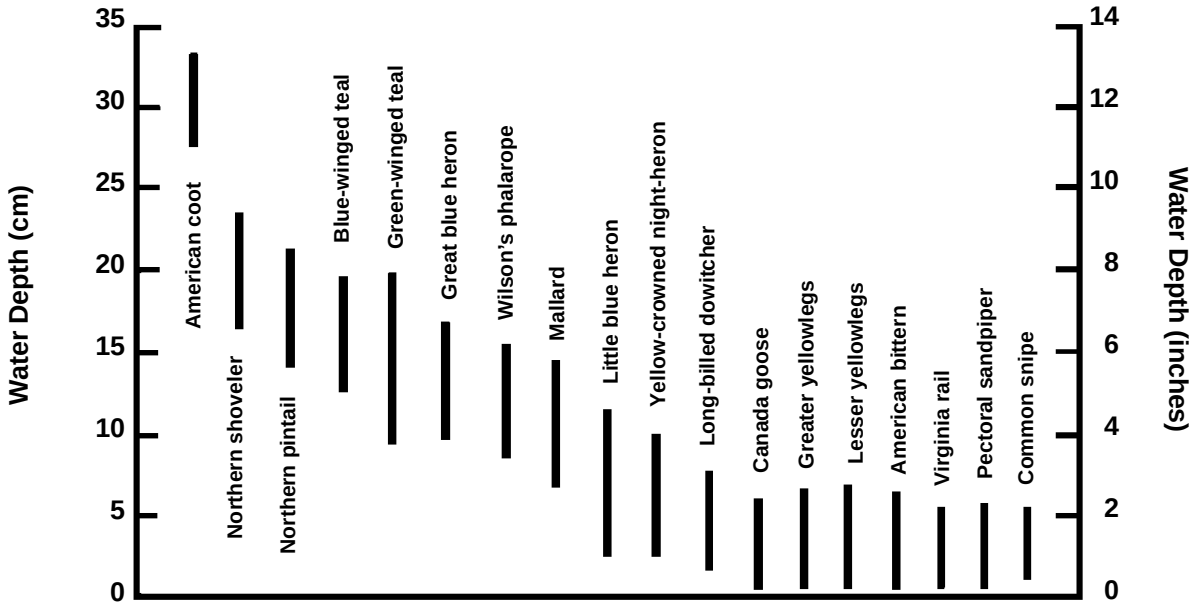


Fig. 2. Preferred water depths for wetland birds commonly associated with moist-soil habitats.

shallower water (Fig. 2). The most effective use of invertebrate foods by wetland birds occurs when drawdowns to promote plant growth are scheduled to match key periods of migratory movement in spring. By varying drawdown dates among units, the productivity of each unit can be maintained and resources can be provided for longer periods. Slow drawdowns also prolong use by a greater number and diversity of wetland wildlife.

Effects of Drawdown Rate

Moist-soil Plant Production

Fast Drawdowns

Sometimes fast drawdowns (1–3 days) are warranted, especially in systems with brackish or saline waters where the slow removal of water may increase the level of soil salts. However, in most locations fast drawdowns should only be scheduled early in the season or when flood irrigation is possible. Rapid drawdowns that coincide with conditions of high temperature and little rainfall during the growing season create soil moisture conditions that often result in poor moist-soil responses (Table 4). Some germination may occur, but generally development of root systems is inadequate to assure that these newly established plants survive during summer drought. Thus, at latitudes south of St. Louis, fast drawdowns are never recommended after 15 June if irrigation is not possible.

Slow Drawdowns

Slow drawdowns (2–3 weeks) usually are more desirable for plant establishment and wildlife use. The prolonged period of soil saturation associated with slow drawdowns creates conditions favorable for moist-soil plant germination and establishment (Table 4). For example, slow drawdowns late in the growing season can result in seed yields of 700 pounds per acre. Rapid drawdowns on adjacent units subject to identical weather conditions have resulted in 50 pounds per acre. Furthermore, slow drawdowns provide shallow water over a longer period, ensuring optimum foraging conditions for wildlife. If salinities tend to be high, slow drawdowns should only be scheduled during winter or early in the season when ambient temperatures and evapotranspiration are low.

Table 4. *Comparison of plant, invertebrate, bird, and abiotic responses to rate and date of drawdown among wet and dry years.*

	Drawdown rate	
	Fast[a]	Slow[b]
Plants		
Germination		
Period of ideal conditions	short	long
Root development		
Wet year	good	excellent
Dry year	poor	excellent
Seed production		
Early season	good	excellent
Mid–late season	not recommended	excellent
Wet year	good	good
Drought year	poor	good
Cocklebur production	great potential	reduced potential
Invertebrates		
Availability		
Early season	good	excellent
Mid–late season	poor	good
Period of availability	short	long
Bird use		
Early season	good	excellent
Mid–late season	poor	good
Nutrient export	high	low
Reducing soil salinities	good	poor

[a] Less than 4 days.
[b] Greater than 2 weeks.

Invertebrate Availability in Relation to Drawdowns

When water is discharged slowly from a unit, invertebrates are trapped and become readily available to foraging birds along the soil–water interface or in shallow water zones (Table 4). These invertebrates provide the critical protein-rich food resources required by pre-breeding and breeding female ducks, newly hatched waterfowl, molting ducks, and shorebirds. Shallow water for foraging is required by the vast majority of species; e.g., only 5 of 54 species that commonly use moist-soil impoundments in Missouri can forage effectively in water greater than 10 inches. Slow drawdowns lengthen the period for optimum foraging and put a large portion of the invertebrates within the foraging ranges of many species. See *Fish and Wildlife Leaflet* 13.3.3 for a description of common invertebrates in wetlands.

Spring Habitat Use by Birds

Slow drawdowns are always recommended to enhance the duration and diversity of bird use (Table 4). Creating a situation in which the optimum foraging depths are available for the longest period provides for the efficient use of food resources, particularly invertebrate resources supplying proteinaceous foods. Partial drawdowns well in advance of the growing season (late winter) tend to benefit early migrating waterfowl, especially mallards and pintails. Early-spring to mid-spring drawdowns provide resources for late migrants such as shovelers, teals, rails, and bitterns. Mid- and late-season drawdowns provide food for breeding waders and waterfowl broods. These later drawdowns should be timed to coincide with the peak hatch of water birds and should continue during the early growth of nestlings or early brood development.

Fall Flooding Strategies

Scheduling fall flooding should coincide with the arrival times and population size of fall migrants (Table 5). Sites with a severe disease history should not be flooded until temperatures

Table 5. *Water level scenario for target species on three moist-soil impoundments and associated waterbird response.*

	Unit A		Unit B		Unit C	
	Water level		Water level		Water level	
Period	Scenario	Response	Scenario	Response	Scenario	Response
Early fall	Dry	None	Dry	None	Gradual flooding starting 15 days before the peak of early fall migrants; water depth never over 4 inches	Good use immediately; high use by teal, pintails, and rails within 2 weeks
Mid fall	Dry	None	Flood in weekly 1–2-inch increments over a 4-week period	Excellent use by pintails, gadwalls, and wigeons	Continued flooding through September	Excellent use by rails and waterfowl
Late fall	Flood in weekly 2–4-inch increments over a 4–6-week period	Excellent use immediately by mallards and Canada geese	Continued flooding, but not to full functional capacity	Excellent use by mallards and Canada geese	Continued flooding to full functional capacity	Good use by mallards and Canada geese
Winter	Maintain flooding below full functional capacity	Good use by mallards and Canada geese when water is ice free	Maintain flooding below full functional capacity	Good use by mallards and Canada geese when water is ice free	Continued flooding to full pool	Good use by mallards and Canada geese when water is ice free
Late winter	Schedule slow drawdown to match northward movement of migrant waterfowl	Excellent use by mallards, pintails, wigeons, and Canada geese	Schedule slow drawdown to match northward movement of early migrating waterfowl	Excellent use by mallards, pintails, wigeons, and Canada geese	Schedule slow drawdown to match northward movement of waterfowl	Good use by mallards and Canada geese when water is ice free
Early spring	Continued slow drawdown to be completed by 1 May	Excellent use by teals, shovelers, shorebirds, and herons	Drawdown completed by 15 April	Excellent shorebird use	Drawdown completed by 15 April	Excellent shorebird use

moderate. When flooding is possible from sources other than rainfall, fall flooding should commence with shallow inundation on impoundments suited for blue-winged teals and pintails. Impoundments with mature but smaller seeds, such as panic grass and crabgrasses, that can be flooded inexpensively are ideal for these early migrating species. Flooding always should be gradual and should maximize the area with water depths no greater than 4 inches (Fig. 3). As fall progresses, additional units should be flooded to accommodate increasing waterfowl populations or other bird groups such as rails. A reasonable rule of thumb is to have 85% of the surface area of a management complex flooded to an optimum foraging depth at the peak of fall waterfowl migration.

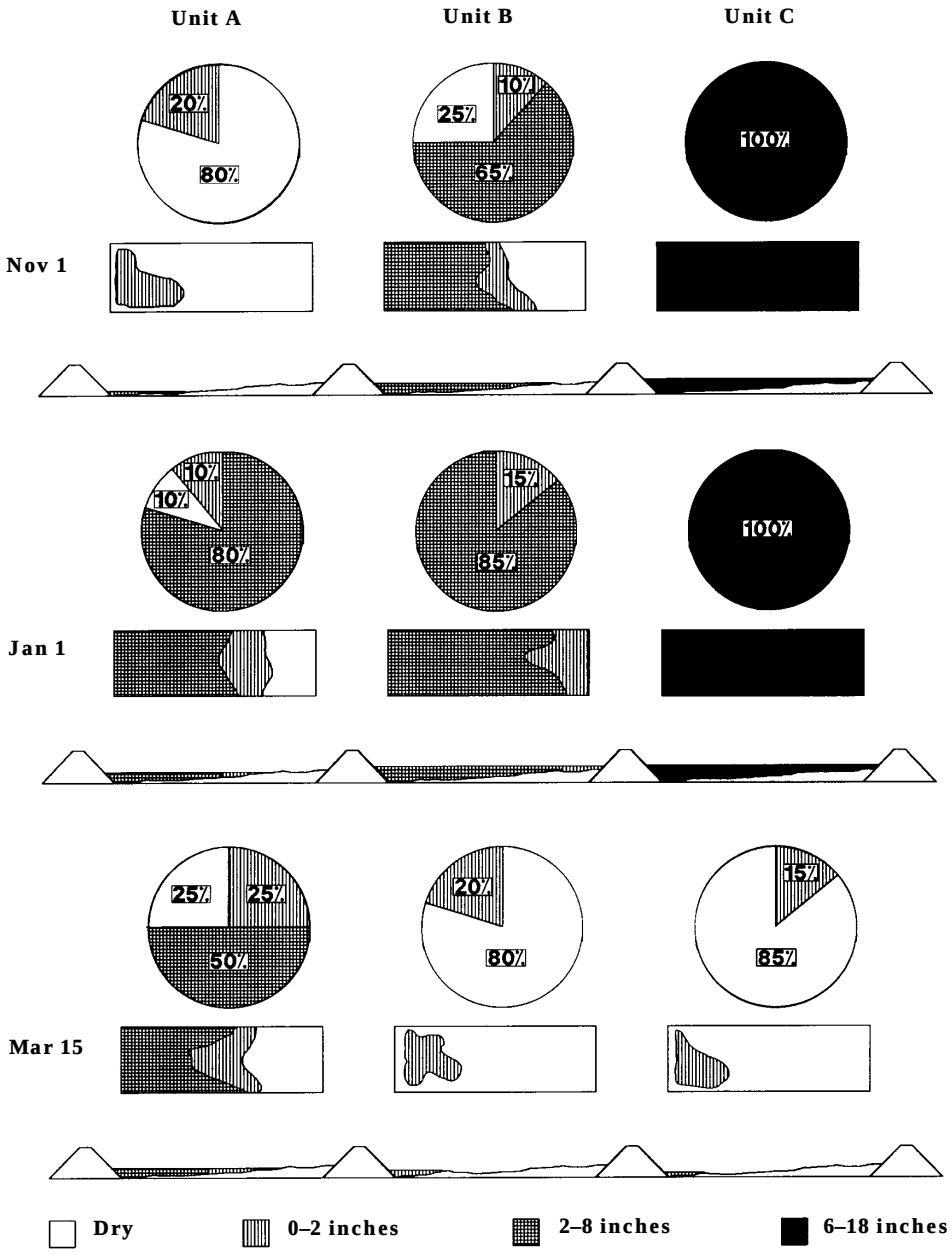


Fig. 3. Planned flooding strategies for three moist-soil units during one winter season. The initiation, depth, and duration of flooding are different for each unit. Note that two of the three units were never intentionally flooded to capacity. This does not mean that natural events would not flood the unit to capacity. Flooding strategies should be varied among years to enhance productivity.

Suggested Reading

Eldridge, J. 1990. Aquatic invertebrates important for waterfowl production. U.S. Fish Wildl. Leafl. 13.3.3. 7 pp.

Fredrickson, L. H., and T. S. Taylor. 1982. Management of seasonally flooded impoundments for wildlife. U.S. Fish Wildl. Serv., Resour. Publ. 148. 29 pp.

Fredrickson, L. H., and F. A. Reid. 1986. Wetland and riparian habitats: a nongame management overview. Pages 59–96 *in* J. B. Hale, L. B. Best, and R. L. Clawson, eds. Management of nongame wildlife in the Midwest: a developing art. Northcentral Section, The Wildlife Society, Madison, Wis.

Fredrickson, L. H. and F. A. Reid 1988. Waterfowl use of wetland complexes. U.S. Fish Wildl. Leafl. 13.2.1. 6 pp.

Reid, F. R., J. R. Kelley, Jr., T. S. Taylor, and L. H. Fredrickson. 1989. Upper Mississippi Valley wetlands—refuges and moist-soil impoundments. Pages 181–202 *in* L. Smith, R. Pederson, and R. Kaminski, eds. Habitat management for migrating and wintering waterfowl in North America. Texas Tech University Press, Lubbock.

Appendix. Common and Scientific Names of Birds Named in Text.

Pied-billed grebe	*Podilymbus podiceps*
American bittern	*Botaurus lentiginosus*
Great blue heron	*Ardea herodias*
Little blue heron	*Egretta caerulea*
Yellow-crowned night-heron	*Nycticorax violaceus*
Tundra swan	*Cygnus columbianus*
Snow goose	*Chen caerulescens*
Canada goose	*Branta canadensis*
Mallard	*Anas platyrhynchos*
Northern pintail	*Anas acuta*
Northern shoveler	*Anas clypeata*
Blue-winged teal	*Anas discors*
Canvasback	*Aythya valisineria*
Virginia rail	*Rallus limicola*
American coot	*Fulica americana*
Greater yellowlegs	*Tringa melanoleuca*
Lesser yellowlegs	*Tringa flavipes*
Pectoral sandpiper	*Calidris melanotos*
Long-billed dowitcher	*Limnodromus scolopaceus*
Wilson's phalarope	*Phalaropus tricolor*
Common snipe	*Capella gallinago*

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
***Fish and Wildlife Leaflet* 13**
Washington, D.C. • 1991

Build a duck nest box

Wood ducks, Barrow's goldeneyes, common goldeneyes, hooded mergansers, common mergansers and buffleheads are all cavity nesting ducks. They build nests in abandoned woodpecker holes or natural tree cavities caused by disease, fire or lightning. These ducks will also use a constructed nesting box. Here are plans for a nest box that you can build, install and maintain. The design, which is used by the Ducks Unlimited Greenwing program, may even attract other cavity nesting birds such as kestrels, tree swallows, great crested flycatchers or screech owls.

Cedar is ideal*

Cedar lumber is recommended because it is naturally resistant to weather and insects. You can also use any materials you have available such as pine or plywood. The box pictured uses 10.5 linear feet of 1" X 10" (3/4" thick by 9 1/4" wide) lumber that is rough on one side (for the inside of the box).

*Ducks Unlimited staff in the interior of British Columbia indicate that plywood boxes better withstand the region's temperature extremes.

Finishing touches

Ducks Unlimited does not recommend applying a finish to cedar boxes. A finish might help to extend the life of a plywood box.

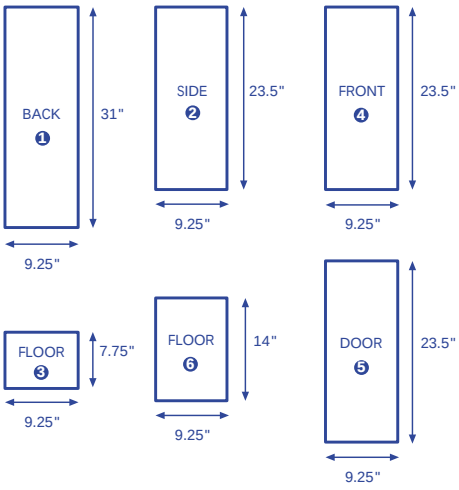
If you decide to apply a finish to your nest box, use a nontoxic wood preserver or a light shade of an earth tone paint. The ducks will find your box by seeing the contrast in color caused by the entry hole. Do not apply finish inside the box.

Cavity nesting ducks do not carry nesting materials. It's important to help them out by placing four to six inches of wood shavings in the bottom of the box. You can find wood shavings at your local pet or farm supply store. **Do not use sawdust.** It can suffocate ducklings.

Every year, in the fall after the nesting season has completed or in the winter, clean out old nesting material from the box and replace it with a fresh layer of wood shavings. **This annual cleaning needs to be a part of your long-term maintenance commitment once you place your nest box.**

Constructing and placing a nest box is a fun project that brings years of enjoyment. Above: this pole mounted nest box features a conical metal predator guard. Below: wood duck drake.

MATERIAL MEASUREMENTS - *not to scale*



PROCEDURE

Tools needed: handsaw or table saw, drill and 1/2" bit, jigsaw, screwdriver, sandpaper, pencil, measuring tape, straight-edge

1) Measure and cut your wood to produce the six pieces. Number the pieces as shown. See material measurements.

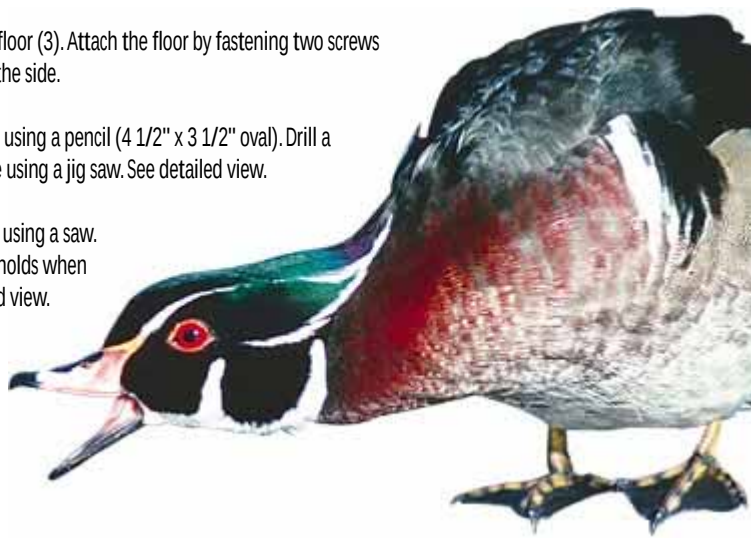
2) Attach the back (1) to the side (2) using four screws fastened from the back of the box. See exploded view (next page).

3) Drill five 1/2" drainage holes in the floor (3). Attach the floor by fastening two screws through the back and two through the side.

4) Draw the entry hole on the front (4) using a pencil (4 1/2" x 3 1/2" oval). Drill a pilot hole and cut out the entry hole using a jig saw. See detailed view.

5) Score the inside face of the front (4) using a saw. The horizontal slots will provide toeholds when the ducklings climb out. See detailed view.

continued…



Finding the right place

Now that you've completed construction of your nest box, you need to consider where to install it. Be sure to place the box in a location that will be convenient for monitoring and annual maintenance.

Where to find tenants

To increase the chances of your nest box being used by waterfowl, it should be located in an area attractive to cavity nesting ducks. You'll see these birds using wooded wetlands that contain water year round or, at least, throughout the summer. You'll also see them using trees along riverbanks and lake shorelines.

Positioning your nest box

Nest boxes can be mounted on tree trunks or on steel poles beside the water or above the water.

Good placement a dead tree at the water's edge
Better placement a solid dead tree in the water
Best placement boxes on poles near standing, flooded, dead trees

Live trees can be used for mounting boxes, but keep a close eye on your box. Growing trees may loosen mounts and make boxes less attractive to the birds.

Tree Trunks
Live and dead trees are suitable. If beavers are about, don't place nest boxes on poplar or white birch trees. Beavers eat these trees.

Steel Poles
Make sure the poles are fixed solidly in the soil, or marsh bottom, to ensure that the nest boxes are stable. Drill two holes in this pole to accommodate a predator guard (see below).

- Boxes should be placed above typical high water levels and at a height that will allow you to access the box for monitoring and maintenance (about 4 to 6 feet above land or water). In terms of distance inland, try to keep your box close to the water.
- Clear an unobstructed flight path to your nest box by removing branches that might be in the way.
- The entrance hole to the box should face the water.
- You can tip the box forward a little bit to help the ducklings reach the entrance.

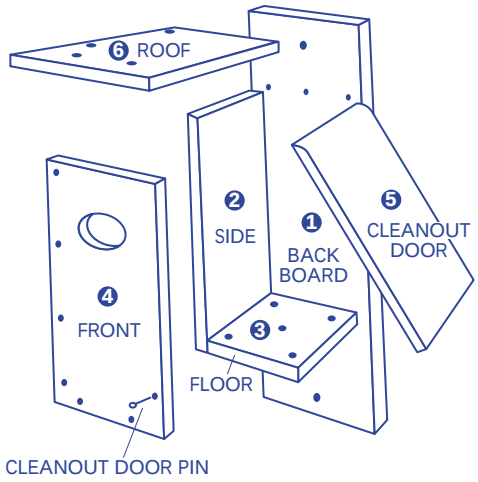
PROCEDURE (continued)

6) Attach the front (4) using six screws.

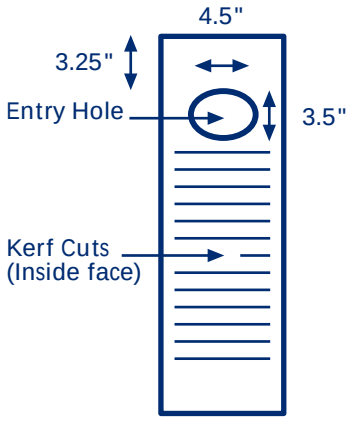
7) Round the top, outside edge of the door (5). See exploded view. Fasten the door at the top with one screw from the front and one from the back. The two screws form the hinge and allow the door to open. Pin the door shut with a nail from the front.

8) Attach the roof (6) using four screws from the top and three screws from the back (be careful not to screw into the door). The box is now ready to install. Don't forget to put a 4-6 inch layer of wood shavings in the box for nesting material.

EXPLODED VIEW - *not to scale*



DETAILED FRONT VIEW
not to scale



Predator Guards

A predator guard will help to improve the chance of a successful hatch by preventing egg-eating raccoons from entering your nest box.

1) Steel Sheet Sandwich

36" X 49" sheet of 28 gauge steel

- Fold the sheet in half along the 49" length, creating a front and a back, each 24" wide
- Along one 36" side, make a 1" fold towards the inside centre
- Drill two holes, 34" apart (see diagram)
- Place your guard so it surrounds the pole or tree trunk. Slip the unfolded side under the 1" fold. Using vice-grips, bend the corners in to lock these pieces and prevent the guard from opening.
  - *Pole mount:* bolt the guard into place about 2" below the nest box.
  - *Tree mount:* nail the guard in place — if the tree is alive, check the guard often to ensure tree growth hasn't popped the guard off.

2) Plastic Pipe Guard

Metal or plastic pipe (stove pipe, sewer pipe) drilled at the top and bottom and bolted to the tree or pole makes an effective predator guard. To prevent small rodents from crawling through, place a crumpled piece of chicken wire between the pole and the guard.

3) Plastic "Crazy Carpet" Guard

A new use for children's inexpensive plastic snow riders located in any toy store. Wrap the carpet around the tree and tack it in place. Be sure to provide room to grow if you place this guard on a living tree.

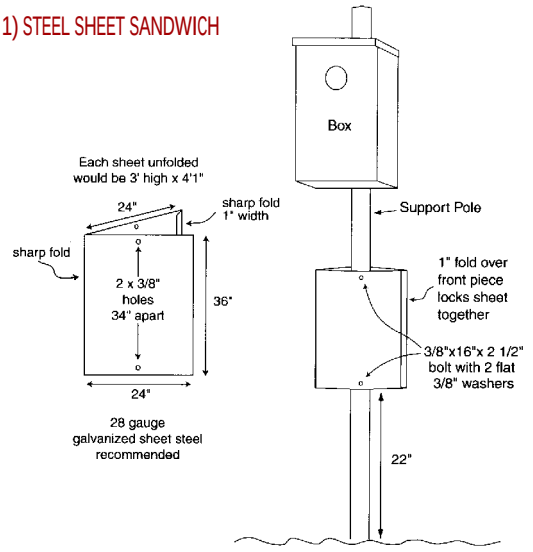
Nest box maintenance — a long-term commitment

Once a cavity nesting bird starts using your box, you'll likely see many broods raised over the years. Nesting sites for these birds are limited in number. When they find a good nesting site, there is a very good chance they'll return in following years. When you put up a nest box you are committing yourself to maintaining that box. Fall and winter are the best times to remove old nesting material, tighten any loose screws and mounts, and add new wood shavings.

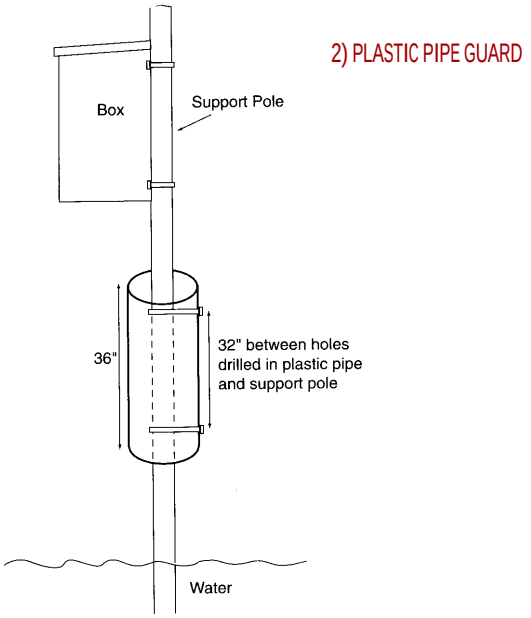
If you don't have any ducks using your box over the summer, don't worry. Waterfowl biologists have seen waterfowl migrating in the fall scope out potential nesting sites for next spring. This too is a good reason to keep your boxes in top condition. You never know when somebody might be popping in!

This information has been compiled from the *Nest Box Guide for Waterfowl* by Ducks Unlimited and the Canadian Wildlife Service, Environment Canada; and a *Conservator* article (Vol. 19, No. 3) by Mearl Rooney.

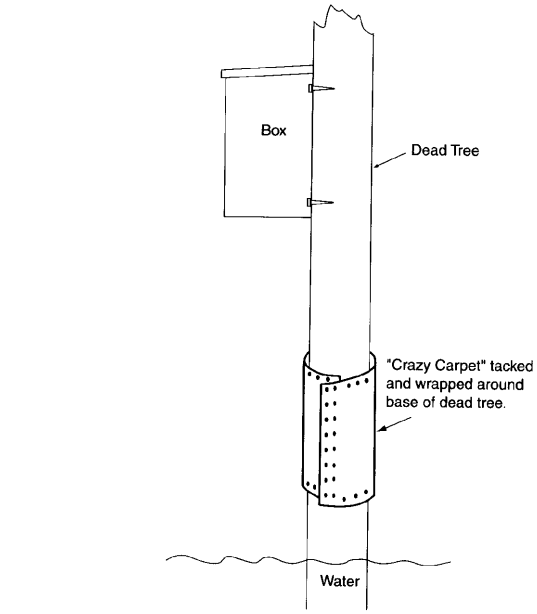
1) STEEL SHEET SANDWICH



2) PLASTIC PIPE GUARD



3) CRAZY CARPET GUARD



USDA NRCS Natural Resources Conservation Service
Wildlife Habitat Management Institute

WILDLIFE HABITAT COUNCIL℠

Wood Duck
(Aix sponsa)

Fish and Wildlife Habitat Management Leaflet

General Information

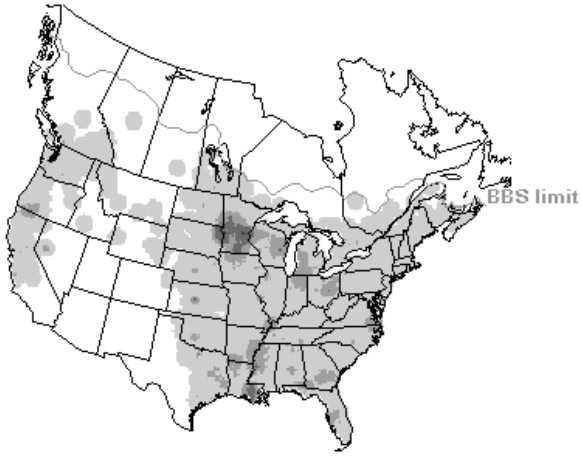
The wood duck is considered by many bird watchers to be North America's most colorful waterfowl species. Its scientific name, Aix sponsa, translates into “waterbird in bridal dress.” Today the wood duck is one of the most common waterfowl species breeding in the United States. However, this was not always the case. Writings from the early 19th century indicate that wood ducks were in abundant supply and very popular for their tasty meat and bright decorative feathers. By the late 1880's, unregulated hunting and destruction of woodland and wetland habitat had caused the wood duck population to decline to alarmingly low levels. By the beginning of the 20th century, wood ducks had virtually disappeared from much of their former range.

In response to the Migratory Bird Treaty established in 1916 and enactment of the Federal Migratory Bird Treaty Act in 1918, wood duck populations began to slowly recover. By ending unregulated hunting and taking measures to protect remaining habitat, wood duck populations began to rebound in the 1920's. The development of the artificial nesting box in the 1930's gave an additional boost to wood duck production. Wood ducks eagerly accepted boxes as suitable nesting sites, and over the following fifty years, conservation groups and individuals helped increase numbers of wood ducks by preserving habitat and erecting nest boxes. The combination of hunting restrictions and habitat conservation and management measures enabled wood duck populations to rebound enough to support conservative hunting in the 1940's. The story of the wood duck is an example of how active wildlife management techniques can have a tremendous effect on the overall success of an individual species.

This pamphlet is designed to serve as an introduction to the habitat requirements of the wood duck and to assist in the development of a comprehensive wood duck management plan. The success of any individual species management plan depends on targeting the specific needs of the species and analyzing the designated habitat areas as a whole to ensure that all habitat requirements are present. This guide also provides recommendations for monitoring the program to ensure successes are documented and problems are addressed before they impact the success of the overall management plan.

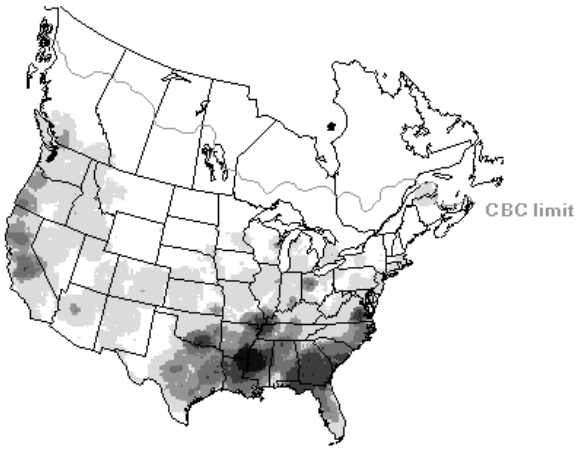
Range

The wood ducks' range extends on the east coast from Nova Scotia west to the north central U.S. and south to Florida and the Gulf of Mexico. Birds nesting in New England winter in the Atlantic states from the Carolinas southward. Midwestern wood ducks winter in the area extending from Georgia west to Texas. On the west coast, the wood ducks' range extends from British Columbia



Breeding Range

south to the Mexican border. Upper west coast wood ducks will winter in southern California and the Mexican Pacific coast. Southern breeding wood ducks are year-round residents. Fall migration generally begins in October and extends into November. Spring migration occurs during March and April. Wood ducks migrate either in pairs or in small flocks. Wood ducks respond well to habitat protection and restoration activities, and breeding pairs are increasing use of suitable habitat outside traditional breeding areas.



Winter Range

Habitat Requirements

General

Wood ducks nest in woodland areas along lakes, rivers, and vegetated wetland areas. During the winter months, wood ducks inhabit bottomland hardwood wetlands, beaver ponds and flowages, river oxbows, meanders and backwaters, and other inland freshwater forested wetland areas. Habitat areas chosen by wood ducks are commonly used by other waterfowl species such as black ducks, hooded mergansers, and ring-necked ducks. High-quality wood duck habitat is intricately linked to preservation and management of old growth timber along river corridors and availability of nesting sites. Although wood duck populations have recovered, the largest threat to their future is the continued loss of habitat. By protecting and restoring floodplain timber, river oxbows and meanders, and other freshwater wetland and riparian habitats, landowners can assist in the continued success of wood ducks and other migratory waterfowl species that rely on similar habitats.

Food

Food for young birds and adults differs dramatically. The early diet of ducklings consists largely of insects, aquatic invertebrates, small fish, and other high-protein animal material. After six weeks of age, the young switch to plant foods until their diet consists of approximately 90 percent vegetative material, primarily aquatic plants such as algae, watermeal, watershield, sago pondweed, and duckweed. Adult wood ducks feed on a variety of nuts and fruits, aquatic plants and seeds, and aquatic insects and other invertebrates. Insects and aquatic invertebrates are particularly important food items of adult hens during egg laying in spring. Acorns and other forest mast are important fall and winter foods. While acorns are the primary winter foods, the seeds of bald cypress, hickory, sweet gum, buttonbush, arrow-arum, bur-reed, and wild rice are also common winter foods. Wood ducks feed primarily in shallow water areas, but will also forage on the forest floor for seeds, acorns, and nuts.

Important wood duck food plants. The following species are known to be important food items in the diet of wood ducks. Those species in bold print are of particular value for their usefulness as a winter food source.

oak (acorns)	**hickory (nuts)**	**elm**	**bald cypress**	**beech (nuts)**	**sweet gum**	**bulrush**
ash	**button bush**	maple	blackgum	**bur-reed**	rice cutgrass	pondweed
arrow-arum	**wild rice**	**sedge**	smartweeds	barnyard grass	nightshade	watershield
cowlily	beggarticks	duckweed	**grape**	St. John's-wort	panic grasses	waterlily

These species may be used to enhance vegetation which already exists in and around woodland areas and aquatic habitats. Adding these species to those currently existing will enhance food availability for wood ducks.

Cover — Nesting

Wood ducks nest in natural tree cavities and in some cases, those excavated and abandoned by woodpeckers. Nesting boxes are also readily accepted for nesting. Nesting pairs typically select cavities in deciduous woodland areas in close proximity to rivers, wetlands, and other suitable aquatic habitats used for brood rearing. Cavities located 30 feet or more above the ground are preferred, but the height can vary from near ground level to 65 feet. Suitable natural cavity dimensions typically have an entrance hole diameter of at least 4 inches, an inside diameter of approximately 6 to 8 inches, and a depth of at least 24 inches. Optimal nesting habitat contains up to five suitable cavities per acre in close proximity to brood-rearing habitat; however, since most natural cavities are not suitable for use by nesting wood ducks, these conditions frequently require that 50 or 60 natural cavities per acre exist. This illustrates the utility of providing suitable artificial nesting boxes to augment the availability of natural cavities.

Nest Box Design. — Nest boxes should be constructed of a weather-resistant wood; cedar or cypress is often recommended. The wood can be painted, stained, or treated, but only on the outside surface. The entrance hole should have a 4-inch diameter or be an oval that is 3 inches high and 4 inches wide. Numerous nest box designs have been used with success; fig. 1 provides one example. A 3-inch wide strip of $^1/_4$-inch mesh hardware cloth should be securely fastened to the inside of the box under the entrance to function as a ladder for the hen and newly hatched ducklings. The cut edges of this cloth should be folded back before insertion to avoid injury to the ducklings. Another method of assisting the ducklings in their climb from the nest to the entrance hole is to roughen up the wood surface under the hole with a chisel. A 3-inch layer of coarse sawdust should be placed at the bottom of the box to serve as nesting material and to help prevent the eggs from rolling around. The lid or one side of the box should be removable to facilitate monitoring and cleaning. All wood duck boxes should be fitted with a galvanized sheet metal predator guard (see fig. 2). The predator guard should be placed 6 to 12 inches below the bottom of the box.

Nest Box Installation. — Wood ducks are highly secretive in selecting nest sites to minimize impacts of nest predators and competition from other wood ducks. Therefore, it is important to locate individual nest boxes in relatively secluded areas within timber stands where natural cavities would occur naturally. Nest boxes can be placed either on land or over the water. If located over the water, they should be placed at least 4 feet above the high water level and the entrance hole should face the open water rather than the shoreline. Because of ease of access by predators, installation of nest boxes directly on trees should be avoided. Nest boxes placed on land should be located from 30 to 150 feet away from the shoreline. Boxes placed directly on the shoreline appear to be more likely frequented by nest predators. Since the hen must lead her ducklings to water soon after they hatch, the area between the nest box and the water's edge should be free of any major obstacles such as roads or fencing. Nest boxes placed on poles over water are generally more easy to monitor than those placed in trees. Regardless of whether the box is placed over the water or land, the entrance should be clear of obstructions to provide easy access for the ducks.

In order to maximize nest box use while minimizing nest dumping (see sidebar below), it is generally recommended that nest boxes should be placed at least 600 feet apart and should not be visible to one another. When placing nest boxes in isolated locations, consider ease of access for monitoring purposes.

Cover — Brood Rearing

Wood duck broods require shallow water for foraging on invertebrates and aquatic plants that contain some protective cover from predators. A ratio of 50 to 75 percent cover to 25 to 50 percent open water is preferred as brood-rearing (and breeding) habitat. Cover may be provided by trees or shrubs overhanging the water, flooded woody vegetation and debris, and herbaceous emergent vegetation. Ideal shrub cover is

provided by mature shrubs that provide a dense canopy about two feet above the water surface. Button bush is an important shrub species in a large portion of the wood duck's range due to its brushy growth form, providing brood cover, and its prolific seed production, used heavily by foraging adults. Reliance on permanent, deeper water bodies for brood habitat should be avoided to minimize duckling mortality from aquatic predators such as snapping turtles and large fish.

Adult molting cover requirements are generally met by suitable brood-rearing habitat. Permanent water, cover, and food are the key elements of molting habitat.

Cover — Winter

In areas where wood ducks winter, areas similar to brood rearing habitat provide adequate winter cover. Bottomland hardwood wetlands and quiet river backwaters and streams with an abundance of partially submerged downed timber, shrubs, and woody debris are favored. Winter-persistent herbaceous emergent vegetation that has a shrubby-like life form (e.g., cattail, soft rush, bulrush, bur-reed, etc.) may also provide adequate winter cover. Security provided by overhead woody cover is the key element of good wood duck roosting habitat.

Water

Water requirements for wood ducks are assumed to be met where suitable brood-rearing and wintering habitat exist.

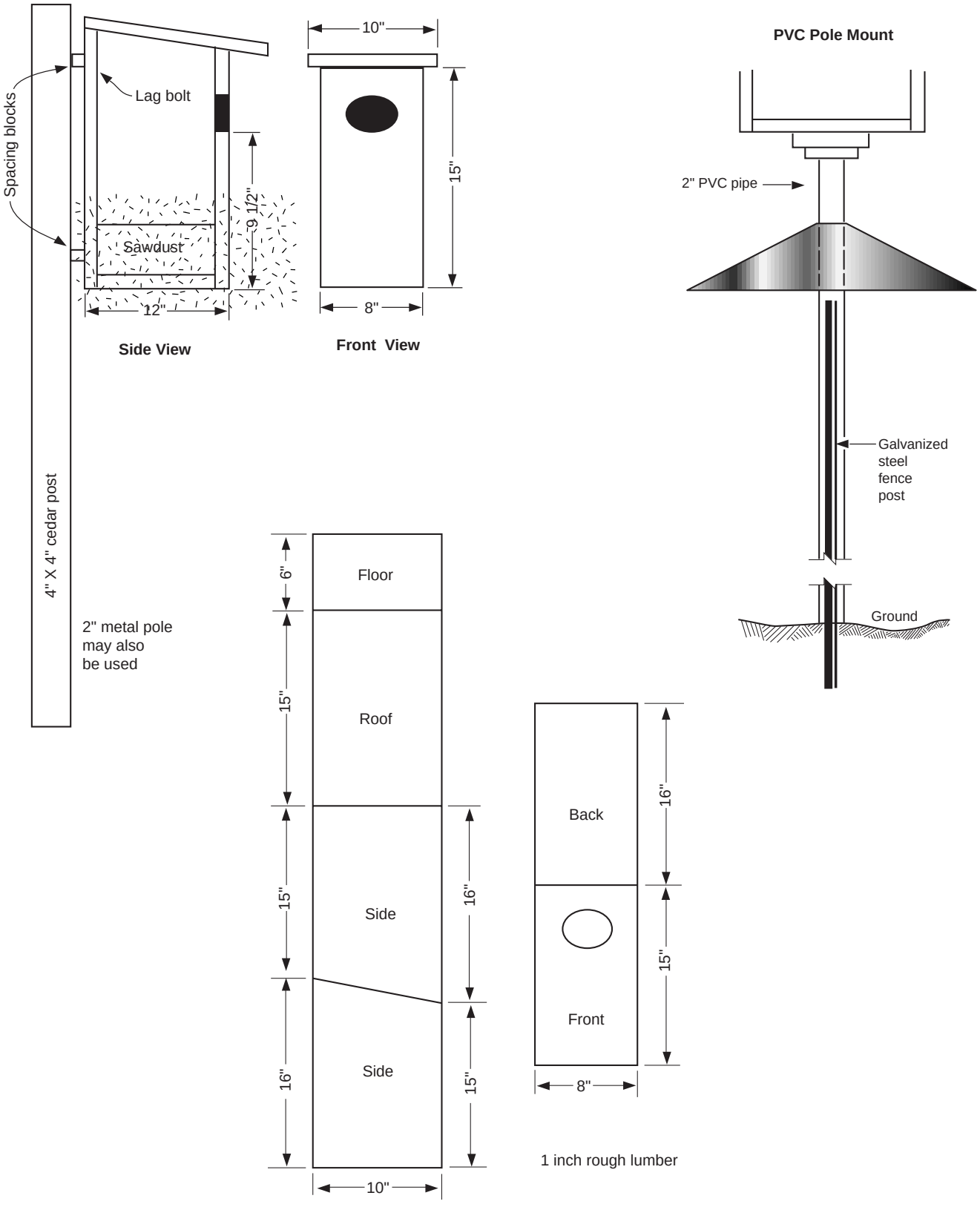
Interspersion of Habitat Components

In order for successful wood duck reproduction and survival to occur, all the habitat components must be available in relative proximity to one another. Since wood ducks are highly mobile during winter, the most critical aspect of habitat interspersion, or the mix of different habitat types, is the proximity of suitable brood-rearing habitat to nesting habitat in the spring. The highest-quality nesting habitat is of little use if the nearest brood-rearing habitat is more than a mile distant. Likewise, the best brood-rearing habitat will not support wood duck broods if there is no nesting habitat in the vicinity. In southern areas where wood ducks are year-round residents, the best habitats consist of a complex of forested wetland habitats that include live forest, green-tree reservoirs, rivers, oxbows, riparian corridors, beaver ponds, shrub-scrub and robust emergent herbaceous wetlands.

Minimum Habitat Area

Since wood ducks are able to nest at some distance from brood-rearing habitat, no reasonable estimate of minimum nesting habitat size exists. In addition, no good estimates for minimum wintering habitat area are available due to the high mobility of wintering birds. However, at least 10 acres of wetland or other aquatic habitat in a contiguous unit, or in isolated parcels separated by no more than 100 feet of upland, is needed in close proximity to nesting habitat to support brood rearing. Lands outside the immediate planning area should be considered when making the determination of minimum habitat area for wood duck reproduction.

Fig. 1. Wood duck nesting box design



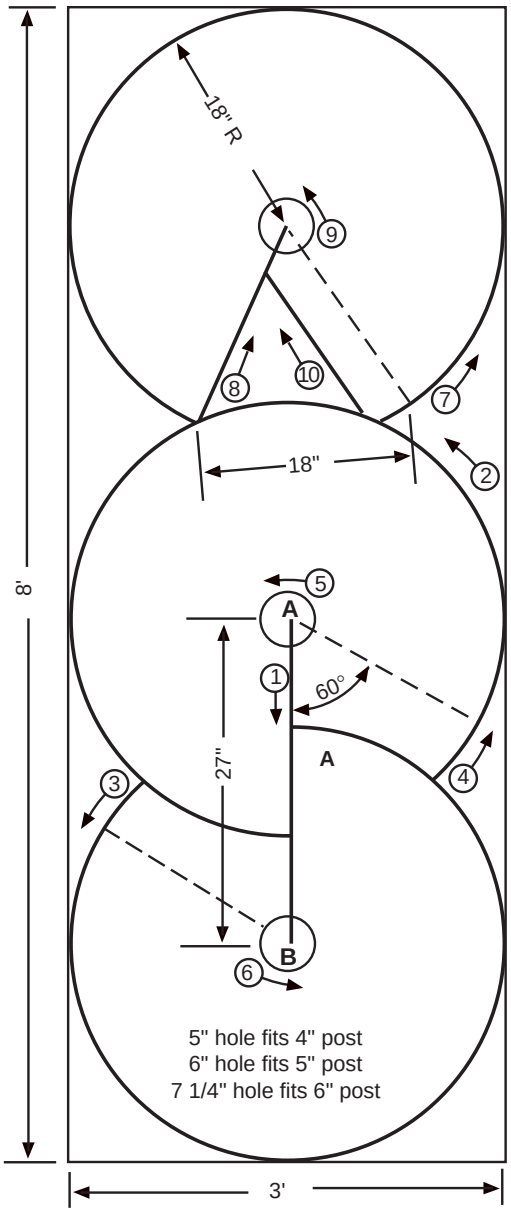
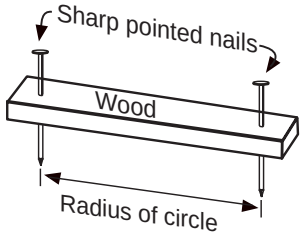
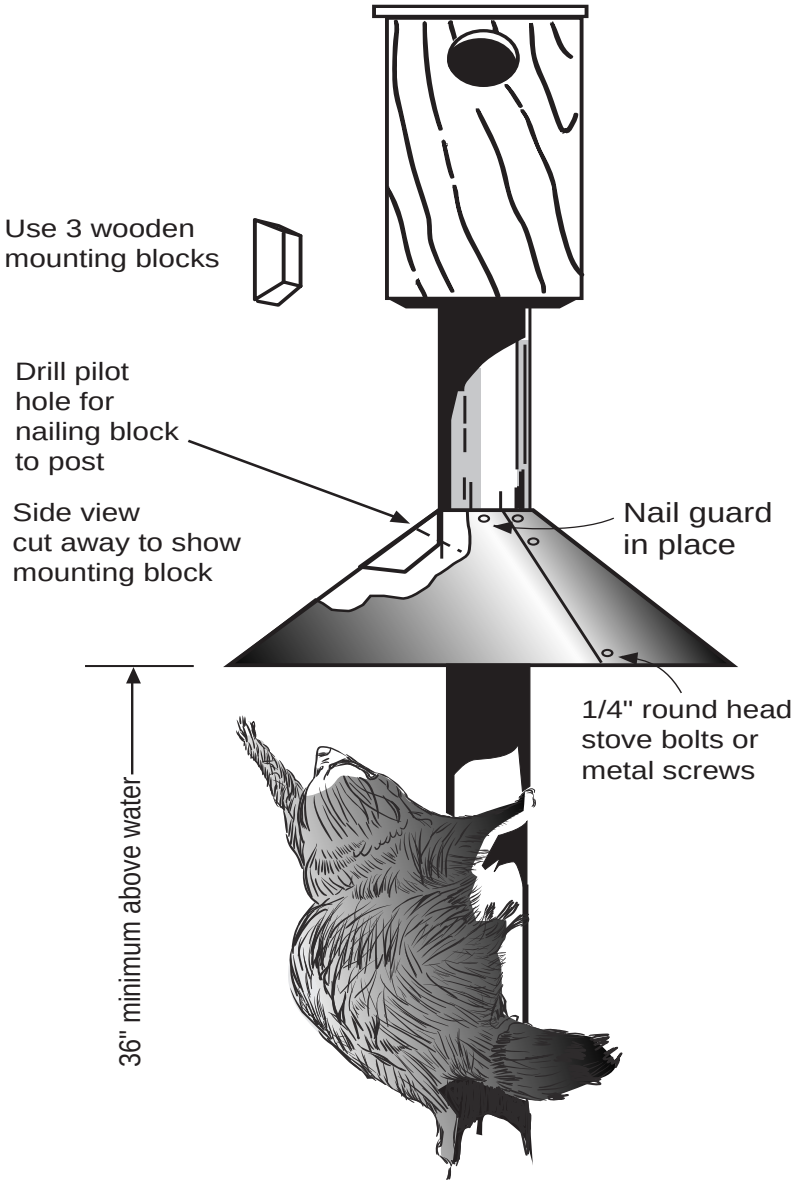


Fig. 2. Standard cone-shaped predator guard. At left is a layout for cutting three predator guards from a 3 ft x 8 ft sheet of 26-gauge galvanized metal. When installing the guard, overlap the cut edge to the dotted line. To facilitate cutting, follow the sequence of numbers. Make circular cuts in counterclockwise direction. To make initial cut on line A–B, make a slot at A with a wood chisel, use tinsnips, and wear leather gloves.



Home made compass for scribing metal



To minimize access to nest boxes by predators, metal predator guards should be installed on all wood duck box support posts.

Dump-Nests. — While the normal brood size for wood ducks is 10 to 15, nests have been found to contain 30 eggs or more. These extra eggs are the result of "egg dumping" or intraspecific brood parasitism. Egg dumping occurs as a result of several factors, including nest predation and lack of available nest sites. Dumping occurs when a female wood duck, frequently a first-year breeder, follows another hen to hidden or scarce nest sites during the egg-laying period. The visiting bird is stimulated to lay eggs in the nest of the other hen. In the wild, this impulse is kept in check because wood ducks normally nest in isolated locations. Artificial nesting structures are often mistakenly erected close together and in highly visible locations, such as the center of a pond. This creates a situation where egg dumping is common, and overall reproductive success plummets. A hen whose nest is dumped with too many eggs may abandon it; the result is a huge amount of wasted reproductive effort. In a natural scenario, approximately 80 percent of eggs hatch. But where egg dumping is out of control, hatch rates may drop to as low as 10 percent. Because of this, it is critical to locate nest boxes in isolated locations as described above. If wood ducks are very rare in the area, it may be necessary to place boxes in open areas initially to encourage use, and then moving them to more secretive locations as the population increases.

Wood Duck Habitat Requirements Summary Table.

Habitat Component	Habitat Requirements
Food — Young	• Insects, aquatic invertebrates, small fish, and other high-protein animal material. • Aquatic plants such as algae, watermeal, watershield, sago pondweed, and duckweed.
Food — Adult	• Seeds of oaks, bald cypress, hickory, sweet gum, beech, button bush, arrow-arum, bur-reed, wild rice, and other mast-producing plants. • Aquatic insects and other invertebrates. • Aquatic plants and seeds.
Nesting Cover	• Natural tree cavities or artificial nesting boxes in deciduous woodlands in close proximity to rivers, wetlands, and other suitable aquatic habitats used for brood rearing.
Brood-Rearing Cover	• Shallow water for foraging on invertebrates and aquatic plants that contain some protective cover from predators. A ratio of 50 to 75 percent cover to 25 to 50 percent open water is preferred.
Winter Cover	• Bottomland hardwood wetlands with an abundance of partially submerged downed timber, shrubs, and woody debris.
Water	• Water requirements are met where wetlands suitable as brood-rearing and wintering habitat exist.
Interspersion	• Prefer a complex of forested wetland habitats that include live forest, green-tree reservoirs, rivers, oxbows, riparian corridors, beaver ponds, shrub-scrub and robust emergent herbaceous wetlands.
Minimum Habitat Size	• At least 10 acres of wetland or other aquatic habitat should be available in a contiguous unit or in isolated parcels separated by no more than 100 feet of upland in close proximity to nesting habitat.

Limiting Factors

For planning purposes, inventory the site to determine the availability of each of the basic habitat components, based on the above narrative habitat requirement descriptions. Habitat components that are absent or rated low are limiting the value of the habitat for wood ducks.

	Availability/Quality			
Habitat Component	**High**	**Medium**	**Low**	**Absent**
Food				
Nesting cover				
Brood-rearing cover				
Winter cover (may not be applicable if wood ducks do not winter in the area)				
Water				
Interspersion of habitat components				
Minimum habitat size				

Management Prescriptions

Management treatments should address the habitat components that are determined to be limiting wood duck habitat potential. For planning purposes, select among the possible action items listed below to raise the quality or availability of each habitat component determined to be limiting. A list of programs that may provide financial or technical assistance to carry out specific management practices is provided.

Habitat Component	Management options for increasing habitat quality or availability	Assistance Programs
Food	• Plant, preserve and encourage trees shrubs and herbaceous food plants (see plant species list Insert).	WHIP, EQIP, WRP, PFW, CRP
	• Restore hydrology on previously drained forested wetland.	WRP, PFW, EWP
	• Restore hydrology and vegetation on previously drained and cropped wetland.	WRP, CRP, PFW
	• Establish shallow water areas and artificial wetlands.	WRP, CRP, PFW
	• Provide winter water on cropland and woodland.	WHIP
Nesting cover	• Install artificial nesting boxes over and near wetland areas.	WHIP, WRP, PFW
	• Preserve old growth timber, especially large, live hardwood trees in and adjacent to wetlands conducive to natural cavities.	WRP
Brood-rearing cover	• Restore hydrology on previously drained forested wetland.	WRP, PFW, EWP
	• Restore hydrology and vegetation on previously drained and cropped wetland.	WRP, CRP, PFW, EWP
	• Establish woody riparian vegetation along streams.	CRP, WRP, EQIP, PFW, WHIP
Winter cover	• Restore hydrology to previously drained forested wetland.	WRP, PFW, EWP
	• Restore hydrology and vegetation to previously drained and cropped or grazed wetland.	WRP, CRP, PFW
	• Provide winter water on cropland and woodland.	WHIP
Water	• Restore or establish bottomland hardwood or emergent herbaceous wetland.	WRP, CRP, PFW
Interspersion and minimum habitat size	• Combine above prescriptions to increase interspersion of habitat components or size of habitat blocks available.	WRP, CRP, PFW, EQIP, EWP

For landowners interested in making their individual efforts more valuable to the community, they can work with WHC and NRCS to involve school and scout groups and their families in habitat projects. A wood duck management project is an easy way to provide fun hands on learning opportunities, especially for children. If the land is corporate owned, encourage interested employees to become involved. Involve students or scouts in building and monitoring nest boxes. The educational benefits can greatly increase the value of your individual wood duck management project.

Nest Box Monitoring. — Before nesting boxes are erected, a maintenance and monitoring plan to ensure the success of the program should be developed. Old nests and those of invasive species such as European starlings must be cleaned out regularly if the boxes are to be used more than once during a nesting season. The monitoring program should ensure that boxes are monitored at least once before the beginning of the nesting season, and should be checked at least once a month during the nesting season if multiple use of nest boxes per nesting season is desired. Boxes should remain out during the winter to provide winter cover sites for screech owls and other resident birds. For Wildlife Habitat Council member organizations, the monitoring program may enroll in WHC's *Nest Monitoring Program*, useful in WHC's *Corporate Wildlife Habitat Certification Program*. Enrollment can be accomplished by contacting the WHC Nest Monitoring Program Coordinator at (301) 588-8994.

Programs that provide technical and financial assistance to develop fish and wildlife habitat on private lands.

Program	Land Eligibility	Type of Assistance	Contact
Conservation Reserve Program (CRP)	Highly erodible land, wetland, and certain other lands with cropping history. Stream-side areas in pasture land.	50% cost-share for establishing permanent cover and conservation practices, and annual rental payments for land enrolled in 10 to 15-year contracts. Additional financial incentives are available for some practices.	NRCS or FSA State or County Office
Emergency Watershed Program (EWP) Floodplain Easements	Flood-damaged croplands.	Up to 100% cost-share for floodplain wetland restoration and payments for purchase of conservation easements.	NRCS State or County Office
Environmental Quality Incentives Program (EQIP)	Cropland, range, grazing land & other agricultural land in need of treatment.	Up to 75% cost-share for conservation practices in accordance with 5 to 10-year contracts. Incentive payments for certain management practices.	NRCS State or County Office
Partners for Fish and Wildlife Program (PFW)	Most degraded fish and/or wildlife habitat.	Up to 100% financial and technical assistance to restore wildlife habitat under minimum 10-year cooperative agreements.	Local office of the U.S. Fish and Wildlife Service
Waterways for Wildlife	Private land	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals.	Wildlife Habitat Council (301-588-8994)
Wetlands Reserve Program (WRP)	Previously degraded wetland and adjacent upland buffer, with limited amount of natural wetland, and existing or restorable riparian areas.	75% cost share for wetland restoration under 10-year contracts, and 30-year easements, and 100% cost-share on restoration under permanent easements. Payments for purchase of 30-year or permanent conservation easements.	NRCS State or County Office
Wildlife at Work	Corporate land.	Technical assistance on developing habitat projects into a program that will allow companies to involve employees and the community	Wildlife Habitat Council (301-588-8994)
Wildlife Habitat Incentives Program (WHIP)	High-priority fish and wildlife habitats.	Up to 75% cost-share for conservation practices under 5 to 10-year contracts.	NRCS State or County Office
State Fish and Wildlife Agencies and private groups such as state waterfowl associations, Ducks Unlimited, Pheasants Forever, and others may have assistance programs in your state.			State or local contacts

References

Bellrose, F.C. 1980. Ducks, geese, and swans of North America, Third ed. Stackpole Books, Harrisburg, PA. 540 pp.

Bellrose, F.C. and D.J. Holm. 1994. Ecology and management of the wood duck. Stackpole Books, Mechanicsburg, PA. 588 pp.

Drugger, K.M., and L.H. Fredrickson. 1992. Life history and habitat needs of the wood duck. U.S. Dep. Inter. Fish and Wildl. Serv., Fish and Wildlife Leaflet 13.1.6. Waterfowl Management Handbook. Washington, D.C. 8 pp.

DuPont, 1990. Nest boxes for wood ducks. Remington Farms. Remington/DuPont.

Ehrlich, P.R.., D.S. Dobkin, and D. Wheye. 1988. The birder's handbook — A field guide to the natural history of North American birds. Simon & Schuster Inc., New York, NY.

Fredrickson, L.H., G.V. Burger, S.P. Havers, D.A. Graber, R.E. Kirby, and T.S. Taylor, eds. 1990. Proceedings of the 1988 North American Wood Duck Symposium, St. Loius, MO. 390 pp.

Haramis, G.M. 1995. A primer for wood duck nest box management. Pages C66-C84 In W.R. Whitman, et al., (eds). Waterfowl habitat restoration, enhancement, and management in the Atlantic Flyway, Third Ed. Environmental Management Comm., Atlantic Flyway Council Technical Section, and Delaware Div. Fish and Wildlife.

Sauer, J.R., J.E. Hines, G. Gough, I. Thomas, and B.G. Peterjohn. 1997. The North American Breeding Bird Survey Results and Analysis. Version 96.4. Patuxent Wildlife Research Center, Laurel, MD.

Sauer, J.R., S. Schwartz, and B. Hoover. 1996. The Christmas bird count home page. Version 95.1. Patuxent Wildlife Research Center, Laurel, MD.

Soulliere, G.J., C.A. Nauman, E. Lyle, and A.E. Geiger. 1992. Comparative use of wood duck nest house designs in Wisconsin. Wild Soc. Bull. 20:156-163.

Stephens, S.E. 1995. Effect of reduced nest-box size on wood duck production. M.S. Thesis, Mississippi State Univ., Mississippi State, MS. 45 pp.

Stephens, S.E., R.M. Kaminski, B.D. Leopold, and P.D. Gerard. 1998. Wood duck reproduction in large and small nest boxes. Wildl. Soc. Bull. In press.

Stokes, D., and L. Stokes. 1990. The complete birdhouse book. Little, Brown and Company, Boston, MA.

Wildlife Habitat Council

1010 Wayne Avenue, Suite 920
Silver Spring, MD 20910
(301) 588-8994

The Wildlife Habitat Council's mission is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, non-profit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.

Natural Resources Conservation Service Wildlife Habitat Management Institute

100 Webster Circle, Suite 3
Madison, MS 39110
(601) 607-3131

In cooperation with partners, the mission of the Wildlife Habitat Management Institute is to develop and disseminate scientifically based technical materials that will assist NRCS field staffs and others to promote conservation stewardship of fish and wildlife and deliver sound habitat management principles and practices to America's land users.

ALABAMA A&M AND AUBURN UNIVERSITIES

ALABAMA COOPERATIVE Extension SYSTEM

ANR-979

Understanding Wetlands And Endangered Species: Definitions And Relationships

Imagine you are walking through the woods. Up ahead, you see a small opening surrounded by trees, shrubs, wildflowers, and grasses. The opening has standing water with small clumps of leafy vegetation scattered throughout and isolated trees standing in the water. Around this opening the ground is soggy and dark. You see a snake move silently by while a salamander watches you before darting away.

You find a stump and sit to rest. As you settle back, you begin to notice many birds flying from one tree to the next, their calls ringing in the air. You hear tree frogs and the buzz of mosquitoes at your ear. You notice crawfish mounds near the water and droppings from a raccoon and a fox. You see the footprints of several deer, and you can see minnows in the shallow water. Water lilies float on the water surface. Butterflies visit the swamp lilies and dragonflies dart through the air.

What is this place and why are there so many different plants and animals here? This place is a wetland. Wetlands provide food, cover, and nesting sites (habitat) for many different animals—many of which are becoming increasingly rare.

We all know that the whys and hows of wetlands and endangered species protection are among the more controversial and actively debated natural resource issues of our day. Many people, even those who have a great love for wildlife, have been taught that wetlands are "wastelands" which serve no purpose unless they are drained and "put to use." My purpose here is to explain, in general terms, what wetlands and endangered species are and to discuss the relationships which often exist between the two. This explanation will emphasize the role wetlands play in providing habitat for many plants and animals and the consequences loss of wetland habitat has had on many species.

What Are Wetlands?

While the warm, fuzzy description given at the beginning of this publication helps develop a mental picture of a wetland, it leaves out the mosquito bites and humidity for which these areas are famous. In fact, wetlands have had a bad reputation, especially with early settlers who thought that "swamp vapors" caused fevers. This bad reputation and the realization that wetlands, when drained, often converted to very productive and valuable farm land were the root causes of wetland acreage losses which began in earnest in the mid-1800s.

Wetlands share some of the characteristics of both uplands and open water. Because wetlands are often located in an intermediate position between uplands and open water, many people call them transitional areas. Despite the early belief that wetlands were more valuable if converted to another use, time has proven that wetlands serve many functions which make them valuable in their natural state. Some of the valuable functions performed by wetlands are: protection of water quality, flood prevention, water storage, and wildlife habitat.

A few common types of wetlands include: fringe wetlands located along the shoreline of lakes; salt and freshwater marshes located in coastal areas; deepwater swamps and bottomland hardwood forests along rivers; and prairie potholes located in Canada and the upper midwestern states.

Three Components Of A Wetland

To be considered a jurisdictional or legal wetland, all three of the following components must be present: wetland hydrology; hydric soils; and hydrophytic vegetation.

The hydrology (the presence, abundance, and source of water) determines and maintains the structure and function of a wetland. The hydrology of a wetland also drives the formation of hydric soils.

Hydric soils are soils that are "saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper part." Anaerobic conditions develop when water displaces oxygen present within the pore spaces of a soil. Hydric soils are often gray in color and may smell like rotten

eggs. Orange-colored deposits often occur around roots growing within hydric soils. Such things as how often and how long the soils are saturated or flooded; the depth of flooding; the time of year during which the soils are saturated or flooded, and whether the water is fresh or saline determine the type of vegetation found in a wetland.

Hydrophytic vegetation literally means "water-loving" vegetation. Plants that are able to grow and reproduce in wetlands do so because of special adaptations which allow them to survive in a waterlogged environment. Many wetland plants have very spongy roots. These roots have air spaces, which are believed to allow the movement of oxygen from the leaves to the roots, thereby allowing the plant to thrive despite the anaerobic conditions present in the soil. Wetland plants may have adventitious roots (roots growing out of the trunk above the soil surface), surface roots (roots growing at or just above the soil surface), or lenticels (openings on roots and stems for oxygen exchange). The type and abundance of vegetation is an important factor in determining what types of animal species use the wetland.

Wetland Productivity

Many wetlands have very high primary productivity rates. This means that the plants growing in the wetland are very efficient at converting sunlight, water, and soil nutrients into plant tissue. Typically, the most productive wetlands are coastal wetlands and wetlands located adjacent to rivers or streams. The reason that many of these areas are so productive is related to the hydrology or movement of water which occurs within many wetlands.

Coastal wetlands flood regularly due to tidal water movement. Tidal flooding flushes the soils of coastal wetlands, removing toxins and wastes which may make the soils inhospitable to plants or burrowing animals. In addition, the regular movement of water into and out of coastal wetlands helps to reaerate soils. This reaeration results in more vigorous growth of wetland plants.

Wetlands adjacent to rivers flood on a fairly regular basis. This movement of water delivers nutrients, sediment, and organic matter from upland areas, creating the rich soils for which these systems are so valued.

Which Animals Inhabit Wetlands?

Not surprisingly, the fact that many wetlands are highly productive means that they are also rich in animal species. Animals are attracted to wetlands because they provide food, water, cover, and nesting sites. In short, wetlands provide many animals with homes. Many species live their entire lives in wetlands and are completely dependent on them for survival. Other species are dependent on wetlands only during a portion of their life cycle. For these species wetlands serve either as a summer home, a winter home, or an occasional feeding or resting spot.

Wetlands provide critical habitat for wildlife, and, in fact, wetlands exceed all other land types in wildlife productivity. It has been estimated that in the United States roughly 150 species of birds and more than 200 species of fish depend on wetlands for their survival.

Many birds such as the great blue heron, great egret, bald eagle, osprey, red-shouldered hawk, owls, wild turkey, belted kingfisher, red-bellied woodpecker, pileated woodpecker, and several species of swallows, sparrows, and warblers use wetlands. Ducks occupy wetlands in great numbers. Duck species include the wood duck, mallards, black ducks, blue-winged teal, gadwall, widgeon, and the northern pintail.

Mammals such as the muskrat, beaver, raccoon, and white-tailed deer also use wetlands. In addition, a wide variety of reptiles, turtles, and freshwater fish depend on wetlands for survival.

One group of animals often overlooked when the inhabitants of wetlands are considered is the invertebrate species. These small animals, which include flatworms, aquatic earthworms, leeches, crawfish, and fairy shrimp, are vital links between plants and the animal food chains. Many invertebrates graze on living plants while others consume dead organic material. The invertebrates are in turn eaten by fish, birds, frogs, toads, and turtles. So, in fact, invertebrates make energy available to animals which may consume little or no plant material.

While much remains to be learned about the many different species of invertebrates that inhabit wetlands of various types, research has shown that these species have very specific habitat requirements. What happens to these vital links when wetlands are altered or destroyed? What happens to the animals that depend on these species for some or all of their nutritional requirements? Obviously, if the flow of energy, in the form of food, from one species to another is interrupted, there will be a negative impact on both species diversity and on population size.

What Are Endangered And Threatened Species?

The Earth is rich in both animal and plant species. However, a number of species are experiencing trouble meeting their needs. Some of these species are considered "endangered" while others are considered "threatened." Endangered species are species that, if not protected, are in imminent danger of permanently disappearing from Earth. Threatened species are species that, if not protected, are likely to become endangered in the foreseeable future. In 1973, Congress passed the Endangered Species Act with the express purpose of protecting species that were in danger of extinction.

There are many reasons why a species may face extinction, including such natural events as long-term changes in climate and worldwide sea level fluctuations. Some species are found only in small numbers in few locations which means that any change (whether natural or induced) could negatively impact them. Today, people have the ability to alter land, water, air, and climate to a degree never before seen. As a consequence, the majority of species facing extinction today do so as a result of habitat degradation or destruction caused by people. Worldwide, roughly 1,100 species have been designated as either threatened or endangered. In addition, another 3,600 have been identified as candidates for threatened or endangered status although official action has not been taken.

Why Is Wetland Habitat Threatened?

Wetland habitat degradation can result from either increased or decreased flow of water into or out of an area; decreased water quality, resulting from excess nutrients and toxic chemicals originating from faulty septic tanks; overflowing sewers; or runoff from agricultural lands or urban areas. Wetland habitat destruction results from the transformation from natural areas to agricultural fields, urban development, or plant monocultures.

Another danger facing wetland-dependent species is the fragmenting of wetlands into smaller and smaller unconnected areas. When this happens, species requiring large areas of land to survive will begin to disappear. This has been observed with the black bear in Louisiana and the Florida panther in Florida. Other animals, which might not need large ranges, may still face the problem of inbreeding or isolation from suitable reproductive partners simply because they can no longer move from one nearby wetland site to another.

Wetlands have been particularly hard-hit with both habitat degradation and destruction. In fact, roughly half of all wetlands that existed within the lower 48 states at the time of European settlement have disappeared. Some states, such as California have lost as much as 90 percent of the wetlands present 200 years ago. Alabama has lost approximately 50 percent of its original wetlands, Mississippi and Tennessee have lost roughly 59 percent, and North Carolina has lost 44 percent. Kentucky has lost 80 percent of the wetlands that were present 200 years ago. Historically, most of this loss was to agriculture. Present-day wetland loss is often associated with urban expansion, particularly in coastal areas. Conversion of bottomland hardwood forests to pine does still occur in parts of the Southeast.

How Does Wetland Loss Affect Wetland-Dependent Species?

Not surprisingly, coupled with the dramatic destruction of wetlands and degradation of remaining wetlands, there has been a marked decrease in the populations of many animal and plant species that depend on these systems for survival. At least 95 plant, 5 mammal, 22 bird, 4 reptile, 3 amphibian, and 22 fish species listed as endangered or threatened depend on wetland habitats for survival. In 1986, there were 188 species of animals listed as threatened or endangered by the federal government. Of these, roughly 50 percent were wetland related. The animal groups with the largest numbers listed as threatened or endangered are the fish, mussels, and

Federally Listed Endangered And Threatened Species Associated With Wetlands.*

	Number Of Endangered Species Associated With Wetlands	Number Of Threatened Species Associated With Wetlands	Percent Of Total Species Listed In United States
Plants	17	12	28
Animals			
Mammals	7	—	20
Birds	16	1	68
Fishes	26	6	48
Reptiles	6	1	63
Amphibians	5	1	75
Insects	1	4	38
Mussels	20	—	66
Total	98	25	

Source: Niering 1988.
*Only species listed within the United States are included here.

birds. In 1986, 103 plants were listed as threatened or endangered, and 28 percent were considered wetland dependent.

As of 1991, the U.S. Fish and Wildlife Service had listed 595 plant and animal species as threatened or endangered. Of this number, 256 (43 percent) are wetland dependent. In fact, wetlands provide fully 60 percent of all threatened species and 40 percent of all endangered species listed in 1991 with essential habitat. The table illustrates the breakdown of threatened and endangered species by taxonomic groups.

Information on many wetland-dependent plant and animal species is limited. However, data on waterfowl, which migrate from northern to southern wetlands every year, have been collected for many years. Although these species are not threatened or endangered, they have experienced significant decline in numbers. It was estimated that there were 145 million ducks migrating from Alaska, Canada, and the northern prairie states in the period just after World War II. By 1992, that number had dropped to 64 million—a 56 percent reduction. This decrease was attributed primarily to loss of habitat. Many people feel that the decrease observed in duck populations is an indication that many other wetland species are also experiencing declines.

Migratory species, such as waterfowl, may require different types of wetlands at different times during the year. In 1982 it was estimated that 80 percent of the American breeding bird population and more than 50 percent of the 800 species of protected migratory birds relied on wetlands. This means that impacts on wetlands in one part of the United States, Canada, Mexico, or South America may adversely impact the numbers and species composition of migratory birds. This fact complicates attempts to protect wetland-dependent species because decisions affecting migratory birds must be made not only across state boundaries, but across countries and in some cases continents.

Conclusion

As you can see, wetlands are valuable real estate to many plants and animals. The next time you discuss the issues of wetlands and endangered species I hope the information provided here will help you have a better understanding of how these two issues are related. Hopefully I've helped you to a better understanding of the value of wetlands and how many animal and plant species depend on them for survival. Unless we all begin to understand this relationship, you can expect to hear more and more about endangered species at the same time that you hear about wetland loss.

References

Barnes, T. G., L. R. Kiesel, and J. R. Martin. 1992. Private lands wildlife management: A technical guidance manual and correspondence course. The Kentucky Cooperative Extension Service. University of Kentucky, Lexington, Kentucky.

Dahl, T. E. 1990. Wetland losses in the United States, 1780s to 1980s. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC.

Dennison, M. S., and J. F. Berry. 1993. Wetlands: Guide to science, law, and technology. Noyes Publications, Park Ridge, New Jersey.

Mitsch, W. J., and J. G. Gosselink. 1993. *Wetlands.* Van Nostrand Reinhold, New York.

Niering, W. A. 1988. Endangered, threatened and rare wetland plants and animals of the continental United States. In *The Ecology and Management of Wetlands,* Vol. 1, *Ecology of Wetlands,* edited by D. D. Hook. Timber Press, Portland, Oregon.

Weller, M. W. 1979. Wetland Habitats. In *Wetland Functions and Values: The State of Our Understanding,* edited by P. E. Greeson, J. R. Clark, and J. E. Clark. American Water Resources Association, Minneapolis, Minnesota.

Kathryn Flynn, *Extension Forester,* Assistant Professor, Forestry, Auburn University

For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

ALABAMA COOPERATIVE Extension SYSTEM

ANR-979

Issued in furtherance of Cooperative Extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, and other related acts, in cooperation with the U.S. Department of Agriculture. The Alabama Cooperative Extension System (Alabama A&M University and Auburn University) offers educational programs, materials, and equal opportunity employment to all people without regard to race, color, national origin, religion, sex, age, veteran status, or disability. UPS, 10M07, New 5:96, ANR-979

United States Department of Agriculture

NRCS Natural Resources Conservation Service

May 2003

Wetland Plantings for Wildlife

Indiana Biology Technical Note No. 3

Land users can have a significant impact on wildlife species and populations by taking action to maintain or improve existing wetlands. Managing wetlands for a specific group of plants or animals can be a successful and rewarding experience.

This document is a tool to assist individuals who wish to restore or enhance wetlands. A landowner can increase the likelihood that their wetland will be used by a wider variety of wildlife if some of the recommended plants are incorporated into management plans. Because wetlands are complex habitats, consider working with one of the specialists listed in the **Where To Go For Help** section.

WETLAND HABITATS

The term "wetland" describes a wide range of habitats including:

- **wet meadows** consisting mostly of saturated soils with grasses and sedges,
- **shallow water marshes** containing emergent vegetation such as cattails, bulrushes and sedges,
- **scrub/shrub wetlands** with lowland shrubs such as willows, dogwoods, and buttonbush,
- **forested wetlands** containing green ash, silver maple, water tolerant oaks and hickory trees, and
- **open water areas** with floating vegetation like water lilies.

The depth and permanence of water primarily determine which flora and fauna will dominate a wetland. It is this variation in water conditions and vegetation types that most often determine which wildlife will be found in wetlands across the state. All types of wetlands regardless of size, depth, and duration of flooding, can be important to wildlife as a source of food, water, and cover.

Trees, shrubs, and emergent wetland plants stand above the water's surface and supply wildlife with cover and food. Wetland-adapted wildlife depend upon these plants to provide shelter for feeding, resting, and reproduction.

Wild Iris - Ken Collins, NRCS

At various times of the year, wetlands also provide cover and other benefits for other upland wildlife species including rabbits, deer, great-horned owls, and red-tailed hawks. By learning more about the basic needs of various wildlife species, landowner efforts to influence wildlife can be more effective.

MANAGING THE SURROUNDING LANDSCAPE

Wetlands do not exist in isolation. Much of what goes on around a wetland directly affects how that wetland functions. Thus, a landowner can influence the wetland through activities on the adjacent lands. Depending on the type of vegetation, the surrounding landscape can serve as valuable habitat for wildlife. For example, ducks and other waterfowl will often nest in grasses near wetlands. On the other hand, if your wetland contains woodland with snags, the site might attract wood ducks. Wooded borders are also used by a variety of amphibians and reptiles during the non-breeding season.

Buffers. A buffer between the adjacent land and the wetland is an important management tool. A minimum buffer width of at least 20 feet can filter nutrients, sediments, and toxins from the wetland. Normally, greater widths provide greater benefits. Depending upon the species planted, buffers can also act as a visual screen or noise barrier, as well as provide habitat for wildlife.

Muscatatuck WRP - Gerry Roach, NRCS

Buffers that include cool season grass/legume mixes can provide food and cover for wildlife. These plants are called cool season because growth occurs primarily during the spring and fall. An example mixture is Orchardgrass, Timothy, Alfalfa, and Ladino Clover. Recommended mixtures and seeding rates can be found in the *Upland Wildlife Habitat Management* Standard under the Reference Information section.

Grass buffers need to be maintained by periodic mowing at an interval of 1 to 3 years. This will provide a healthy grassland area and prevent encroachment by trees. Note that the buffer should not be mowed during the primary nesting season for grassland birds of March 1 through July 15.

Many landowners are also planting the upland areas adjacent to the wetland with warm season grasses, such as Big Bluestem, Indian Grass, and Switchgrass. The plants are called warm season grasses because growth primarily occurs during the heat of the summer. These grasses are popular because of the excellent habitat provided for many upland game birds and grassland songbirds, as well as nesting habitat for waterfowl. When mixed with wildflowers, the warm season grass planting can also provide an attractive border around the wetland. Special care is needed for planting and managing warm season grasses. See *Warm Season Grass Establishment* under the Reference Information section, or consult one of the specialists listed in the **Where To Go For Help** section.

Another option is to maintain the buffer in trees and shrubs with a minimum width of 50 to 100 feet. Tree and shrub buffers take longer to establish than grasses because woody plants are slower to develop and require special maintenance during the first few years. Wooded buffers are especially beneficial to many amphibians and aquatic reptiles that require this type of habitat during the non-breeding season. Tree species and planting rates (see *Wetland Restoration* Standard), and planting procedures (see *Tree/Shrub Establishment* Standard) can be found in the Reference Information section.

Fencing. For wetlands in agricultural areas, you may need perimeter fences to keep cattle or other livestock from entering the wetland. Cattle in particular do considerable damage to the plants and can cause significant amounts of sediment to enter the water. Options can include single-strand or double-strand, high-tensile electric fence. Woven wire is more likely to trap debris and is less favored as an option. Fencing is placed as far from the wetland as the landowner can afford. Fences close to a wetland edge are not as beneficial to wildlife, although they can help improve water quality. In areas where streams and wetlands coincide, cattle crossings may be necessary.

ESTABLISHING WETLAND PLANTS

Recently Restored Wetlands. Many restored wetlands do not require planting, as long as the original topsoil is preserved. Many wetland plants produce seeds that can lay dormant for years under drained conditions, but will germinate when water is restored to the site. The total amount and variety of seeds that have remained viable in the soil is commonly known as a “seed bank”.

Landowners are often surprised at the variety of wetland plants that establish themselves within the first year after restoration. These plants come from both existing seed banks and by colonization from off-site sources, such as nearby ditch banks. The longer the intervals between draining and restoration, however, the less successful seed banks are, and planting may become necessary. Natural regeneration of native plants is preferred, but the seeds of invasive and aggressive species may also lurk in the seed bank. Consider your planting options after evaluating the plant composition of the wetland following the first growing season.

Buttonbush - Kansas City Zoo

Invasive and Aggressive Species. Landowners should be aware that there are plants that can dominate wetlands to the exclusion of other plant species. Most non-native plants introduced to new areas by humans do not cause significant environmental problems. Some plants however, reproduce aggressively and spread into wild habitats. These plants may out compete native species and inhibit the use of the area by wildlife.

Examples of invasive plants include species such as purple loosestrife, phragmites, and reed canarygrass that will often move into a new wetland uninvited and dominate the site. In more open water sites, non-native species like water lily can spread to nuisance levels. It is therefore recommended that you do not plant exotic or non-native species in your wetland. Because even native species like cottonwood, black willow, and cattails can dominate a wetland under the right conditions, monitoring your wetland is highly recommended.

Planting considerations. At times, it may be necessary to supplement the natural regeneration of wetland plants. Planting of nursery stock may be needed in these cases. The timing of seed planting is critical for plant survival. Contact your local Natural Resources Conservation Service (NRCS) office for information regarding planting dates and seeding rates for specific species. Nursery stock may have to be ordered several months to a year prior to planting. Plants and seeds should be appropriate for your region (plants adapted to the southern part of the state, for example, may not fare well in northern Indiana).

The selection of plants should also reflect the expected water conditions of the site. Many grasses, sedges, and rushes require moderate fluctuations in water level, but submergent or floating species (such as pond lilies) need more stable and deeper waters. Few woody species can tolerate continuous flooding, so placement at the drier end of the wetland is recommended. The tables in this document contain a "Soil Moisture Tolerance" column that gives a general range of soil moisture preferred by each plant. Contact your local NRCS office regarding the soil characteristics on your property.

WETLAND PLANT TABLES

The following pages contain tables showing wetland plants that can provide food, cover and other benefits for wildlife. The column headings found in the tables give examples of possible wildlife benefits. Note however, that there is no guarantee that a listed wildlife species will automatically inhabit the wetland by planting a particular species of plant. For example, planting bur oak will not necessarily guarantee that raptors will someday nest on site. At the same time, there are also many other wildlife species not listed that may utilize various plants for a portion of their life cycle.

In addition to the plants listed in this guide, many other native species provide for the various needs of wetland wildlife. See the Reference Information section for additional information on desirable wetland plants common to Indiana wetlands.

WETLAND TREES AND SHRUBS BENEFICIAL TO WILDLIFE

TREES	SOIL MOISTURE TOLERANCE[1]	WATERFOWL (Food)	SONGBIRDS (Food & Nesting)	MAMMALS (Food & Shelter)	RAPTORS (Nesting & Perch Sites)	COMMENTS
Ash, Green (*Fraxinus pennsylvanica*)	VPD – WD		X	X		
Gum, Black *(Nyssa sylvatica)*	PD – WD	X	X			Eaten by wood duck and turkey
Hackberry (*Celtis occidentalis*)	SPD – WD		X	X		
Hickory, Bitternut *(Carya cordiformis)*	SPD – WD	X		X		Eaten by wood duck, squirrel & turkey
Hickory, Shellbark *(Carya laciniosa)*	VPD – WD	X		X		Eaten by squirrel & turkey
Oak, Bur (*Quercus macrocarpa*)	PD – ED			X	X	
Oak, Cherrybark (*Quercus pagoda*)	SPD – WD		X	X	X	Use south of U.S. 40
Oak, Pin (*Quercus palustris*)	VPD – WD	X	X	X		
Oak, Shumard (*Quercus shumardii*)	SPD – WD	X	X	X	X	
Oak, Swamp Chestnut (*Quercus michauxii*)	SPD – WD	X		X		
Oak, Swamp White (*Quercus bicolor*)	VPD – WD		X	X	X	
Pecan (*Carya illinoinensis*)	SPD – WD		X	X		Use south of U.S. 40
Persimmon *(Diospyros virginiana)*	SPD – WD		X	X		
Serviceberry (*Amelanchier arborea*)	MWD – WD		X			
Sweetgum (*Liquidambar styraciflua*)	PD – WD	X	X	X		
Sycamore (*Platanus occidentalis*)	PD – WD	X	X	X	X	

SHRUBS	SOIL MOISTURE TOLERANCE[1]	WATERFOWL (Food)	SONGBIRDS (Food & Nesting)	MAMMALS (Food & Shelter)	RAPTORS (Nesting & Perch Sites)	COMMENTS
Buttonbush (*Cephalanthus occidentalis*)	SPD – WD	X	X	X		Wilted leaves may be toxic to livestock
Cherry, Choke (*Prunus virginiana*)	SPD – WD		X	X		
Chokeberry, Black *(Aronia melanocarpa)*	SPD – WD		X			
Dogwood, Alternate Leaf (*Cornus alternifolia)*	SPD – WD	X	X	X		Twigs browsed by deer and rabbits
Dogwood, Gray (*Cornus racemosa)*	SPD – WD		X	X		Eaten by pheasant, turkey and grouse
Dogwood, Red-osier (*Cornus stolonifera*)	VPD – WD		X	X		Eaten by grouse, quail, deer & rabbits
Dogwood, Rough Leaved *(C. drummondii)*	PD – WD		X	X		
Dogwood, Silky (*Cornus amomum*)	VPD – WD	X	X	X		Sometimes browsed by rabbits & deer
Elderberry (*Sambucus canadensis*)	VPD – WD		X	X		Eaten by pheasant, turkey and quail
Highbush Cranberry (*Viburnum trilobum*)	VPD – WD	X	X	X		Fruit eaten by grouse and pheasant
Nannyberry (*Viburnum lentago*)	SPD – WD	X	X	X		
Ninebark *(Physocarpus opulifolius)*	VPD – WD		X	X		Eaten by ruffed grouse
Spicebush (*Lindera benzoin*)	VPD – WD			X		Eaten by rabbit, quail and grouse
Spirea (*Spiraea alba and S. tomentosa)*	VPD – WD			X		Eaten by grouse, deer and rabbits
Wild Sweet Crabapple *(Malus coronaria)*	SPD – ED		X			Recommended for quail
Winterberry (*Ilex verticillata*)	VPD – SPD		X	X		Emergency food source for wildlife

WETLAND GRASSES AND WILD FLOWERS BENEFICIAL TO WILDLIFE

GRASS or GRASS-LIKE	SOIL MOISTURE TOLERANCE[1]	WATERFOWL (Food)	SONGBIRDS (Food & Nesting)	MAMMALS (Food & Shelter)	BUTTERFLIES (Food)	COMMENTS
Canada Blue Joint Grass (*Calamagrostis canadensis*)	SPD – VPD	X		X		
Fowl Manna Grass *(Glyceria striata)*	SPD – VPD	X				
Prairie cordgrass (*Spartina pectinata*)	SPD – VPD	X	X	X		
Switchgrass (*Panicum virgatum*)	PD - WD	X	X	X		
Virginia Wildrye *(Elymus virginicus)*	PD - WD	X	X	X		
Wild Rice (*Zizania aquatica*)	VPD – PD	X	X			Prefers shallow water

WILD FLOWERS	SOIL MOISTURE TOLERANCE[1]	WATERFOWL (Food)	SONGBIRDS (Food & Nesting)	MAMMALS (Food & Shelter)	BUTTERFLIES (Food)	COMMENTS
Arrowhead, Broadleaf (*Sagittaria latifolia*)	VPD – PD	X		X		Prefers shallow water
Aster, New England *(Aster novae-angliae)*	PD – WD		X		X	
Aster, Flat Topped *(Aster umbellatus)*	PD – SPD		X		X	
Aster, Swamp *(Aster puniceus)*	PD – SPD		X		X	
Bottle gentian (*Gentiana andrewsii*)	VPD – PD				X	
Cardinal Flower (*Lobelia cardinalis*)	PD – SPD		X		X	
Coneflower, Tall (*Rubeckia laciniata*)	PD – WD		X		X	
Cup Plant (*Silphium perfoliatum*)	PD – WD		X		X	
Dense Blazing Star *(Liatris spicata)*	PD – WD				X	
Dock, Prairie (*Silphium terebinthinaceum*)	SPD – ED			X	X	
Irises (*Iris virginica*)	VPD – PD			X	X	
Joe-pye-weed (*Eupatorium fistulosum, E. pupurpeum, or E. maculatum*)	VPD – SPD	X	X		X	
Lily, Michigan (*Lilium michiganense*)	PD – WD			X	X	
Milkweed, Swamp (*Asclepias incarnata*)	PD – SPD		X		X	
Nodding Bur Marigold *(Bidens cernua)*	PD – SPD	X	X			
Obedient Plant *(Physostegia virginiana)*	PD – SPD				X	
Prairie blazing star (*Liatris spicata*)	PD – WD				X	
Reed, Giant Bur *(Sparganium eurycarpum)*	VPD – PD	X				Prefers shallow water
Rushes, Native (*Juncus spp.*)	VPD – WD[2]	X	X	X		Examples: Spike & Slender
Sago Pondweed *(Potamogeton pectinatus)*		X				
Sedges, Native (*Carex spp.*)	VPD – WD[2]	X	X			Examples: Lake & Fox
Smartweeds, Native (*Polygonum spp.*)	VPD – SPD	X	X	X		Example: Pennsylvania
Wild Celery *(Vallisneria americana)*		X				

[1] KEY: **ED** = Excessively Drained **WD** = Well Drained **SPD** = Somewhat Poorly Drained **PD** = Poorly Drained **VPD** = Very Poorly Drained

[2] Varies with species.

WHERE TO GO FOR HELP

The following agencies and organizations can provide more information about wetlands and associated wildlife. The type of available assistance is listed as bulleted items for each group.

U.S.D.A. Natural Resources Conservation Service

Offices are located at the USDA Service Center in each county and are listed in the telephone book under *U.S. Department of Agriculture*. Also see Indiana Field Service Centers at:
http://www.in.nrcs.usda.gov/

Assistance includes:

- Providing funding for wetland restoration programs
- Providing technical assistance on wetland management
- Making wetland determinations on agricultural land

U.S. Environmental Protection Agency (EPA)

http://www.epa.gov/owow/wetlands/

Assistance includes:

- Providing wetland information regarding education, regulations, and protection

U.S. Fish and Wildlife Service

620 South Walker Street
Bloomington, IN 47403-2121
Phone: 812-334-4261
http://midwest.fws.gov/Bloomington/

Assistance includes:

- Providing technical assistance on wetland and wildlife management
- Providing technical guidance regarding Threatened and Endangered Species

U. S. Army Corps of Engineers

Assistance includes:

- Providing guidance on, and issuing Nationwide Permits
- Making wetland determinations on non-agricultural land

South Bend Field Office

U.S. Army Corps of Engineers
2422 Viridian Drive Suite # 101
South Bend IN 46628
Phone: (574) 232-1952
Fax: (574) 232-3075
http://www.lre.usace.army.mil/index.cfm?chn_id=1546

Indianapolis Field Office

U.S. Army Corps of Engineers
9799 Billings Road
Indianapolis, IN 46216
Phone: (317) 532-4197
http://www.lrl.usace.army.mil/orf/orgs/addresses.htm

Newburgh Field Office

U.S. Army Corps of Engineers
P.O. Box 489
Newburgh, IN 47629-0489
Phone: (812) 853-0472
http://www.lrl.usace.army.mil/orf/orgs/addresses.htm

Purdue University Ext. Wildlife Specialist

Phone: (765) 647-3538
bmacgowan@fnr.purdue.edu

Assistance includes:

- Providing technical assistance on wetland and wildlife management

IDNR Division of Fish and Wildlife District Wildlife Biologist

http://www.state.in.us/dnr/fishwild/huntguide1/wbiolo.htm

Assistance includes:

- Providing technical assistance on wetland and wildlife management

IDNR Division of Water

http://www.in.gov/dnr/water/

Assistance includes:

- Issuing construction in a floodway permits for riparian wetlands

IDNR Division of Soil Conservation

http://www.in.gov/dnr/soilcons/programs/iwcp/index.html

Assistance includes:

- Implementing the *Indiana Wetlands Conservation Plan* that includes the guiding principles for wetland conservation in Indiana

State of Indiana

Indiana WETlands
http://www.in.gov/wetlands/about/index.html

Assistance includes:

- Providing information about wetlands, permitting, current legislation, upcoming meetings and events, and subscribing to special wetland e-mails

Local Soil and Water Conservation District

http://www.state.in.us/dnr/soilcons/contact/swcds.html

Assistance includes:

- Determining and addressing local wetland resource needs in each county

REFERENCE INFORMATION

Natural Resources Conservation Service (NRCS) Techincal Standards:

- *Wetland Restoration* (657)
- *Wetland Enhancement* (659)
- *Wetland Wildlife Habitat Management* (644)
- Restoration and Management of Declining Habitats (643): see section on *Sedge Meadow Habitat*
- *Upland Wildlife Habitat Management* (645)
- *Tree/Shrub Establishment* (612)

  Indiana Biology Technical Note No. 1: *Using Micro and Macrotopography in Wetland Restoration*

  Download from:

  http://www.in.nrcs.usda.gov/PlanningandTechnology/fotg/Section4/section4.htm

---

Indiana Department of Natural Resources (IDNR) publications:

IDNR Division of Fish and Wildlife
Public Affairs Section
402 W. Washington St., Rm. W273
Indianapolis, Indiana 46204

- ***Life Series***. Publications containing information on species-specific habitat requirements, diets, distribution and abundance for many common Indiana wildlife

  Download from:

  http://www.IN.gov/dnr/fishwild/publications/fis.htm

- ***Habitat Management Fact Sheets.*** Fact sheets providing information about beneficial habitat management and practices for Indiana wildlife

  Download from:

  http://www.in.gov/dnr/fishwild/hunt/facts.htm

- ***Warm Season Grass Establishment*** Fact Sheet

  Download from:

  http://www.in.gov/dnr/fishwild/hunt/warmgrass.pdf

The Department of Forestry and Natural Resources, Purdue University publications:

Forestry Building
195 Marsteller Street
West Lafayette IN 47907-2033
(765) 494-3591

- ***Management of Forested Wetland Ecosystems in the Central Hardwood Region***

  Download from:

  http://www.agcom.purdue.edu/agcom/Pubs/fnr.htm

- ***Wetlands, Regulations and You: What Every Indiana Farmer Needs to Know***

  Download from:

  http://persephone.agcom.purdue.edu/AgCom/Pubs/FNR/FNR-171.pdf

---

The Indiana Native Plant and Wildflower Society (INPAWS) promotes "…the appreciation, preservation, conservation, utilization and scientific study of the flora native to Indiana…"
The INPAWS website (http://www.inpaws.org/) contains the following information:

- ***Sources for plants native to Indiana & the Lower Midwest***
- ***Landscaping with Plants Native to Indiana - Recommended Plants and their Sources***
- ***Recommended reference books for plants native to Indiana***

Managing Your Restored Wetland**,** Cole, A. C., T. L. Serfass, M. C. Brittingham, and R. P. Brooks, Pennsylvania State University CES, University Park, PA, 1996.

Download from:

http://pubs.cas.psu.edu/FreePubs/pdfs/uh086.pdf

American Wildlife and Plants: A Guide to Wildlife Food Habits. Martin, Alexander, Herbert Zim, and Arnold Nelson, Dover Publications, Inc., 500 pp., 1961.

NRCS Natural Resources Conservation Service

WILDLIFE HABITAT COUNCIL℠ © 1988 WHC

Ecologically Isolated Wetlands

October 2006 *Fish and Wildlife Habitat Management Leaflet* *Number 38*

Introduction

Wetlands are areas where water covers the soil surface or is present either at or near the surface of the soil all year or part of the year. The presence of water and subsequent lack of oxygen creates a particular type of soil (hydric soil) in which plants adapted to flooding can grow. Examples of flood tolerant plants, or hydrophytes, include cattails, sedges, smartweed, rushes, marsh marigolds, bur reed, cypress, and willows. The presence of hydrophytes, hydric soils, and water is used to identify wetland areas.

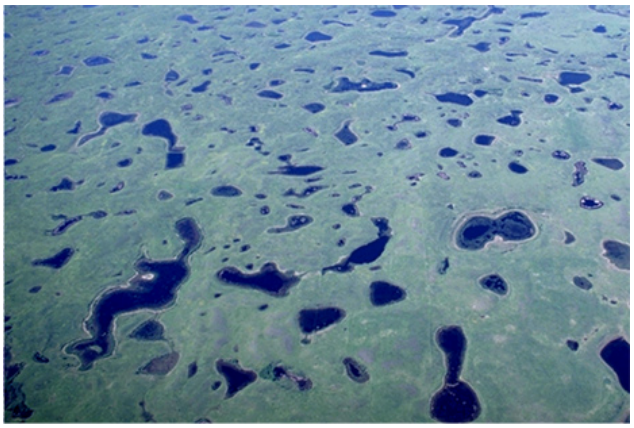
Wetlands are dynamic, highly productive systems. In fact, wetlands, as measured by the amount of plant material produced (primary productivity), are one of world's most productive ecosystems. High production of wetland plants is the result of rapid recycling of nutrients that occurs with changing water levels and breakdown of dead plant material catalyzed by wet conditions. Dead plant material, rapidly broken down in water by microorganisms, which in turn are fed upon by aquatic invertebrates, is the fuel that supports the abundance and diversity of wetland associated wildlife.

This leaflet is intended for landowners or land managers who have wetlands on their property or whose properties historically contained wetlands. It is also intended for conservation planners seeking to understand and restore wetland functions by mitigating for the effects of habitat isolation. This leaflet describes wetland processes and functions, ecological and economic benefits of healthy wetlands, risks associated with wetland loss and degradation, and, finally, steps that might be undertaken to reduce the effects of isolation.

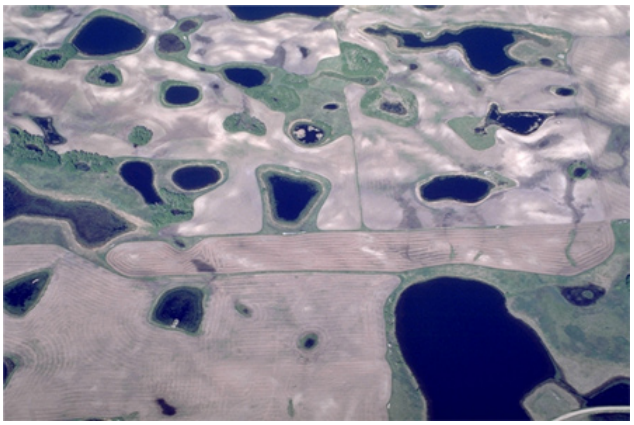
Wetland functions and economic benefits

Wetlands are formed and maintained through various processes, depending on the hydrology, climate, and other factors related to the site. For example, in the northern plains of North America, numerous shallow depressions were created by glaciers that covered the region 12,000 to 25,000 years ago. These so-called potholes are filled in the spring with runoff from snowmelt or rain, or from elevated ground water tables that saturate porous lowland soils and provide a relatively constant source of water through the summer. Coastal wetlands are subject to daily and seasonal tidal influences, variable terrestrial inputs, and occa-

(a)



(b)



Ducks Unlimited

Conversion of wetlands and adjacent habitats to agricultural uses has contributed to their functional isolation. Aerial photos of prairie pothole region before (a) and after (b) conversion of upland grasslands to cultivation.

NRCS

Bottomland forest in central Mississippi

sional catastrophic events such as hurricanes. In the active delta of the Mississippi River, nutrient-rich sediments carried by late winter/spring floodwaters are released as river water leaves the main courses, forming extensive mudflats that are rapidly vegetated by wetland plants. Further up the river, the productivity of bottomland forests depends on nutrients delivered by winter/spring floodwaters and detrital-based processes that occur when bottomlands are flooded. The timing of flooding is highly variable, but it is generally delayed in the widely separated basins in the intermountain west that are fed by snowmelt from surrounding mountain ranges. These are just a few examples of the varied hydrological patterns in wetlands.

Historically, wetlands were not well understood, and they were undervalued and underappreciated. They were often regarded as wastelands and impediments to development and were readily converted into other land uses, leading to widespread wetland loss and isolation. Today, wetlands are recognized as important landscape features that provide numerous economic, ecological, and social benefits. Wetlands offer many services including flood control, ground water recharge and discharge, erosion control, water quality control, water for livestock, and recreational opportunities. In fact, it is estimated that the global value of wetland resources is $14.9 trillion, or 45 percent of the value of all natural ecosystems.

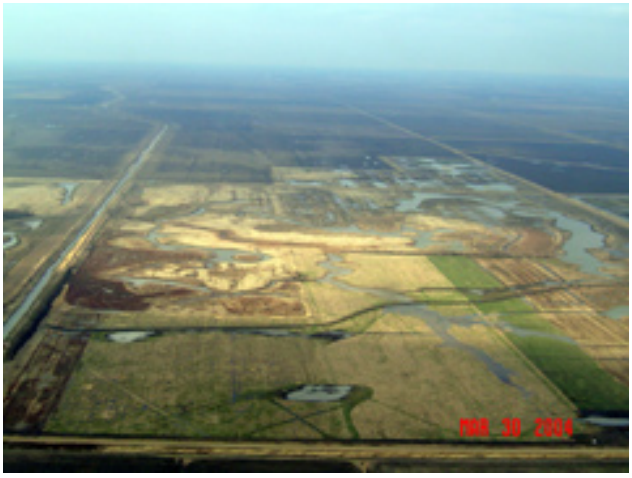
Wetlands are often compared to natural sponges, which slowly release stored surface water, rain, snowmelt, ground water, and floodwater. Wetland vegetation contributes to this process by slowing the water's momentum and allowing it to percolate into and be stored in the underlying soils. This lowers flood heights, reduces erosion, and recharges ground water, which contributes to surface water flow during dry periods of the year. Wetlands help protect adjacent and downstream landowners from flood and/or erosion damage to crops or infrastructure. For example, under normal circumstances, a watershed composed of at least 30 percent wetlands can reduce flood water levels by 60 to 80 percent compared to watersheds containing no wetlands.

Wetland vegetation absorbs and filters a variety of sediments, nutrients such as nitrogen and phosphorus, and other chemical and organic pollutants, thus maintaining water quality in rivers, streams, and lakes and reducing municipal water treatment costs. Wetland plants take up nitrogen, phosphorus, and other agricultural contaminants, while the hydric soils characteristic of wetlands chemically bind other pollutants. Studies have shown that a 1-acre wetland can effectively purify the nitrate runoff from about 100 acres of cropland. Organic waste in wetlands is broken down by bacteria and other microorganisms in the water column and the mud. Wetlands are used to treat municipal wastes (urban storm water runoff, landfill leachate), runoff from feedlots, mining wastes, pulp mill wastes, and other industrial wastes.

Wetland loss and isolation

Loss and degradation of wetlands in North America since European settlement has been substantial. Indeed, it is estimated that more than half of the wetlands in the United States have been drained and converted to other purposes. Ten states (Arkansas, California, Connecticut, Illinois, Indiana, Iowa, Kentucky, Maryland, Missouri, and Ohio) have lost 70 percent or more of their original wetland acreage. The losses continue to this day—58,000 acres of wetlands are lost each year in the United States. Some categories have been especially impacted by human development. For example, the shallowest and most easily drained wetlands (wetlands receiving only temporary flooding) have been essentially eliminated from regions with intensive agricultural activity. As a result of wetland loss and degradation, remaining wetlands have become increasingly disconnected (isolated) from surrounding wetlands, resulting in a loss of critical habitat for a wide variety of wildlife species.

The term isolated wetlands has many different meanings; wetlands can be isolated geographically, hydrologically, or ecologically. In this leaflet, isolated wetlands refers to ecologically isolated wetlands. Ecologically isolated wetlands are those that are not connected to each other or to other bodies of water by vegetated corridors or buffers, through which wildlife can easily disperse. Ecologically isolated wetlands include those that are separated from other bodies of water by a distance too great for a given wildlife species to move, as well as those isolated by natural or



Woodbury County Conservation Board

Restored Owego Wetland Complex in northwestern Iowa

human-made barriers, such as steep cliffs or roads, over or around which it is difficult for wildlife to pass.

Ecological isolation can be viewed along a continuum, depending on the wildlife species in question. For example, some prairie pothole wetlands might be considered isolated for amphibians with limited capabilities for dispersal, but for waterfowl that are able to traverse longer distances, these same wetlands can be highly connected. While a few wetlands are naturally isolated, human activities, especially those related to urban and agricultural development, are major contributors to wetland isolation.

Wetlands that are ecologically connected to one another (those that are not ecologically isolated) are referred to as wetland complexes. Wetland complexes consist of groups of wetlands that are functionally inter-connected by upland vegetated corridors or buffers, creating a mosaic of habitat for wildlife. Wildlife populations are most viable when a variety of wetland types exist in complexes and wildlife are able to move freely among diverse habitats to satisfy their complex life history needs. Where wildlife species may inhabit isolated wetlands, their survival, reproduction, and dispersal abilities may be impaired by isolation. Healthy populations of many wildlife species depend not just on a single wetland, but on a landscape that consists of a variety of wetlands connected with vegetated corridors: a wetland complex. Thus, a high diversity and abundance of smaller wetlands is critical in maintaining wildlife populations and is more often valuable to wildlife than a few larger wetlands of the same type.

Wetland-adapted wildlife

A diverse assemblage of flora and fauna have adapted to, and are thus dependent on, the historic abundance and seasonality of wetlands for their life history needs. Wetlands are top producers of waterfowl, songbirds, shorebirds, wading birds, reptiles, amphibians, and many invertebrate species. Wetland complexes containing a variety of wetland types and connected to upland habitat are needed to meet the range of habitat requirements of wildlife populations that have evolved with the presence of wetlands.

Even seasonal and temporary wetlands provide critical habitat for wildlife adapted to breeding exclusively in these areas. For example, many amphibians are adapted to ephemeral wetland habitats for breeding and rearing. In northern areas, they actively court and lay their eggs in the spring when wetlands contain lots of water due to snowmelt and spring rains. Seasonal and temporary wetlands are ideal nursing areas for developing amphibians because of the relatively warm water temperatures, abundant microorganisms for food, and lack of predators. Fully developed, amphibians emerge in summer and are able to move to surrounding aquatic, riparian, or upland habitat to forage or overwinter. Temporary wetlands provide ideal courtship and egg-laying location for amphibians because they tend to dry out in the summer, making them unable to support fish, which are effective predators of amphibian eggs, larvae, and adults.

Like amphibians, many invertebrates require the fish-free aquatic environments of wetland in which to lay eggs and/or go through larval stages. Invertebrates also take advantage of the seasonality of wetlands as their egg and larval stages often correspond to wet times of the year. Invertebrates are vital to the survival of wetland ecosystems, as they form the base of the food chain.

U.S. Fish and Wildlife Service

Waterfowl migration northward

Migratory waterfowl are also adapted to seasonal wetland dynamics. During their migratory journey northward, migratory waterfowl have adapted to the seasonal occurrence and productivity of wetlands and wetland complexes. Smaller wetlands are of particular importance, as they tend to thaw sooner in the spring than larger wetlands thereby providing protein-rich invertebrates and high-energy seeds and tubers, required by waterfowl during this time.

A significant number of species of conservation concern are dependent on wetland habitats. Wetlands provide habitat for one-third of federally listed endangered and threatened plant and animal species. A study by NatureServe found that at least 66 species listed as threatened, endangered, or candidate under the Endangered Species Act are supported by isolated wetland habitats. Nearly two-thirds of these listed species are completely dependent on isolated wetland habitat for their survival. Any further loss or degradation of wetland habitats could have a serious impact on the survival of these and other wildlife species.

Wetland complexes aid in the dispersal and recolonization of suitable habitats for amphibians and other wildlife species. The loss of individual wetlands within complexes reduces the connectivity and threatens remaining species populations. It has been shown that amphibian species richness decreases with greater wetland isolation. For example, if a population of amphibians in one wetland dies out due to factors such as prolonged drought or disease, amphibians from neighboring wetlands will be able to recolonize the site. However, if a wetland becomes isolated, recolonizing by amphibian populations is not possible due to the distance or barriers between wetlands. This may place local populations at the risk of extirpation and overall biodiversity will decline over time.

NRCS

Bottomland hardwood restoration in Arkansas

As wetlands continue to be lost, degraded, or isolated, the health and survival of many wildlife populations is at risk. Wetland-adapted wildlife require connectivity among wetlands to meet their varied habitat requirements. For example, waterfowl may breed in small wetlands but move to upland areas to nest. For wildlife populations to be healthy, they must be able to access their required habitats. When wetlands become isolated from one another or from upland areas, wildlife are limited in their abilities to access their required habitats and the health of these populations can decline.

Wetland restoration and enhancement

Because their ecological and economic values are now well understood, wetland restoration and enhancement projects are often undertaken to restore these values. Restoration refers to the return of a degraded or lost wetland to a pre-existing condition, or as close to that condition as possible. Enhancement refers to increasing one or more of the functions performed by an existing wetland beyond what currently or previously existed in the wetland.

Specific recommendations for wetland restoration and enhancement are beyond the scope of this leaflet. However, the Environmental Protection Agency and the Natural Resources Conservation Service have developed a number of technical resources on this topic. These include the Interagency Workgroup on Wetland Restoration's "An introduction and user's guide to wetland restoration, creation, and enhancement," available at *http://www.epa.gov/owow/wetlands/pdf/restdocfinal.pdf* and Conservation Practice standards 644 (Wetland Wildlife Habitat Management), 657 (Wetland Restoration), and 659 (Wetland Enhancement), available at *http://www.wli.nrcs.usda.gov/restoration/*. Landowners should begin wetland restoration or enhancement projects by reviewing these documents and contacting natural resource professionals to discuss the development, implementation, and evaluation of a wetland restoration or enhancement project.

Planning, implementation, and evaluation— Restoration and enhancement projects are often complicated, as the hydrology, climate, and current and historic plant and animal communities must be considered. Extensive planning must be done before a wetland restoration or enhancement project can be implemented. First, the landowner must understand the problems (wetland functions that have been lost) and opportunities (how lost functions can be restored) that exist. For wetland restoration or enhancement projects, the local landscape and historical factors that led to the creation and function of the

wetland in the first place must be understood. These factors include land use, topography, climate, precipitation patterns, soil types, ground and surface water flows, and vegetation communities. The factors contributing to the wetland loss or degradation must also be researched, as well as the possible opportunities to restore or enhance the wetland.

Once the problems and opportunities are understood, objectives for restoration must be outlined. Objectives might include planting riparian buffers, fencing livestock from wetland areas, or reducing point and nonpoint sources of pollution. The available resources able to undertake the restoration or enhancement project must be inventoried and analyzed to formulate a plan of action and any alternative plans of action that might be considered. Available resources might include wetland restoration expertise or financial resources. Armed with all this information, landowners will be well equipped to make decisions and decide on the proper plan of action for their wetland restoration or enhancement project.

Wetland restoration or enhancement plans can involve both passive and active activities, and often both are used at the same site. Passive restoration involves removing the factors that caused the loss or degradation in the first place, and allowing the natural recolonization of wetland plant and animal communities and the reestablishment of wetland hydrology and soils. Passive approaches to wetland restoration are most appropriate when the degraded site retains basic wetland characteristics. Active restoration involves direct control of the site processes, such as re-contouring, changing waterflow, and/or intensive planting and seeding. Active approaches to wetland restoration are most appropriate when a wetland is severely degraded or lost. For example, if a wetland has been drained and converted to cropland a number of years ago, and it does not retain hydric soils or hydrophytes, an active approach to restoration is necessary. Landowners and managers are strongly urged to discuss their wetland restoration or enhancement plans with experts from Federal, State, or local government agencies or qualified personnel from conservation organizations. These experts may also be available to help the landowner implement the plan. Evaluation of the plan throughout the planning process, as well as during and after its implementation, is key to the success of the project, as well as future wetland restoration and enhancement projects.

Misguided restoration or enhancements—The restoration of lost wetlands can add ecological and economic value to the landscape. However, restoration that results in the establishment of isolated wetlands has limited value and may even be detrimental to wildlife populations or entire ecosystems. For example, in areas where the majority of wetlands have been lost, restoring a single wetland will not restore the values associated with historical wetland complexes. In these areas, restoration plans should be undertaken to restore not only a single wetland, but a number of wetlands that are ecologically connected in wetland complexes. In restoring wetland complexes, it is important to ensure that a variety of wetland types are created and that vegetated corridors between these wetlands are maintained. A mosaic of both wetland and upland areas on the landscape is essential for many wildlife species.

Wetland enhancement projects designed to increase a particular wetland function often degrades other important wetland functions. For example, adding more water to a wetland may create better fish habitat, but it may degrade habitat for amphibians and/or decrease the ability of the wetland to hold flood waters. The costs and benefits of each wetland enhancement project should be considered and project goals should include minimizing any decrease in existing wetland functions.

A brief history of wetland protection in the United States

Section 404 of the Clean Water Act gives the U.S. Army Corps of Engineers the authority to issue permits to dredge or fill navigable waters of the United States. Until recently, the Corps had used a working definition of navigable waters that afforded Federal protection for almost all of the Nation's wetlands. However, in 2001, the United States Supreme Court issued a decision that restricted the Corps' jurisdiction to navigable waters, their tributaries, and wetlands adjacent to these navigable waters and tributaries. Therefore, wetlands not connected to navigable waters by surface water flow are now excluded from the Clean Water Act, which provided one of the few Federal mechanisms for the protection of these unique ecological communities. While the Federal Endangered Species Act and the Swampbuster program may protect some of these wetlands, their protection now falls mainly on State, tribal, and local governments and individual landowners.

Assistance programs

Financial and technical assistance for wetland habitat projects are available from an array of government agencies and public and private organizations. Table 1 lists the contact information of organizations that can provide information about wetland management, as well as other natural resource projects, and describes their associated conservation incentive programs.

Table 1 Technical and financial assistance to restore or enhance wetlands

Program	Land eligibility	Type of assistance	Wetland restoration or enhancement opportunities	Contact
Conservation Reserve Program	Highly erodible land, wetland, and certain other lands with cropping history, stream-side areas in pasture land	50% cost-share for establishing permanent cover and conservation practices and annual rental payments for land enrolled in 10- to 15-year contracts. Additional financial incentives for some practices	Plant long-term, resource-conserving covers in wetland and upland areas to improve water quality, control erosion, and enhance wildlife habitat	NRCS or FSA State or local office
Partners for Fish and Wildlife Program	Most degraded fish and/or wildlife habitat	Up to 100% financial and technical assistance to restore wildlife habitat under a minimum 10-year cooperative agreement	Restore wetland hydrology; plant native trees, shrubs, grasses, and other vegetation; install fencing and off-stream livestock watering facilities to allow for restoration of stream and riparian areas; remove exotic plants and animals	U.S. Fish and Wildlife Service local office
Waterways for Wildlife	Private land	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals	Enhance wetland and adjacent upland habitats by planting buffers, creating habitat structures, and other activities	Wildlife Habitat Council
Wetlands Reserve Program	Previously degraded wetland and adjacent upland buffer	75% cost-share for wetland restoration under 10-year contracts and 30-year easements and 100% cost-share on restoration under permanent easements. Payments for purchase of 30-year or permanent conservation easements	Restore and protect wetlands and limited adjacent upland area; improve wetland wildlife habitat	NRCS State or local office
Wildlife at Work	Corporate lands	Technical assistance on developing habitat projects into programs that allow companies to involve employees and the community	Enhance wetland and adjacent upland habitats by planting buffers, creating habitat structures, and other activities	Wildlife Habitat Council
Wildlife Habitat Incentives Program	High-priority fish and wildlife habitats	Up to 75% cost-share for conservation practices under 5- to 10-year agreements	Establish and improve fish and wildlife habitat including wetland and adjacent upland habitats, particularly those for wildlife species experiencing declining or significantly reduced populations	NRCS State or local office

References

Online Sources

Chesapeake Bay Program Office. 2003. Wetlands: general info. *http://www.chesapeakbay.net/wetlds1.htm* [Accessed 14 June 2004].

Farm Service Agency. n.d. Eligible farms. *http://www.fsa.usda.gov/mt/farmable%20wetlands%20fact%20sheet04.htm* [Accessed 10 June 2004].

Farm Service Agency Online. 2003. Conservation Reserve Program. *http://www.fsa.usda.gov/pas/publicatoins/facts/html/crp03.htm* [Accessed 10 June 2004].

Iowa Department of Natural Resources. 2001. Farmable Wetlands Program. *http://www.state.ia.us/government/dnr/organiza/fwb/wildlife/pages/farmablewet.htm* [Accessed 10 January 2002].

Iowa State University College of Agriculture. n.d. IWRACP about wetlands. *http://www.ag.iastate.edu/centers/iawetlands/About.html* [Accessed 24 November 2004].

U.S. Environmental Protection Agency. 2005. Wetlands. *http://www.epa.gov/owow/wetlands/* [Accessed 29 July 2005].

U.S. Army Corps of Engineers Sacramento District. 2000. Wetlands and agriculture: section 404 of the Clean Water Act and Swampbuster in the Food Security Act. *http://www.spk.usace.army.mil/cespk-co/regulatory/SB.html* [Accessed 9 June 2004].

Printed Sources

Anderson, J.K., R.W. Spain, L.D. McKinney, and A. Sansom. 2000. Wetlands assistance guide to landowners. Texas Parks and Wildlife, Austin, TX.

Berry, C.R., Jr., and D.G. Buechler. 1993. Wetlands in the Northern Great Plains: a guide to values and management. U.S. Fish and Wildlife Service and the Agricultural Extension Service, South Dakota State University, Brookings, SD.

Comer, P., K. Goodin, G. Hammerson, S. Menard, M. Pyne, M. Reid, M. Robles, M. Russo, L. Sneddon, K. Snow, A. Tomaino, and M. Tuffly. 2005. Biodiversity values of geographically isolated wetlands: an analysis of 20 U.S. States. NatureServe, Arlington, VA.

Dahl, T.E. 1990. Wetlands losses in the United States 1780's to 1980's. U.S. Fish and Wildlife Service, Washington, D.C. Available at: *http://www.npwrc.usgs.gov/resource/othrdata/wetloss/wetloss.htm*.

Gibbons, J.W. 2003. Terrestrial habitat: a vital component for herpetofauna of isolated wetlands. Wetlands 23: 630-635.

Interagency Workgroup on Wetland Restoration. n.d. An introduction and user's guide to wetland restoration, creation, and enhancement. National Oceanic and Atmospheric Administration, Environmental Protection Agency, Army Corps of Engineers, U.S. Fish and Wildlife Service, and Natural Resources Conservation Service, USA. Available at *http://www.epa.gov/owow/wetlands/pdf/restdocfinal.pdf*.

Lehtinen, R.M., S.M. Galatowitsch, and J.R. Tester. 1999. Consequences of habitat loss and fragmentation for wetland amphibian assemblages. Wetlands 19:1-12.

Leibowitz, S.G. 2003. Isolated wetlands and their functions: an ecological perspective. Wetlands 23: 517-531.

Petrie, M., J.P. Rochon, G. Tori, R. Pederson, and T. Moorman. 2001. The SWANCC decision: implications for wetlands and waterfowl. Ducks Unlimited, Memphis, TN. Available at: *http://www.ducks.org/conservation/404_report.asp*.

Tiner, R.W., H.C. Bergquist, G.P DeAlessio, and M.J. Starr. 2002. Geographically isolated wetlands: A preliminary assessment of their characteristics and status in selected areas of the United States. U.S. Fish and Wildlife Service, Northeast Region, Hadley, MA. Available at: *http://wetlands.fws.gov/Pubs_Reports/isolated/report.htm*.

Winter, T.C., and J.W. LaBaugh. 2003. Hydrologic considerations in defining isolated wetlands. Wetlands 23: 532-540.

Natural Resources Conservation Service
Mailing address:
P.O. Box 2890
Washington, DC 20013

Street address:
14th and Independence Avenue SW
Washington, DC 20250

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

www.nrcs.usda.gov

Wildlife Habitat Council
8737 Colesville Road, Suite 800
Silver Spring, Maryland 20910
(301) 588–8994

The mission of the Wildlife Habitat Council is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, nonprofit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.

www.wildlifehc.org

Primary author: **Raissa Marks**, Wildlife Habitat Council. Drafts review by **Erika Smith** and **Rob Pauline**, Wildlife Habitat Council; **William Hohman** and **Mark Lindflott**, Natural Resources Conservation Service; **Mark Oja**, U.S. Department of Agriculture; **Leigh Frederickson**, University of Missouri; **Milton W. Weller**, Texas A&M.