Wildlife Habitat Education Program

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Many people have been involved in writing and preparing the National 4-H Wildlife Habitat Education Program manual over the years. This edition represents the fourth major revision. Editors of previous editions included:

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History of the National 4-H Wildlife Habitat Education Program

The Wildlife Habitat Education Program (WHEP) began in 1978 under the direction of Dr. James L. Byford, Extension Wildlife Specialist, and Dr. Thomas K. Hill, Extension Fisheries Specialist, at the University of Tennessee. They realized the passion many youth have for wildlife and initiated the **Tennessee 4-H Wildlife Judging Contest**, which was modeled after the popular 4-H livestock judging contests. The program was immediately accepted throughout Tennessee. With support from the U.S. Fish and Wildlife Service, a conference was held in 1985 to explore the possibility of a Southern Region Program. The first Southern Region Invitational was held in 1987. In 1988, the second Southern Region Invitational was supported by the International Association of Fish and Wildlife Agencies, and a conference was held concurrently to discuss the possibility of a national event. In 1989, the first national event was held with the support of the U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies.

In 1990-91, the program was expanded nationally, and this manual was produced with sponsorship by Champion International Corporation and the U.S. Fish and Wildlife Service. The new national program was called the **National 4-H Wildlife Habitat Evaluation Program**. The manual was revised in 1998-99 to incorporate new information in wildlife science and management. The Ruffed Grouse Society, Rocky Mountain Elk Foundation, and the USDA Cooperative State Research, Education and Extension Service were added as sponsors of the manual revision. The manual incorporated the basic concepts originated by Byford and Hill with the addition of ecoregions across the U.S. and a wider array of wildlife management practices and wildlife species. Since 1991, the manual has undergone four major revisions (the latest in 2014), each incorporating new information and revision of contest activities. This process is important and highlights the need to incorporate additional information as research makes it available and as interest among participants changes.

Starting in 2010, FFA teams were invited to compete in WHEP. FFA teams and 4-H teams do not compete against each other, but rather against teams within each organization. Additionally, in 2010, the name **Wildlife Habitat *Evaluation* Program** was changed to **Wildlife Habitat *Education* Program** to reflect the intent of the program to provide curriculum on wildlife management in addition to the contest format. WHEP was acknowledged with the Conservation Education Award by The Wildlife Society in 1996 and earned the 4-H National Program of Distinction Award in 2011.

This manual is intended for use in preparing for the National WHEP Invitational as well as state and local educational programs. It is the intent of the organizers to move the national contest to different locations each year. This manual is designed to provide uniformity for the program and provide wildlife management information using representative species occupying major ecoregions across the U.S.

Table of Contents

Introduction

The National 4-H Wildlife Habitat Education Program (WHEP) is designed to teach youth the fundamentals of wildlife and fisheries science and management. WHEP is an official 4-H program; however, the National Invitational is open to FFA participants as well. The National Invitational is open only to senior division 4-H members or FFA participants. Junior-high and junior division 4-H members are eligible to compete at county, regional (within a state), and/or state events.

In this program, youth learn how management for wildlife includes managing land, water, and populations. The manual and activities are focused not only on increasing knowledge in wildlife management, but also in developing skills to apply that knowledge. Additional benefits include development of life skills, such as decision-making, leadership, written and oral communication, and meeting other young people and professionals from around the country who have interests in natural resources.

It is important to understand ecological processes as well as life requirements of various wildlife species before making management recommendations. The **Concepts and Terms**, **Ecoregions**, **Wildlife Species**, and **Wildlife Management Practices** sections of this manual provide basic information related to wildlife ecology and management as well as the life requirements of various wildlife species. The Wildlife Challenge (Activity III) allows participants to showcase their knowledge from these sections.

Wildlife managers must be able to inventory and evaluate an area as habitat for various wildlife species. They must be able to explain the condition of the area and identify the wildlife present to landowners and other interested individuals. Once the inventory and evaluation is completed, managers recommend the appropriate wildlife management practices to enhance habitat for certain wildlife species. **On-site Recommendation of Wildlife Management Practices** (Activity I) provides experience with this decision-making process. The **Written Wildlife Management Plan** (Activity II-A) and **Oral Reasons** for the written plan (Activity II-B) should explain management recommendations so others can understand and consider them.

About the Manual

This manual is divided into the following major sections.

Wildlife Management Concepts and Terms introduces basic wildlife management principles. These concepts and terms are the basis for the remainder of the manual. Participants should be prepared to use the wildlife management concepts and terms in their written plan and oral presentation as appropriate.

Ecoregions identifies areas of the U.S. with distinctly different vegetation communities and wildlife species. This section gives a brief description of the vegetation and land use found in the ecoregions, explains typical stages of plant succession, lists wildlife species that may be considered in the national contest and summarizes wildlife management practices that can be used in each ecoregion.

Wildlife Species provides information about habitat requirements and wildlife management practices used for the various species.

Wildlife Management Practices explains each of the wildlife management practices discussed in the Wildlife Species section.

WHEP Activities and Scoring provides information on each activity, how it is administered, and how the national contest is scored.

Appendix A provides blank score sheets for On-site Recommendations for Wildlife Management Practices (Activity I).

Appendix B provides definitions of food groups for various wildlife species.

The Glossary defines technical words used in the manual.

How to Use the Manual

Leaders and participants should first learn the concepts and terms. Then, locate and mark materials pertinent for a particular ecoregion.

Determine which ecoregion will be used for a local, state, or national contest. Maps and ecoregion descriptions are in the Ecoregions section. The Wetlands and Urban descriptions are applicable to all ecoregions.

Determine which wildlife species will be used. A list of species accompanies each ecoregion. There are many field guides and websites that provide photos and additional information for these wildlife species.

Locate and mark the selected species in the Wildlife Species section. It is important to be able to identify species from different sources and be able to identify the male, female, adult, and juvenile of a species. Learning life history information about a species is critical to make appropriate management decisions.

Locate and mark the appropriate practices in the Wildlife Management Practices section. Learning how various wildlife management practices affect wildlife species is critical. Note that not all wildlife management practices listed in the manual are used in every ecoregion. The **Wildlife Challenge** (Activity III) may require information from various portions of the manual, including **Wildlife Species**, **Wildlife Management Practices**, **Concepts and Terms**, and the ecoregion of the contest (including **Urban** and **Wetlands** Ecoregions).

Preparing for Contests

Participants should read and understand the **Concepts and Terms** section of the manual. Leaders should explain the concepts and terms and provide local examples to clarify any misunderstanding. This section is important because the activities require understanding of these concepts and terms. Students should use these terms and concepts in their presentations during the contest.

Once the concepts are understood, leaders should review the appropriate regional information with participants. Leaders have the flexibility to use any of the information from the **Ecoregions** section they believe is appropriate. Leaders and participants should review plant succession processes, common plants, wildlife species and wildlife management practices. Specific information about habitat requirements and recommended wildlife management practices are found in the **Wildlife Species** section. Many teams/participants find it helpful to mark those species included in the ecoregion they are judging so the information is more easily found when studying.

Leaders can introduce participants to the contest activities through various exercises. Some make note cards or flash cards to help when studying. Conducting practice sessions at outdoor sites is helpful. Participants should get outside and find examples of the principles and practices discussed in this manual. Habitat requirements available for the species selected should be identified, as well as what features are missing. Leaders may use "quiz bowls" and question-answer sessions to measure learning. Field guides and other teaching materials may be used to further learning. State wildlife agencies, state Extension wildlife specialists, and county Extension offices have information regarding the availability of learning materials. Collecting pictures or specimens of the species from several different sources will help with the identification portion of the test.

Local and state events may use different wildlife species and activities from those recommended in the manual. However, at the national event, all activities and only the wildlife species and wildlife management practices listed in this manual will be used.

Beginning and young participants should not be expected to perform all the activities. Organizers of local and state events may limit activities for junior division participants. Written management plans and oral reasons may not be appropriate for this age group. Participants in the national event will be expected to perform all of the activities in this manual.

General Rules and Guidelines

The national event will comply with all policies and guidelines for national 4-H competitive events.

I. Contestants and Eligibility:

A. Each state is allowed to enter only one 4-H team and/or one FFA team or up to two 4-H individual contestants and/or two FFA individual contestants. A team will consist of no less than three and no more than four official entrants who are 4-H or FFA members in their state during the current year. If a state is unable to assemble a team, it may send up to two contestants to participate in individual events only.

B. **Contestants must have already passed their 14th birthday, and may not have reached their 19th birthday as of January 1 of the year of the Invitational**.

C. An individual or team may enter the National 4-H Wildlife Invitational event only once during his/her 4-H or FFA career. A team (or individual) may not compete as a 4-H team (or individual) one year, then come back another year as an FFA team (or individual).

D. The team of contestants must be certified as the official state entry by the state Extension or FFA director, or by a person designated by the director. The individuals or team may be selected by any procedures a state considers appropriate. It is required that each state obtain medical authorizations for participants and accompanying adults.
E. If a participant has an Individual Education Plan, a copy of the IEP and any special accommodations must accompany the official entry for the team. Once the IEP and accommodations are received, they will be reviewed. The National WHEP Committee will make all reasonable efforts to accommodate participants with IEPs.

Contestants in the National 4-H WHEP Invitational must **not** have taken classes or participated in official post-secondary (university, college, junior college, or technical school) competitive events of a similar nature in the same subject matter area. Neither can participants be a member of a post-secondary team undergoing training in preparation for an event. For example, a contestant who has competed in an official collegiate wildlife contest, on or off campus, or taken college courses related to natural resources is ineligible to compete in the National 4-H WHEP Invitational. The state 4-H program leaders are responsible for determining the eligibility for participants in national 4-H competitive events from their respective states.

II. General Contest Rules and Information:
The date, location and ecoregion for the National Invitational will be announced no later than May 1.
A. State team entries must be submitted through the official entry process.
B. Each team can have no more than two adults serving as coaches or chaperones accompanying the team to the invitational.
C. Although there will be educational opportunities before the contest begins, all contestants should study this manual and be prepared before coming to the national event. Questions will not be allowed during the contest except for those related to contest procedure.
D. A materials packet to supplement this manual may be available for leaders and participants in advance of the national event. The packet may contain information on the ecoregion and wildlife species used in the upcoming event. The materials packet will be supplied by the Extension wildlife specialist, 4-H office or other qualified personnel from the state hosting the national event.
E. Contestants will be required to adhere to the host state's Code of Conduct. No alcohol, tobacco or drug use will be allowed during the event.
F. Contestants and coaches/chaperones are required to take part in all phases of the National Invitational, including the opening ceremony, educational program, contest, fun activities, coaches tour, and awards banquet.

On Contest Day:
A. All contestants must provide their own pencil and clipboard. However, no storage clipboards are allowed.
B. No electronic devices of any kind are allowed at the contest site. This includes, but is not limited to, cell phones and iPods/mp3 players. No backpacks are allowed. Bags for medical reasons should be discussed with the National WHEP Committee before contest day.
C. Contestants will work independently on the individual activities. No talking by contestants will be allowed during the individual activities.
D. Anyone caught cheating may be disqualified at the discretion of the National WHEP Committee.
E. All adults, except contest officials, will be separated from contestants at all times while the contest is in progress. All adults must participate in the designated coaches' activity during contest day.
F. An official committee will score the contest and analyze results. Their decision is final.

G. The team score will be the sum of the three highest scores in the individual Activities, plus the team score for the management plan, which will include the top three scores for oral reasons.
H. After the event, individual and team scores will be made available to the teams. Contest score sheets will not be distributed.
I. Distribution of awards is determined by the state host. However, every National Invitational will recognize for 4-H and FFA:

Team Awards
First Place
Second Place
Third Place
***Note**: If there are less than 4 teams competing, awards may be limited to the winning team only.*

Individual Awards
First Place High Individual
Second Place High Individual
Third Place High Individual
***Note:** Individual awards will be determined by Activities I and III.*

Wildlife Management Concepts and Terms

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

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

Concepts and terms

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

From species and communities to ecosystems and landscapes

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

Plant succession and its influence on wildlife

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

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

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

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

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

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

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

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

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

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

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

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

Craig Harper

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

Craig Harper

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

Habitat and habitat requirements

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

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

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

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

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

Species richness and diversity

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

Nonnative and invasive species

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

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

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

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

Focal species management and ecosystem management

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

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

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

Craig Harper

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

Craig Harper

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

Edge

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

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

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

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

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

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

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

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

John Weir

Craig Harper

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

John Gruchy

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

Craig Harper

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

Arrangement and interspersion

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

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

Craig Harper

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

Area-sensitive species

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

Vertical structure

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

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

Craig Harper

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

Carrying capacity

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

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

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

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

Craig Harper

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

Compensatory and additive mortality

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

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

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

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

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

Home range, movements, migration, and corridors

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

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

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

Food webs

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

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

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

Alan Windham

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

Ecoregions

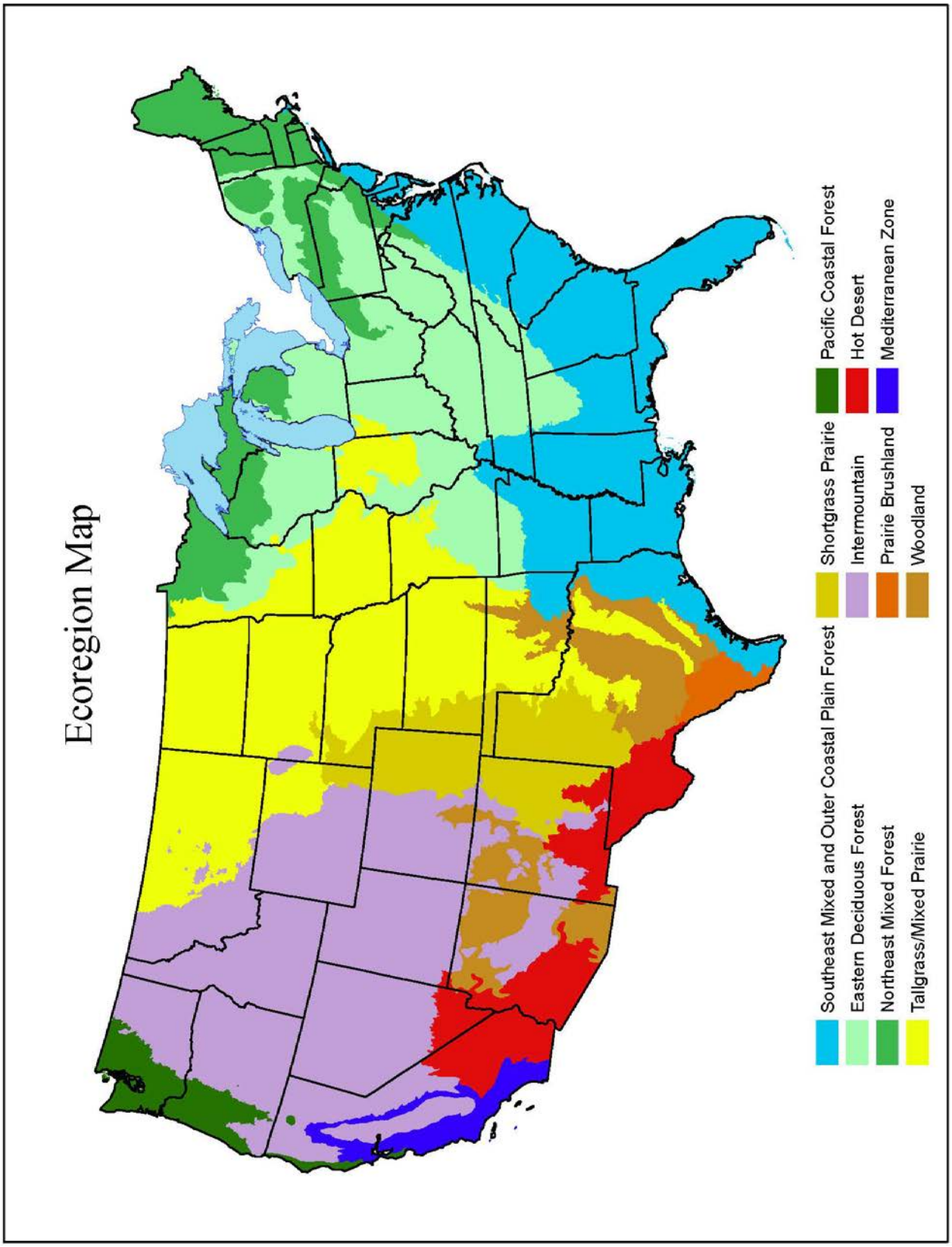
Areas of the country can be separated into ecoregions having similar climate, vegetation and wildlife. They are described in very general terms. Wetlands and Urban areas are found within all ecoregions. At the end of each ecoregion description is a list of wildlife species recommended to use when evaluating an area in that ecoregion. You can use any or all of the listed species as well as additional species when applicable. However, only those listed will be used in the National Invitational event. Some of the species listed are considered a nuisance in some areas and circumstances. Contest organizers may exclude such species from local activities or center the activities on why the species are pests and what can be done to decrease problems.

Each ecoregion description is followed by a table that identifies wildlife management practices for various wildlife species that occur in that ecoregion. Specific information on recommended wildlife management practices can be found in the wildlife species section.

List of Ecoregions

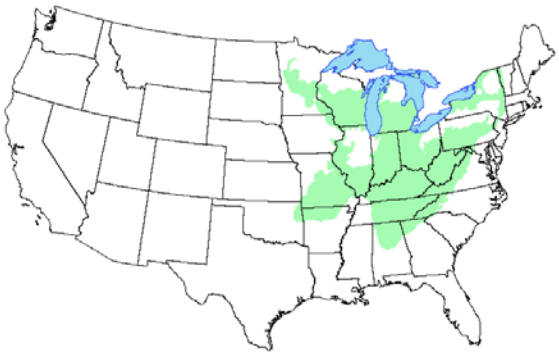
Eastern Deciduous Forest
Great Plains Grassland – Shortgrass Prairie
Great Plains Grassland – Tallgrass/Mixed Prairie
Hot Desert
Intermountain – Foothills
Intermountain – Montane
Intermountain – Sagebrush
Intermountain – Subalpine
Mediterranean
Northeast Mixed Forest
Pacific Coastal Forest
Prairie Brushland
Southeast Mixed and Outer Coastal Plain Forest
Woodland

Special area considerations within each ecoregion:
Urban
Wetlands


Ecoregion Map
Pacific Coastal Forest
Hot Desert
Mediterranean Zone
Shortgrass Prairie
Intermountain
Prairie Brushland
Woodland
Southeast Mixed and Outer Coastal Plain Forest
Eastern Deciduous Forest
Northeast Mixed Forest
Tallgrass/Mixed Prairie

Eastern Deciduous Forest

Physical description



Most of the terrain is rolling except for the Appalachian Mountains and Ozark Mountains, which can be steep. The average annual precipitation ranges from approximately 35 inches to 90 inches and is usually well-distributed throughout the year. Summers are hot; winters are cold.

Dominant vegetation

Deciduous trees dominate the landscape across the Eastern Deciduous Forest ecoregion where there is a lack of disturbance. Depending on location, trees such as oaks, hickories, maples, American beech, basswood, buckeye, yellow poplar, walnut, and birches are common in the overstory and can be indicators of a climax successional stage. Prevalent midstory trees include flowering dogwood, sassafras, sourwood, eastern redbud, hophornbeam, American hornbeam, and striped maple. Common shrubs include arrowwood, black huckleberry, blueberries, hawthorn, pawpaw, spicebush, viburnums, and witchhazel. A wide variety of forbs and ferns may be found in the understory. Common evergreen trees on many sites undergoing succession include eastern redcedar, Virginia pine, and shortleaf pine. In the Appalachians, eastern hemlock has been an important component in the Eastern Deciduous Forest. However, its decline following invasion of the Asian hemlock adelgid will surely lead to functional changes within this ecoregion.

Deciduous forest cover occurs over the Eastern Deciduous Forest ecoregion, except where areas have been cleared for agriculture and livestock.

Changes in the composition, structure and function of the Eastern Deciduous Forest have already occurred during the past 100 years with the loss of American chestnut and the near total exclusion of fire. Prior to fire suppression, savannas and woodlands dominated by oak and shortleaf pine (depending on geographic location) were prevalent over much of this ecoregion.

Well-interspersed with forested areas in the Eastern Deciduous Forest ecoregion are agricultural fields, pastures and hayfields, and fields undergoing succession. Virtually all of these “old-fields” have been cropped in the past, and the vast majority has since been planted to nonnative grasses, especially tall fescue. Restoring old-fields and other open areas that contain nonnative sod grasses to native grasses and forbs is a major objective concerning wildlife conservation in this ecoregion. Native grasses, forbs, brambles, and shrubs occurring naturally in openings and savannas

include bluestems, panicgrasses, indiangrass, switchgrass, asters, lespedezas, tick-trefoils, partridge pea, pokeweed, blackberry, wild plum, and sumacs.

Commonly occurring nonnative invasive plants in the Eastern Deciduous Forest ecoregion include tall fescue, orchardgrass, bermudagrass, serecia lespedeza, royal paulownia, tree-of-heaven, calory pear, autumn and Russian olive, Japanese honeysuckle, bush honeysuckles, Chinese privet, and bicolor lespedeza.

Farming and ranching

Large areas of the Eastern Deciduous Forest ecoregion have been cleared for crop production and livestock forage. The major agriculture crops in the ecoregion are corn, soybeans, wheat, grain sorghum, and cotton. The dominant grasses grown for pasture and hayfields include tall fescue, orchardgrass, bermudagrass, dallisgrass, and bluegrass, all of which are nonnative. Depending on how croplands and pastures are managed, some wildlife species benefit. Unfortunately, crop-fields are usually harvested in late summer or early fall (unless winter wheat is growing), pastures are most often overgrazed (leaving no cover for nesting or loafing), and hayfields are composed of nonnative sod grasses that provide poor structure for most wildlife species. The vast majority of fields that are not in crop production are hayed (or mowed for aesthetic purposes) at least twice per year, usually once during the height of the nesting season for grassland birds, and once in late summer/early fall, which destroys any value as winter cover for wildlife.

Plant succession

Annual forbs (such as common ragweed shown here) and grasses with a few perennial species represent the **initial successional stage**.

Perennial forbs and grasses (such as broomsedge, goldenrod, ironweed (purple flower), and thoroughwort (white flower) shown here) and brambles represent the **second successional stage**.

Young trees and shrubs (such as wild plum and winged sumac shown here), often with perennial grasses and forbs, represent the **third successional stage**.

Craig Harper

Hardwood forests typically represent the **fourth successional stage**. In some areas of the Eastern Deciduous Forest ecoregion, pine forests represent the third or fourth successional stage. Regardless, forests are young before they are old. Young forests (left) provide a different structure than older forests (right). Wildlife associated with forests that are only 2- to 4-years-old are often the same species associated with brushy cover provided in the third successional stage (such as eastern cottontail, northern bobwhite, brown thrasher).

Wildlife associated with Eastern Deciduous Forest

American woodcock
brown thrasher
eastern meadowlark
golden-winged warbler
great horned owl
mourning dove
northern bobwhite
ovenbird
wild turkey
wood duck
bobcat
eastern cottontail
eastern gray squirrel
gray fox
Indiana bat
white-tailed deer
eastern box turtle
timber rattlesnake
bluegill
largemouth bass

Eastern Deciduous Forest	American woodcock	brown thrasher	eastern meadowlark	golden-winged warbler	great horned owl	mourning dove	northern bobwhite	ovenbird	wild turkey	wood duck	bobcat	eastern cottontail	eastern gray squirrel	gray fox	Indiana bat	white-tailed deer	eastern box turtle	timber rattlesnake	bluegill	largemouth bass
Habitat Management Practices																				
Conservation Easement			X	X			X								X					
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Create Snags				X	X					X				X	X					
Delay Crop Harvest																				
Edge Feathering	X	X		X	X		X		X		X	X	X	X		X				
Field Borders		X			X		X		X		X	X				X	X			
Forest Management		X		X	X		X	X	X	X	X	X	X	X	X	X	X	X		
Leave Crop Unharvested						X	X		X	X		X				X				
Livestock Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Nesting Structures										X										
Plant Food Plots						X	X		X	X		X	X			X				
Plant Native Grasses and Forbs			X		X	X	X		X			X				X	X			
Plant Shrubs	X	X		X	X		X		X	X	X	X		X		X	X			
Plant Trees	X			X	X	X		X	X	X	X		X	X	X	X	X	X		
Repair Spillway/Levee						X				X									X	X
Set-back Succession	X	X	X	X	X	X	X		X	X	X	X		X		X	X			
Tillage Management					X	X	X		X	X		X				X				
Water Control Structures						X				X									X	X
Water Developments for Wildlife						X			X	X						X	X			
Population Management Practices																				
Decrease Harvest	X						X		X		X	X	X	X		X			X	X
Increase Harvest									X		X	X	X	X		X			X	X
Wildlife Damage Management					X				X		X	X	X	X		X		X		
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices																				
Construct Fish Pond																			X	X
Control Aquatic Vegetation																			X	X
Fertilize/Lime Fish Pond																			X	X
Reduce Turbidity in Fish Pond																			X	X
Restock Fish Pond																			X	X
Streams: Create Pools																				
Streams: Remove Fish Barriers																				

Great Plains Grasslands – Shortgrass Prairie

Physical description

The terrain is flat to rolling with occasional valleys, canyons, mesas, and buttes. Average annual precipitation ranges from 10 to 25 inches.

Dominant vegetation

In the western Great Plains (or shortgrass prairie), climax vegetation typically consists of short grasses, such as the gramas, buffalograss, needlegrasses, and wheatgrasses. In many areas, various species of shrubs, such as sagebrush, sumacs, salt bush, winterfat, and cholla are found mixed with the grasses. Locoweed, sunflowers, ragweed, lupine, and herbaceous sage are common forbs present in this area.

Within this ecoregion, there are large areas along major rivers and drainages dominated by trees and shrubs, such as cottonwood, American elm, box elder, and various willows. These sites are very attractive to species of wildlife that require woody cover.

Depressions (potholes) caused by glaciation in the north and closed drainages (playas) in the south fill with water, creating numerous wetlands that are extremely valuable to wildlife. These wetlands, especially the smaller ones, are susceptible to periodic drought.

Typical nonnative invasive plants in the Shortgrass Prairie include cheatgrass, Old World bluestem, saltcedar, yellow sweetclover, knapweed, and leafy spurge.

Dwayne Elmore

Shortgrass prairie is dominated by low-growing grasses.

Dwayne Elmore

In some areas of prairie, shrubs such as yucca provide important diversity that several wildlife species require.

Farming and ranching

Cultivated cropland is found in portions of this ecoregion. Where precipitation is adequate or where irrigation is possible, large areas are planted to agricultural crops, such as cereal grains, grain sorghum, flax, sunflowers, and alfalfa. Changes in farm machinery and management have produced large areas of cropland with little or no native vegetation available for wildlife. Recent irrigation water management techniques have reduced the amount of wetlands and riparian vegetation associated with irrigated crops. In the past, large areas of wetlands were drained or altered in some manner so crops could be grown and this practice continues. Much of this area is native rangelands, most of which is grazed by livestock, except for a few locations where terrain is too rugged or water is unavailable. Many acres of rangeland and former cropland have been converted to nonnative grasses, such as Old World bluestem and smooth brome, which have limited wildlife value.

Special: Planting trees for wildlife in this ecoregion is only recommended in areas where trees would have occurred historically, such as in riparian areas or major drainages. The historic occurrence of these trees was influenced by soils, moisture, and fire. Eastern redcedar and ashe juniper are very invasive in this ecoregion and control is important where they occur.

Plant succession

Annual forbs and grasses represent the initial successional stage. Perennial forbs and grasses represent the second successional stage. Shrub cover occurs in some areas and represents a third successional stage. Perennial grasses and forbs with scattered shrubs is the final stage of succession over most of the Shortgrass Prairie. Shrubs and trees are common along riparian areas.

Wildlife associated with Shortgrass Prairie

American kestrel
blue-winged teal
lark bunting
mallard
mourning dove
northern harrier
scaled quail
sharp-tailed grouse
black-tailed prairie dog
coyote
Rocky Mountain mule deer
pronghorn
plains hog-nosed snake
bluegill
largemouth bass

Great Plains Grassland: Shortgrass Prairie	American kestrel	lark bunting	mallard	mourning dove	northern harrier	scaled quail	sharp-tailed grouse	black-tailed prairie dog	coyote	pronghorn	Rocky Mountain mule deer	plains hog-nosed snake	bluegill	largemouth bass
Habitat Management Practices														
Conservation Easement														
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X		
Create Snags	X													
Delay Crop Harvest		X	X	X	X		X							
Edge Feathering									X		X			
Field Borders	X					X	X		X		X			
Forest Management									X		X			
Leave Crop Unharvested			X	X	X		X				X			
Livestock Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Nesting Structures														
Plant Food Plots			X	X			X			X	X			
Plant Native Grasses and Forbs	X	X	X	X	X	X	X		X	X	X	X		
Plant Shrubs	X			X		X	X	X	X		X			
Plant Trees	X			X							X			
Repair Spillway/Levee			X	X									X	X
Set-back Succession	X	X	X	X	X	X	X	X	X	X	X	X		
Tillage Management	X		X	X	X	X	X				X			
Water Control Structures			X	X									X	X
Water Developments for Wildlife			X	X		X				X	X			
Population Management Practices														
Decrease Harvest						X	X	X	X	X	X		X	X
Increase Harvest								X	X	X	X		X	X
Wildlife Damage Management								X	X		X			
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices														
Construct Fish Pond													X	X
Control Aquatic Vegetation													X	X
Fertilize/Lime Fish Pond													X	X
Reduce Turbidity in Fish Pond													X	X
Restock Fish Pond													X	X
Streams: Create Pools														
Streams: Remove Fish Barriers														

Great Plains Grasslands – Tallgrass/Mixed Prairie

Physical description

The terrain is characterized by flat to rolling plains. Average annual precipitation ranges from 20 to 40 inches. Precipitation increases from west to east and is received primarily as spring and summer rain and winter snow. Winters are cold; summers are hot.

Dominant vegetation

Tall grasses, such as various bluestems, indiangrass, and switchgrass, represent the dominant vegetation in the eastern Great Plains (or tallgrass prairie). Commonly occurring forbs include sunflowers, broomweed, western ragweed, and lespedezas. Tall grasses dominate moist sites with soil depth greater than 20 inches, such as floodplains and valleys. Dry sites, such as hill tops and south-facing slopes, are dominated by shortgrass species. Transition sites (in-between areas) consist of a mixture of tall, mixed, and short grasses, including bluegrasses, prairie sandreed, grama grasses, and various dropseeds are found in this area.

Drainages and other moist areas may have shrubs and trees, such as native plum, buttonbush, and cottonwood. Trees and shrubs, such as cottonwood, green ash, bur oak, American elm, box elder, eastern redcedar and various willows, occur along riparian areas with the Great Plains grasslands ecoregion. These sites are very attractive to various wildlife species that are adapted to woody vegetation cover.

Woodlands dominated by post oak and blackjack oak occur on upland sites in the southeast portion of the tallgrass prairie. This area is known as the Cross Timbers. It extends from northern Texas through central Oklahoma into Kansas. All of these vegetation types were historically maintained by a combination of grazing and fire. The lack of fire is a major cause of rangeland deterioration throughout this ecoregion.

Depressions (potholes) caused by glaciation in the north and closed drainages (playas) in the south fill with water, creating numerous lakes, ponds, and other wetlands that are extremely valuable to wildlife. These wetlands, especially the smaller ones, are susceptible to periodic droughts.

Typical nonnative invasive plants in the Tallgrass ecoregion include sericea lespedeza, bermudagrass, Canada thistle, smooth brome, musk thistle, and tall fescue.

Special: Planting trees for wildlife in this ecoregion is only recommended in areas where trees would have occurred historically, such as in riparian areas or major drainages. The historic occurrence of these trees was influenced by soils, moisture, and fire.

Dwayne Elmore

Large expanses of prairie are critical to grassland species, such as the greater prairie-chicken.

Dwayne Elmore

Prairie is not only composed of grasses, but forbs are equally important. This recently burned prairie has abundant forbs and bare ground.

Farming and ranching

Cultivated cropland is found in portions of this ecoregion where precipitation is adequate or irrigation is possible. Large areas are planted into agricultural crops, such as barley, wheat, millet, flax, oats, corn, sunflowers, and alfalfa. In the eastern part of the Great Plains and other areas where soil is fertile, the main crops include wheat, sugarbeets, corn, soybeans, grain sorghum, and alfalfa.

Changes in farm machinery and management have produced large areas of cropland with little or no other types of vegetation available for use by wildlife. Recent irrigation water management techniques have reduced the amount of wetlands and riparian vegetation associated with irrigated crops.

Most of the native range is grazed by livestock except for a few locations where terrain is too rugged or water is unavailable. Many acres of native rangelands in this ecoregion are being invaded by juniper (eastern redcedar) because of fire suppression. Fire is a critical component to rangeland health. The current lack of fire is the greatest threat to wildlife in this ecoregion.

Plant succession

Annual forbs and grasses represent the initial successional stage. Perennial grasses and forbs dominate the second successional stage. The climax community or third stage consists of woody species, such as juniper, osage orange, and elms. Shrubs and trees dominate riparian areas and other sufficiently moist areas that can support woody vegetation.

Wildlife associated with Tallgrass/Mixed Prairie

blue-winged teal
dickcissel
grasshopper sparrow
greater prairie-chicken
mourning dove
northern bobwhite
northern harrier
ring-necked pheasant
wild turkey
coyote
eastern cottontail
red fox
white-tailed deer
plains hog-nosed snake
bluegill
largemouth bass

Great Plains Grassland: Tallgrass/Mixed Prairie	blue-winged teal	dickcissel	grasshopper sparrow	greater prairie-chicken	mourning dove	northern bobwhite	northern harrier	ring-necked pheasant	wild turkey	coyote	eastern cottontail	red fox	white-tailed deer	plains hog-nosed snake	bluegill	largemouth bass
Habitat Management Practices																
Conservation Easement			X	X												
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Create Snags																
Delay Crop Harvest		X	X	X	X		X									
Edge Feathering						X		X	X	X	X	X	X			
Field Borders		X		X		X		X	X	X	X	X	X			
Forest Management						X		X	X				X			
Leave Crop Unharvested	X	X		X	X	X	X	X	X		X		X			
Livestock Management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Nesting Structures																
Plant Food Plots	X			X	X	X		X	X		X		X			
Plant Native Grasses and Forbs	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Plant Shrubs					X	X		X	X	X	X	X	X			
Plant Trees					X			X	X				X			
Repair Spillway/Levee	X				X										X	X
Set-back Succession	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Tillage Management	X	X		X	X	X	X	X	X		X		X			
Water Control Structures	X				X										X	X
Water Developments for Wildlife	X				X				X				X			
Population Management Practices										X						
Decrease Harvest				X		X		X	X	X	X	X	X		X	X
Increase Harvest								X	X	X	X	X	X		X	X
Wildlife Damage Management									X	X	X	X	X			
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Fish Pond/Stream Management Practices																
Construct Fish Pond															X	X
Control Aquatic Vegetation															X	X
Fertilize/Lime Fish Pond															X	X
Reduce Turbidity in Fish Pond															X	X
Restock Fish Pond															X	X
Streams: Create Pools																
Streams: Remove Fish Barriers																

Hot Desert

Physical description

The terrain is relatively flat to rolling with isolated buttes and mountains. Annual precipitation varies from 2 to 25 inches, depending on elevation, but seldom exceeds 7 inches over most of the ecoregion. Moisture is usually received in the form of short, violent storms or cloudbursts in summer and fall.

Summers are hot; winters are cool. There are extreme differences in the daily high and low temperatures, which encourage nightly dew formation. Dew formation is an important water source for wildlife where precipitation is low.

Dominant vegetation

Vegetation is sparse and dominated by cacti and thorny shrubs over most of the ecoregion. Depending on geographic location, the most common plants are creosote bush, bur sage, chamise, paloverde, ocotillo, saguaro, and cholla. Shrubs are often widely spaced with a few short annual grasses growing among them. After rains, many flowers and grasses appear, quickly go to seed, and disappear until the next rain.

Vegetation associated with river and stream courses is more diverse and abundant than in the surrounding areas. Riparian areas are dominated by cottonwoods, willows, tamarisk, mesquite, and a variety of grasses and forbs. The abundance and variety of vegetation and presence of water compared to the surrounding desert makes riparian areas very attractive to wildlife.

Typical nonnative invasive plants in the Hot Desert ecoregion include African rue, Malta starthistle, Russian knapweed, medusahead, bufflegrass, and saltcedar (tamarisk).

Dwayne Elmore

Plants in the Hot Desert are adapted for high temperatures and low rainfall. Many species of cacti, grasses, and shrubs dominate.

Dwayne Elmore

Although deserts may appear barren, there are many species that occur here.

Farming and ranching

Water is diverted from large rivers, such as the Colorado, to irrigate orchards, grain, hay, and vegetable crops. Irrigation water is expensive, which encourages the use of modern irrigation systems that do not waste much water. When waste water is present, it supports a wide variety of vegetation and wetlands not common to this ecoregion. Wildlife species not normally associated with the desert are found in these areas.

Livestock grazing is common where water is available or can be developed. Riparian and wetland areas are attractive for livestock grazing, which must be managed to avoid damaging wildlife habitat.

Plant succession

Plant succession is not conspicuous in the desert. When vegetation is disturbed, it is often replaced by the same type without intervening stages. Replacement of disturbed vegetation can take a long time because of the harsh environment. Annual and perennial grasses and forbs may be found, with a lot of bare ground in between. Shrubs and cacti are also common and represent the final successional stage, except along riparian areas where shrubs and trees are common.

Wildlife associated with Hot Desert

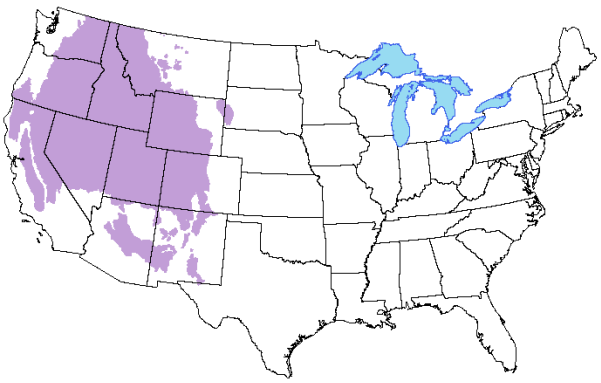
American kestrel
black-throated sparrow
blue-winged teal
crissal thrasher
Gambel's quail
golden eagle
ladder-backed woodpecker
southwest willow flycatcher
white-winged dove
black-tailed prairie dog
coyote
desert cottontail
mountain lion
Rocky Mountain mule deer
pronghorn
Gila monster
bluegill
largemouth bass

Hot Desert	American kestrel	black-throated sparrow	blue-winged teal	crissal thrasher	Gambel's quail	golden eagle	ladder-backed woodpecker	southwest willow flycatcher	white-winged dove	black-tailed prairie dog	coyote	desert cottontail	mountain lion	pronghorn	Rocky Mountain mule deer	Gila monster	bluegill	largemouth bass
Habitat Management Practices																		
Conservation Easement						X		X										
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Create Snags	X						X		X									
Delay Crop Harvest																		
Edge Feathering																		
Field Borders	X										X	X			X			
Forest Management																		
Leave Crop Unharvested			X		X				X			X			X			
Livestock Management	X	X	X	X	X	X	X	X	X	X	X	X		X	X		X	X
Nesting Structures	X																	
Plant Food Plots			X		X				X			X		X	X			
Plant Native Grasses and Forbs	X		X						X	X	X	X		X	X			
Plant Shrubs	X			X	X			X	X		X	X	X		X	X		
Plant Trees	X						X	X	X									
Repair Spillway/Levee			X														X	X
Set-back Succession	X	X	X	X		X		X	X	X	X	X	X	X	X			
Tillage Management	X		X						X			X			X			
Water Control Structures			X														X	X
Water Developments for Wildlife		X	X	X	X				X				X		X	X		
Population Management Practices																		
Decrease Harvest					X					X	X	X	X	X	X		X	X
Increase Harvest										X	X	X	X	X	X		X	X
Wildlife Damage Management						X	X			X	X	X	X		X			
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices																		
Construct Fish Pond																	X	X
Control Aquatic Vegetation																	X	X
Fertilize/Lime Fish Pond																	X	X
Reduce Turbidity in Fish Pond																	X	X
Restock Fish Pond																	X	X
Streams: Create Pools																		
Streams: Remove Fish Barriers																		

Intermountain – Foothills Zone

Physical description

The terrain varies from steep hills at the base of large mountains, to dissected plateaus and flat valleys. Average annual precipitation is between 10 and 25 inches. Most of the moisture is received in winter at higher elevations and in late summer at lower elevations. The summers are warm, and the winters are moderately cold.



Dominant vegetation

The Foothills zone is found directly below the montane zone (in elevation) and is associated with most major mountain ranges in the western U.S. The upper reaches of this ecoregion have many of the characteristics of the montane zone, whereas the lower reaches have similarities with the Sagebrush zone. Typically, the ecoregion is dominated by shrubs, such as scrub oaks, mountain mahogany, serviceberry, bitterbrush, manzanita, buckbrush, and sagebrush. Perennial grasses and many different forbs are also common. Occasionally, aspen and ponderosa pine may be found on moist sites. In the southern areas of this ecoregion, pinyon and juniper trees are found on drier sites.

As with most of the ecoregions in the arid West, the vegetation associated with rivers and streams is more diverse and abundant than the surrounding areas. Riparian areas are usually dominated by cottonwood, willow, tamarisk, Russian olive, sumac, silver buffaloberry, and a variety of grasses and forbs. The abundance and variety of vegetation and the availability of water make these areas very attractive to wildlife.

Typical nonnative invasive plants in the Foothills include cheatgrass, saltcedar, yellow star thistle, knapweed, halogeten, Dyer's woad, and Canada thistle.

Dwayne Elmore

Foothills are typically composed of mixed grass, shrub, and trees. This variety of vegetation provides habitat for a diversity of wildlife species.

Dwayne Elmore

Fire suppression in the foothills has allowed fire intolerant species, such as juniper, to spread into the valley floors. Encroachment of woody species has negatively impacted some species and favored others.

Farming and ranching

Water is often diverted to irrigate crops in the valleys and other areas where slopes are gentle. Hay, alfalfa, and oats are the most common crops. The terrain often makes management of irrigation water difficult. Water that runs off irrigated fields and leaks out of earthen delivery ditches often creates wetlands and/or supports vegetation similar to that found in riparian areas. In some areas, non-irrigated crops, such as wheat and barley, are grown. Most of the ecoregion is used for livestock grazing except where slopes are extremely steep. Cattle and sheep are the most common grazers.

Plant succession

Annual forbs and grasses represent the initial successional stage. Perennial forbs and grasses follow, and shrubs represent the third successional stage. Fire has historically maintained perennial grasses and forbs and shrubs. However, fire does not always revert shrubland to perennial grasses and forbs because many of these shrubs resprout following fire. Shrubs and trees are dominant along riparian areas.

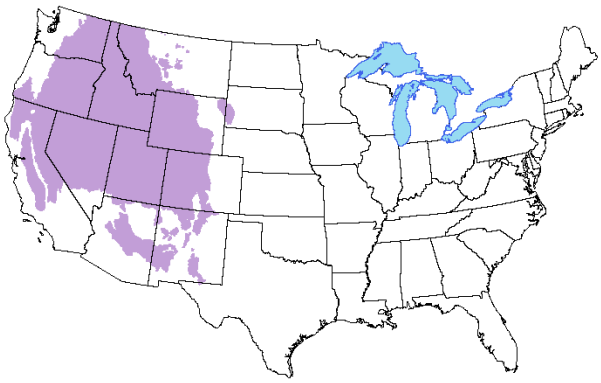
Wildlife associated with Intermountain Foothills

American kestrel
mallard
mourning dove
northern flicker
red-tailed hawk
spotted towhee
wild turkey
coyote
elk
mountain cottontail
Rocky Mountain mule deer
rainbow trout

Intermountain Foothills	American kestrel	dusky grouse	mallard	mourning dove	northern flicker	red-tailed hawk	spotted towhee	wild turkey	coyote	elk	mountain cottontail	Rocky mountain mule deer	rainbow trout
Habitat Management Practices													
Conservation Easement													
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	
Create Snags	X				X	X							
Delay Crop Harvest			X	X		X							
Edge Feathering		X				X	X	X	X	X		X	
Field Borders	X	X				X		X	X			X	
Forest Management		X	X		X	X	X	X	X	X	X	X	
Leave Crop Unharvested			X	X				X				X	
Livestock Management	X	X	X	X			X	X	X	X	X	X	X
Nesting Structures	X												
Plant Food Plots			X	X				X		X	X	X	
Plant Native Grasses and Forbs	X	X	X	X		X		X	X	X	X	X	
Plant Shrubs	X	X		X	X		X	X	X		X	X	
Plant Trees	X	X		X	X	X		X		X		X	
Repair Spillway/Levee			X	X									X
Set-back Succession	X	X	X	X	X	X	X	X	X	X	X	X	
Tillage Management	X		X	X		X		X				X	
Water Control Structures			X	X									X
Water Developments for Wildlife			X	X				X		X		X	
Population Management Practices													
Decrease Harvest		X						X	X	X	X	X	X
Increase Harvest								X	X	X	X	X	X
Wildlife Damage Management					X	X		X	X	X	X	X	
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices													
Construct Fish Pond													X
Control Aquatic Vegetation													X
Fertilize/Lime Fish Pond													X
Reduce Turbidity in Fish Pond													X
Restock Fish Pond													X
Streams: Create Pools													X
Streams: Remove Fish Barriers													X

Intermountain – Montane Zone

Physical description



The terrain includes high rugged mountains of volcanic origin. Average annual precipitation is highly variable, ranging from 10 to 100 inches, depending on the site. The majority of the moisture comes in winter and early spring, except for areas in the southwestern U.S., which also receive monsoon rains in late summer.

Dominant vegetation

Dense coniferous forests of western hemlock, sitka spruce, redwood, Douglas fir, incense cedar, and ponderosa pine are trees usually associated with the final successional stage. Aspen and lodgepole pine dominate large areas for long periods of time in the Rocky Mountains at the higher elevations. In the northern reaches of this ecoregion, silver fir, sitka spruce, and Alaskan cedar are common.

In mature forests, shrub, and herbaceous layers are poorly developed. Dense shrub cover of salal, vine maple, salmon berry and devil's club may be found in openings of the northwest and northern Rocky Mountains. Serviceberry, chokecherry, scrub oak, mountain mahogany, ceanothus, and snowberry are found in the central and southern Rocky Mountains. Manzanita, sticky laurel, currant, waxberry, and buckthorn commonly grow in the Sierra Nevada Mountains. Perennial grasses and a variety of forbs are also common in open areas.

Typical nonnative invasive plants in the Intermountain Montane include cheatgrass, saltcedar, yellow star thistle, knapweed, halogeton, Dyer's woad, and Canada thistle.

Dwayne Elmore

Aspen is an important plant in the montane zone. There are many bird species, such as dusky grouse and ruffed grouse, which depend on it for habitat.

Dwayne Elmore

Open stands of ponderosa pine are maintained by frequent fire in the montane zone.

Farming and ranching

Water is diverted from nearby streams and rivers in the larger valleys to irrigate crops. Livestock grazing is common in this ecoregion where slopes are not too steep. Open areas dominated by shrubs and grasses, as well as areas adjacent to rivers and streams, are used most often for grazing. In some areas, crops such as small grains and alfalfa are grown in the valleys and other areas cleared of native vegetation.

Plant succession

Annual forbs and grasses represent the initial successional stage. Perennial grasses and forbs represent the second successional stage. Shrubs and aspen follow as the third successional stage, and coniferous forest represents the final successional stage.

Wildlife associated with Intermountain Montane

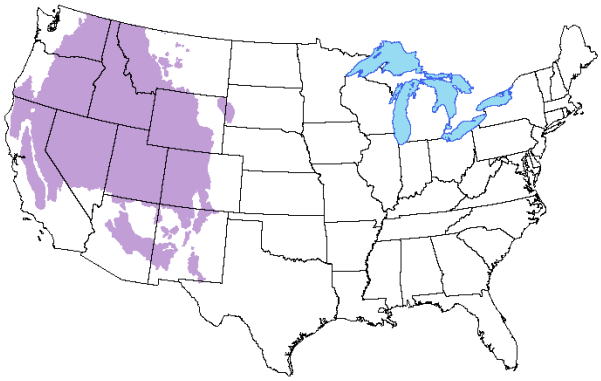
dusky grouse
hairy woodpecker
mountain bluebird
northern goshawk
ruffed grouse
spotted towhee
yellow-rumped warbler
American beaver
American marten
black bear
elk
Rocky Mountain mule deer
snowshoe hare
cutthroat trout
rainbow trout

Intermountain Montane	dusky grouse	hairy woodpecker	northern goshawk	ruffed grouse	spotted towhee	yellow-rumped warbler	American beaver	American marten	black bear	elk	Rocky mountain mule deer	snowshoe hare	cutthroat trout	rainbow trout
Habitat Management Practices														
Conservation Easement														
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X		
Create Snags		X	X	X										
Delay Crop Harvest														
Edge Feathering	X				X				X	X	X			
Field Borders	X										X			
Forest Management	X		X	X	X	X		X	X		X	X		
Leave Crop Unharvested									X		X			
Livestock Management	X	X		X	X	X	X			X	X	X	X	X
Nesting Structures														
Plant Food Plots									X	X	X			
Plant Native Grasses and Forbs	X									X	X			
Plant Shrubs	X			X	X	X	X		X		X	X		
Plant Trees	X	X	X	X		X	X	X	X	X	X	X		
Repair Spillway/Levee														X
Set-back Succession	X			X	X	X			X	X	X			
Tillage Management									X		X			
Water Control Structures							X							X
Water Developments for Wildlife										X	X			
Population Management Practices														
Decrease Harvest	X			X			X	X	X	X	X	X	X	X
Increase Harvest							X	X	X	X	X	X	X	X
Wildlife Damage Management		X					X		X	X	X	X		
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices														
Construct Fish Pond														X
Control Aquatic Vegetation														X
Fertilize/Lime Fish Pond														X
Reduce Turbidity in Fish Pond														X
Restock Fish Pond														X
Streams: Create Pools													X	X
Streams: Remove Fish Barriers													X	X

Intermountain – Sagebrush Zone

Physical description

The terrain includes large, undulating hills within small interior basins that are often surrounded by mountains. Annual precipitation averages 5 to 20 inches and occurs most often in winter and spring. Summers are hot and winters are moderately cold.

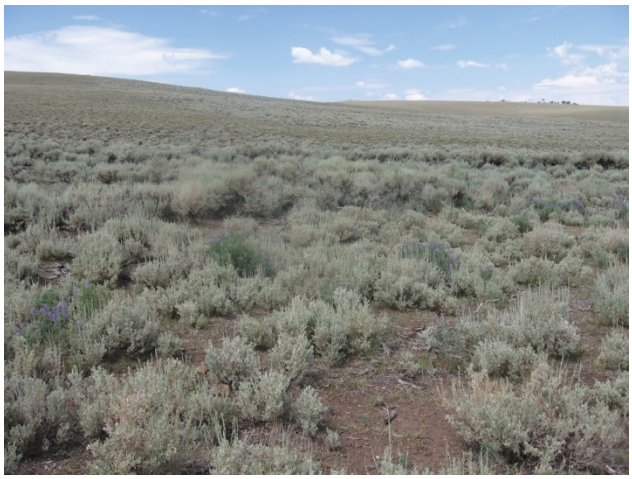


Dominant vegetation

Sagebrush dominates the lower elevations along with other shrubs, such as shad-scale, bitterbrush, fourwing saltbush, rabbitbrush, and horsebrush. Perennial grasses, such as wheatgrasses, needlegrasses, and bluegrasses, are common and intermixed with the shrubs. Forbs, such as lupines, buckwheats and mallows, are also present.

Riparian vegetation is usually much different than the surrounding vegetation and is dominated by cottonwoods, willows, tamarisk, Russian olive, silver buffaloberry, and a variety of grasses and forbs. The abundance and variety of vegetation and the availability of water makes riparian zones very attractive to wildlife.

Typical nonnative invasive plants in the Intermountain Sagebrush include cheatgrass, saltcedar, yellow starthistle, knapweed, halogeton, Dyer's woad, and Canada thistle.



Dwayne Elmore

Sagebrush is the dominant plant in the sagebrush zone. Some species, such as greater sage-grouse, depend on this plant to survive.

Dwayne Elmore

Disturbance, such as fire, often removes sagebrush. Managing vegetation other than sagebrush can both negatively and positively benefit various species. It is important to manage disturbance such that a variety of native species can persist in the sagebrush zone.

Farming and Ranching

Water is diverted from nearby streams and rivers to irrigate crops, such as corn, barley, wheat, and alfalfa, in the lower elevations, and to irrigate grass hayland at higher elevations. The terrain often makes management of irrigation water difficult. Water that runs off irrigated fields and leaks out of earthen delivery ditches often creates wetlands or supports vegetation similar to that found in riparian areas, which is attractive to a variety of wildlife species.

In areas where irrigation water is not available and terrain and climate permit, native rangeland has been converted to nonirrigated cropland. Small grains, such as barley and wheat, are the most common crops. Near croplands are areas not cultivated and remain in native vegetation. This mix of dry cropland and rangeland is important to many wildlife species.

There are large areas of shrubs and grasslands in this ecoregion that are primarily used for livestock grazing. In winter, large herds of domestic sheep often use rangelands within this ecoregion.

Plant succession

Annual forbs and grasses represent the initial stage of succession. Perennial grasses and forbs represent the second stage. Shrubs, along with perennial grasses and forbs are the third successional stage. Shrubs dominate the fourth successional stage. Continued overgrazing of perennial grasses will lead to the grass disappearing and shrubs will dominate.

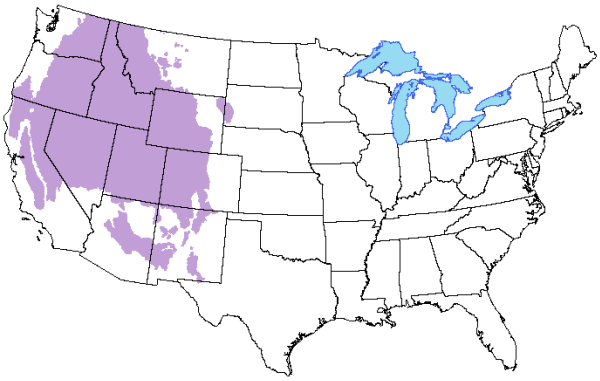
Wildlife associated with the Intermountain Sagebrush

American kestrel
Brewer's sparrow
ferruginous hawk
greater sage-grouse
mallard
mourning dove
northern flicker
sage thrasher
coyote
desert cottontail
pronghorn
Rocky Mountain mule deer
rainbow trout

Intermountain Sagebrush	American kestrel	Brewer's sparrow	ferruginous hawk	greater sage-grouse	mallard	mourning dove	northern flicker	sage thrasher	coyote	desert cottontail	pronghorn	Rocky Mountain mule deer	rainbow trout
Habitat Management Practices													
Conservation Easement				X									
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	
Create Snags	X						X						
Delay Crop Harvest					X	X							
Edge Feathering												X	
Field Borders	X								X	X		X	
Forest Management					X		X						
Leave Crop Unharvested					X	X				X		X	
Livestock Management	X	X	X	X	X	X			X	X	X	X	X
Nesting Structures	X												
Plant Food Plots					X	X	X			X	X	X	
Plant Native Grasses and Forbs	X		X		X	X			X	X	X	X	
Plant Shrubs	X	X		X		X	X	X	X	X		X	
Plant Trees	X		X			X	X						
Repair Spillway/Levee					X	X							X
Set-back Succession	X	X	X		X	X	X	X	X	X	X	X	
Tillage Management	X		X		X	X				X		X	
Water Control Structures					X	X							X
Water Developments for Wildlife					X	X					X	X	
Population Management Practices													
Decrease Harvest				X					X	X	X	X	X
Increase Harvest									X	X	X	X	X
Wildlife Damage Management							X		X	X		X	
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices													X
Construct Fish Pond													X
Control Aquatic Vegetation													X
Fertilize/Lime Fish Pond													X
Reduce Turbidity in Fish Pond													X
Restock Fish Pond													X
Streams: Create Pools													X
Streams: Remove Fish Barriers													X

Intermountain – Subalpine zone

Physical description



The terrain is steeply sloping mountains crossed by many valleys. Average annual precipitation is highly variable, typically ranging from 30 to 60 inches with some areas receiving more than 100 inches. The majority of the moisture comes in the winter and early spring as snow.

Dominant vegetation

Subalpine is directly above the Montane zone in elevation and is associated with most major mountain ranges in the western U.S. The lower reaches have many of the characteristics of the montane zone. In the Sierra Nevada Mountains, coniferous forests of mountain hemlock, California red fir, western white pine, and whitebark pine occur. In the Rocky Mountains, subalpine fir and Engelmann spruce are the dominant tree species. In the Gila Mountains, Engelmann spruce and corkbark fir dominate.

Understory vegetation usually consists of sedges, a variety of forbs, and low-growing shrubs, such as vaccinium, elderberry, bearberry, currant, and willow. Understory plants are sparse where the forest canopy is dense.

Subalpine meadows dominated by grasses, sedges, and forbs, are scattered throughout this ecoregion. Common species include purple reedgrass, alpine fescue, slender wheatgrass, falsebulrush sedge, whiproot clover, and bistort. In high mountain valleys, streams and bogs are surrounded by thick stands of willow and subalpine meadow vegetation. Aspen occurs in the middle stages of plant succession.

Dwayne Elmore

Trees in the subalpine (such as this subalpine fir) grow slowly and rarely attain a tall structure because the growing conditions are so harsh.

Craig Harper

The growing season is short in the subalpine with most plants going dormant by October.

Farming and ranching

An extremely short growing season, rocky soils, and steep slopes prohibit crop production in the Subalpine. In some areas, water is diverted from streams to irrigate high mountain meadows for grass and sedge-hay production. Livestock grazing occurs in localized areas and is usually restricted to the mountain meadows and aspen stands where slopes are less steep.

Plant succession

Annual forbs and grasses represent the initial successional stage. Perennial grasses and forbs represent the second successional stage. Various shrubs and aspen represent the third successional stage, which may be the climax stage on dry, steep slopes with southern exposures. Various conifer trees represent the fourth successional stage in Subalpine. It should be noted that succession takes much longer in Subalpine than in most other ecoregions because of the harsh conditions.

Wildlife associated with the Intermountain Subalpine

American marten
black-capped chickadee
dusky grouse
hairy woodpecker
northern goshawk
white-tailed ptarmigan
yellow-rumped warbler
elk
red squirrel
Rocky Mountain mule deer
snowshoe hare
cutthroat trout
rainbow trout

Intermountain Subalpine	black-capped chickadee	dusky grouse	hairy woodpecker	northern goshawk	white-tailed ptarmigan	yellow-rumped warbler	American marten	elk	red squirrel	Rocky Mountain mule deer	snowshoe hare	cutthroat trout	rainbow trout
Habitat Management Practices													
Conservation Easement													
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X		
Create Snags	X		X	X									
Delay Crop Harvest													
Edge Feathering		X						X		X			
Field Borders		X								X			
Forest Management	X	X		X		X	X	X	X	X	X		
Leave Crop Unharvested										X			
Livestock Management	X	X	X		X	X		X	X	X	X	X	X
Nesting Structures	X												
Plant Food Plots								X		X			
Plant Native Grasses and Forbs		X						X		X			
Plant Shrubs	X	X			X	X				X	X		
Plant Trees	X	X	X	X		X	X	X	X	X	X		
Repair Spillway/Levee													X
Set-back Succession	X	X				X		X		X			
Tillage Management										X			
Water Control Structures													X
Water Developments for Wildlife								X		X			
Population Management Practices													
Decrease Harvest		X			X		X	X	X	X	X	X	X
Increase Harvest							X	X	X	X	X	X	X
Wildlife Damage Management			X					X		X	X		
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices													
Construct Fish Pond													X
Control Aquatic Vegetation													X
Fertilize/Lime Fish Pond													X
Reduce Turbidity in Fish Pond													X
Restock Fish Pond													X
Streams: Create Pools												X	X
Streams: Remove Fish Barriers												X	X

Mediterranean

Physical description

Mediterranean climates are found in only five places on Earth: California and Baja California, the basin of the Mediterranean Sea, southwestern Australia, the western cape of South Africa, and the central coast of Chile. The geologic history of California has produced a complex landscape with variations in topography and climate. The Mediterranean climate ecoregion lies west of the Sierra Nevada and includes a portion of coastal Baja California. The terrain includes gently to steeply sloping mountains, coastal plains, and interior valleys. Average annual precipitation ranges from 12 to 40 inches with most of it occurring in winter as rain. Summers are hot and dry, while winters are mild and rainy.

Rocky or shallow soils have evergreen shrublands called chaparral. Oak woodlands occur where soils are deeper or moisture is more available. Drier areas along the coast and inland at the transition to deserts support coastal sage scrub. Chaparral is the most abundant vegetation type. Mediterranean vegetation is dominated by evergreen trees and trees with short, hard, dense leaves (schlerophyllous). These plants are adapted to fire, summer drought, and cool, moist winters.

Dwayne Elmore

The Mediterranean-like climate found in California creates a grassland that is maintained by fire.

Dwayne Elmore

Many species of shrubs and small trees exist within the grasslands of central California. Periodic fire reduces their structure, but they quickly return after fire.

Dominant vegetation

There are three common but different vegetation types found in this ecoregion: chaparral, oak woodlands, and coastal sage. The chaparral is dominated by chamise, ceanothus, mountain mahogany, and manzanita. The southern oak woodlands are dominated by Engelmann oak, coast live oak, interior live oak, and California walnut. The coastal sage, also called soft chaparral, is dominated by California sagebrush and black sage, as well as California buckwheat. Each vegetation type is summarized below.

Chaparral or Hard Chaparral: Found from 1,000 to 5,000 feet in elevation. At its lower limits, annual grasslands and coastal sage blend in. Most shrubs are 3 to 10 feet tall, with small leathery leaves adapted to hot dry summers. This vegetation type is adapted to a 20-year fire-return interval. Many plants such as creosote contain flammable oils.

Southern Oak Woodlands: Found throughout the Sierra Nevada and Coast Range foothills and lower montane elevations from 1,800 to 4,850 feet, often on steep rocky slopes where snow and cold temperatures occur. Trees are highly variable, growing from 15 to 70 feet tall, depending on the oak species, elevation, and soil type. With frequent annual burning (at lower elevations and on warmer sites), woodlands with large oaks and well-developed grassy understories of native perennial bunchgrasses are common.

Coastal Sage or Soft Chaparral: The coastal sage plant community of California exists along the coast from about San Francisco and Lafayette down through San Diego and inland as far as Riverside in southern California. These shrubs are generally less than 6 feet tall with multiple woody stems. Leaves are often aromatic, gray, woolly, or sticky. Leaves are pliable and thin (malacophyllous), which is why it also called the soft chaparral.

Typical nonnative invasive plants in the Mediterranean ecoregion include red brome, yellow starthistle, leafy spurge, scotch thistle, and medusahead.

Farming and ranching

Agriculture is widespread and diverse within this ecoregion. Stream valleys, coastal plains, and interior valleys are planted in a wide variety of vegetable crops, grain crops, orchards, vineyards, cotton, and hay.

In the drier areas of the ecoregion, water must be diverted from rivers and streams to irrigate orchards, vineyards, citrus, hay, and grain crops. Irrigation water is expensive, which encourages the use of modern irrigation systems that do not waste much water. Waste water, when present, often supports a wide variety of riparian vegetation and wetlands. In the moister areas, crops such as lemons, avocados, vegetables, and flowers are grown.

Ranching operations are present in areas where slopes are not too steep or rocky. Grass for grazing is available for a few years when the oak woodlands burn. Caution must be taken when ranching. Overgrazing can create long-term damage to the vegetation. Overgrazing weakens the native vegetation, allowing aggressive nonnative species to establish.

Plant succession

Oak Woodland: Annual forbs and grasses represent the initial successional stage. Young oaks with open grassland or shrubby understory represent the second successional stage. Mature oaks with an open grassland or shrubby understory represent the final stage of succession.

Coastal Sage Scrub: Annual forbs and grasses, especially mustard, filaree, soft chess, represent the initial successional stage. Perennial grasses and forbs may occur afterward, but shrubs, such as chamise and manzanita, often pioneer in following the annual grasses and forbs. These shrubs often resprout following fire so succession does not always revert to an earlier stage after fire.

Chaparral: annual forbs and grasses represent the initial stage of succession and are usually present immediately after a fire. Shrubs, such as shrub oak, dominate within 2 to 5 years following fire and represent the final successional stage.

Wildlife associated with Mediterranean

All species listed are not found in all of the vegetation types described.

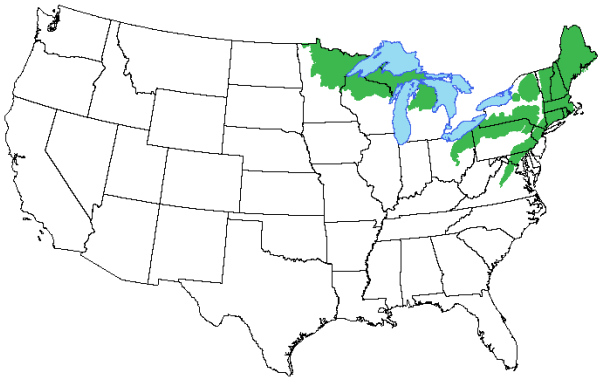
American kestrel
California quail
California thrasher
mallard
mourning dove
Nuttall's woodpecker
Lawrence's goldfinch
western kingbird
desert cottontail
raccoon
Rocky Mountain mule deer
wild pig
Monterey salamander
bluegill
largemouth bass

Mediterranean	American kestrel	California quail	California thrasher	Lawrence's goldfinch	mallard	mourning dove	Nuttall's woodpecker	western kingbird	desert cottontail	raccoon	Rocky Mountain mule deer	wild pig	Monterey salamander	bluegill	largemouth bass
Habitat Management Practices															
Conservation Easement				X											
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X				
Create Snags	X						X	X		X					
Delay Crop Harvest					X	X									
Edge Feathering		X						X		X	X				
Field Borders	X	X						X	X	X	X				
Forest Management			X	X	X		X		X	X	X		X		
Leave Crop Unharvested					X	X			X	X	X				
Livestock Management	X	X	X		X	X			X	X	X			X	X
Nesting Structures	X														
Plant Food Plots		X			X	X			X	X	X				
Plant Native Grasses and Forbs	X	X			X	X		X	X		X				
Plant Shrubs	X	X	X			X		X	X	X	X		X		
Plant Trees	X	X		X		X	X			X	X		X		
Repair Spillway/Levee					X	X				X				X	X
Set-back Succession	X	X	X	X	X	X		X	X	X	X				
Tillage Management	X	X		X	X	X			X	X	X				
Water Control Structures					X	X				X					
Water Developments for Wildlife		X		X	X	X				X	X				
Population Management Practices															
Decrease Harvest		X							X	X	X			X	X
Increase Harvest									X	X	X	X		X	X
Wildlife Damage Management							X		X	X	X	X			
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices															
Construct Fish Pond														X	X
Control Aquatic Vegetation														X	X
Fertilize/Lime Fish Pond														X	X
Reduce Turbidity in Fish Pond														X	X
Restock Fish Pond														X	X
Streams: Create Pools															
Streams: Remove Fish Barriers															

Northeast Mixed Forest

Physical description

The terrain is flat with some rolling hills and low mountains. The average annual precipitation ranges from 24 to 45 inches. Most of the precipitation is received in the summer, but snow is usually on the ground all winter. Summers are warm and winters are very cold.



Dominant vegetation

This ecoregion is transitional between the evergreen-dominated forests to the north and the broadleaf-dominated forests to the south. The final stage of succession can be dominated by both tall broadleaf (deciduous) and evergreen (coniferous) trees. They can be mixed together or in separate stands adjacent to each other. The dominant conifers are white pine, red spruce, subalpine fir, eastern hemlock, and eastern redcedar. Beech, sugar maple, and basswood are the most common deciduous trees. Common shrubs are rhododendron, dogwood, cranberry, and hobblebush. A wide variety of forbs and grasses are found on the forest floor. Typical invasive plants in the Northeast Mixed Forest include Japanese stiltgrass, Canada thistle, garlic mustard, Russian olive, and tree-of-Heaven.

Craig Harper

The lush herbaceous understory of this 22-year-old northern hardwood forest provides optimum brooding cover for ruffed grouse.

Craig Harper

This mature stand of aspen, Eastern hemlock, and sugar maple is displaying peak autumn coloration. This picture shows the aspen slowly succeeding to the more shade-tolerant eastern hemlock and sugar maple.

Farming and ranching

Very large areas of this ecoregion have been cleared of the native vegetation for industrial use, urban sprawl, and production of crops and livestock forage. In some areas, extremely poor soils and short growing seasons put limitations on agriculture. Depending on how the pastures and croplands are managed, some species of wildlife may benefit from farming, especially if trees and shrubs are nearby.

Plant succession

Annual forbs and grasses with a few perennial species represent the **initial successional stage**.

Kip Adams

Perennial forbs and grasses and brambles, such as goldenrods, wildryes, and blackberry, represent the **second successional stage**.

Craig Harper

Young trees and shrubs, such as alder and aspen, along with perennial grasses and forbs, represent the **third successional stage**.


Kip Adams


Kip Adams

Without disturbance, especially fire, aspen gives way to the **fourth successional stage**, which is usually represented by various hardwoods, such as maples, northern red oak, American beech, and birches.


Kip Adams

The **fifth successional stage** is dominated by more shade-tolerant species, such as eastern hemlock, American beech, sugar maple, white pine, and red spruce.

Wildlife associated with Northeast Mixed Forest

American black duck
American woodcock
northern goshawk
black-backed woodpecker
brown thrasher
ovenbird
ruffed grouse
wild turkey
fisher
New England cottontail
moose
red squirrel
snowshoe hare
white-tailed deer
wood frog
bluegill
largemouth bass

Northeast Mixed Forest	American black duck	American woodcock	black-backed woodpecker	brown thrasher	northern goshawk	ovenbird	ruffed grouse	wild turkey	fisher	moose	New England cottontail	red squirrel	snowshoe hare	white-tailed deer	wood frog	bluegill	largemouth bass
Habitat Management Practices																	
Conservation Easement											X						
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Create Snags					X		X		X								
Delay Crop Harvest																	
Edge Feathering		X		X				X			X			X			
Field Borders				X				X			X			X			
Forest Management		X		X	X	X	X	X	X	X	X	X	X	X			
Leave Crop Unharvested	X							X						X			
Livestock Management		X		X		X	X	X			X	X	X	X	X	X	X
Nesting Structures																	
Plant Food Plots	X							X						X			
Plant Native Grasses and Forbs	X							X			X			X			
Plant Shrubs		X		X			X	X		X	X		X	X			
Plant Trees		X	X		X	X	X	X	X	X	X	X	X	X	X		
Repair Spillway/Levee	X									X						X	X
Set-back Succession	X	X	X	X			X	X			X			X			
Tillage Management	X							X						X			
Water Control Structures	X									X						X	X
Water Developments for Wildlife	X							X		X				X	X		
Population Management Practices																	
Decrease Harvest		X					X	X	X	X	X	X	X	X		X	X
Increase Harvest								X		X		X	X	X		X	X
Wildlife Damage Management								X					X	X			
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices																	
Construct Fish Pond																X	X
Control Aquatic Vegetation																X	X
Fertilize/Lime Fish Pond																X	X
Reduce Turbidity in Fish Pond																X	X
Restock Fish Pond																X	X
Streams: Create Pools																	
Streams: Remove Fish Barriers																	

Pacific Coastal Forest

Physical description

The terrain includes coastal plains and broad interior lowland plains and valleys associated with the Puget Sound and Willamette Valley. It also includes ridge and valley zones associated with Coast Ranges and temperate forest zones extending up the western slopes of the Cascade Mountains, as well as those on all sides of the Olympic Mountains. Many narrow river valleys and adjacent steep slopes are associated with these forests. Average annual precipitation ranges from under 30 inches to 180 inches, most in the form of winter rainfall.

Craig Harper

Industrial coniferous forest provide habitat for many wildlife species in the Pacific Coastal Forest ecoregion.

Craig Harper

A lush understory and well-developed midstory is important for many wildlife species.

Dominant vegetation

Final stage of plant succession is typically dense coniferous forests. Depending on the location and elevation, western hemlock, Sitka spruce, Douglas fir and western redcedar are species associated with the climax stage. Grand fir also may be found in the climax stage, and Pacific silver fir and noble fir are often found dominating in the higher mountain zones within the Pacific Coastal Forest. Red alder, either in pure stands or intermixed with earlier stages of plant succession, are found throughout the Pacific Coastal Forest. Big-leaf maple can be found through all stages of plant succession, but seldom in pure stands. In older, managed, even-aged forests, shrub and herbaceous layers are poorly developed. Dense and diverse shrub layers may be found in forest openings, early successional areas and in mature forests. Some dominant shrub species include salal, vine maple, salmonberry, devil's club, vaccinium, elderberries and swordfern, depending on site conditions. Serviceberry, chokecherry, Oregon white oak, snowberry, Oregon grape, oceanspray, hazel, scrub oaks and ceanothus may dominate on some of the drier sites within this ecoregion. Perennial grasses and a variety of forbs are also common in open areas. Typical invasive plants in the Pacific Coastal Forest include Scotch broom, gorse, English ivy, knapweeds, reed canarygrass, butterfly bush, and purple loosestrife.

A major portion of the area consists of managed forest, owned or operated by state agencies, industrial landowners, and nonindustrial private landowners. Many of these managed forests are characterized by even-aged stands of few species, usually Douglas fir or western hemlock. These forests are often managed for wood-fiber production by occasional thinning and clearcut harvest, usually by 70 years of age.

Farming and ranching

In larger valleys, some water is diverted from nearby streams and rivers to irrigate grass hay. Crops such as corn, small grains, fruits, and alfalfa are grown in the lower valley floodplains. Livestock grazing is common and widespread on both the original prairies and pastures converted from forests and wetlands. Dairy farming is common throughout the ecoregion, especially along the coastal corridor.

Craig Harper

Livestock grazing, especially cattle and sheep, is common along the coastal corridor.

Plant succession

Annual forbs and grasses represent the initial successional stage. Perennial grasses and forbs represent the second successional stage. Various shrubs, alder, and vine maple follow as the third successional stage. Coniferous forests, including managed industrial forests, represent the fourth successional stage.

Wildlife associated with Pacific Coastal Forest

great horned owl
hairy woodpecker
marbled murrelet
red-tailed hawk
ruffed grouse
spotted towhee
sooty grouse
wood duck
American beaver
bobcat
Columbian black-tailed deer
coyote
elk
red squirrel
northern red-legged frog
rough-skinned newt
Coho salmon

Pacific Coastal Forest	great horned owl	hairy woodpecker	marbled murrelet	red-tailed hawk	ruffed grouse	sooty grouse	spotted towhee	wood duck	American beaver	bobcat	Columbian black-tailed deer	coyote	elk	red squirrel	northern red-legged frog	rough-skinned newt	Coho salmon
Habitat Management Practices																	
Conservation Easement			X														
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Create Snags	X	X		X	X			X									
Delay Crop Harvest				X													
Edge Feathering	X			X			X			X	X	X	X				
Field Borders	X			X						X	X	X					
Forest Management	X		X	X	X	X	X	X		X	X	X	X	X	X		
Leave Crop Unharvested								X			X						
Livestock Management	X	X			X	X	X	X	X	X	X	X	X	X	X	X	
Nesting Structures								X									
Plant Food Plots								X					X				
Plant Native Grasses and Forbs	X			X		X					X	X	X				
Plant Shrubs	X			X	X	X	X	X	X	X	X	X					
Plant Trees	X	X	X	X	X	X		X	X	X	X		X	X	X		
Repair Spillway/Levee								X								X	
Set-back Succession	X		X	X	X	X	X	X		X	X	X	X				
Tillage Management	X			X				X			X						
Water Control Structures								X	X							X	
Water Developments for Wildlife								X			X		X		X	X	
Population Management Practices																	
Decrease Harvest					X	X			X	X	X	X	X	X			
Increase Harvest									X	X	X	X	X	X			
Wildlife Damage Management	X	X		X					X	X	X	X	X				
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices																	
Construct Fish Pond																	
Control Aquatic Vegetation																	
Fertilize/Lime Fish Pond																	
Reduce Turbidity in Fish Pond																	
Restock Fish Pond																	
Streams: Create Pools																	
Streams: Remove Fish Barriers																	X

Prairie Brushland

Physical description

The terrain is level to rolling hills. Average annual precipitation is between 17 and 32 inches, increasing from southwest to northeast. Most of the moisture is received in the fall and spring. The summers are hot and winters are warm.

Dominant vegetation

Climax vegetation is characterized by grassland mixed with dense to open stands of shrubs forming a shrub savanna. Depending on the area, shrubs such as mesquite, black brush, catclaw, huisache, and guajillo are common in the final successional stage. Other species that contribute to the shrub layer include white brush, bluewood, lotebush, coyotillo, live oak, cenizo, prickly pear, and chollas. Some of the more common grasses associated with climax vegetation include various species of bluestem and paspalum, Arizona cottontop, buffalograss, burgrass, dropseed, windmillgrass, slender grama, hairy grama, common sandbur, and various species of bristlegrass.

Vegetation associated with riparian areas is different than the surrounding vegetation. Trees, such as live oak and hackberry, are common in riparian areas. Mesquite grows much larger, looking more like a tree than a shrub, and the vegetation is generally more robust along rivers and streams where moisture is abundant. The abundance and variety of vegetation combined with the availability of water make these areas attractive for wildlife.

Typical nonnative invasive plants in the Prairie Brushland include old world bluestem, buffelgrass, Lehmann lovegrass, and Chinese tallow tree.

Craig Harper

Brush country in south Texas. Mesquite and prickly pear are prevalent with cottonwood in the drainages. This landscape provides habitat for wild turkey, Northern bobwhite, American kestrel, coyote, white-tailed deer, and many other species.

Selma Glasscock

Openings within brush country add considerable diversity to the landscape matrix and provide food and cover resources for several wildlife species.

Farming and ranching

There is very little farming in this ecoregion. The large areas of shrubs and grasslands are used primarily for livestock grazing. Continual heavy grazing of perennial grasses will reduce perennial grasses and lead to near complete shrub cover, which directly impacts habitat for wildlife and grazable acreage for livestock.

Plant succession

Annual forbs and grasses represent the initial successional stage. Perennial forbs and grasses follow and represent the second successional stage. Shrubs with perennial grasses represent the third and final successional stage, except along drainages where trees may be found.

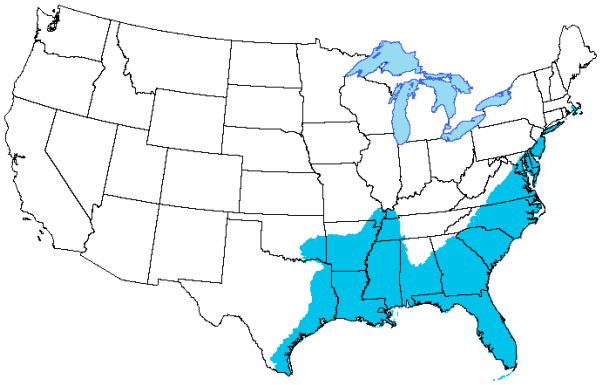
Wildlife associated with Prairie Brushland

black-bellied whistling duck
crested caracara
golden-fronted woodpecker
long-billed thrasher
northern bobwhite
pyrrhuloxia
western kingbird
white-winged dove
wild turkey
collared peccary
coyote
white-tailed deer
wild pig
Texas horned lizard
bluegill
largemouth bass

Prairie Brushland	black-bellied whistling duck	crested caracara	golden-fronted woodpecker	northern bobwhite	pyrrhuloxia	western kingbird	white-winged dove	wild turkey	collared peccary	coyote	white-tailed deer	wild pig	Texas horned lizard	bluegill	largemouth bass
Habitat Management Practices															
Conservation Easement															
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X		X		
Create Snags	X		X				X								
Delay Crop Harvest															
Edge Feathering				X	X	X		X		X	X				
Field Borders				X	X	X		X		X	X				
Forest Management								X		X	X				
Leave Crop Unharvested	X			X			X	X			X				
Livestock Management		X		X			X	X		X	X			X	X
Nesting Structures	X														
Plant Food Plots	X			X			X	X			X				
Plant Native Grasses and Forbs				X			X	X		X	X				
Plant Shrubs		X		X	X	X	X	X	X	X	X		X		
Plant Trees	X	X	X					X							
Repair Spillway/Levee	X													X	X
Set-back Succession		X	X	X	X	X	X	X	X	X	X		X		
Tillage Management	X			X			X	X			X				
Water Control Structures	X													X	X
Water Developments for Wildlife	X				X	X	X	X	X		X				
Population Management Practices															
Decrease Harvest				X				X	X	X	X			X	X
Increase Harvest								X	X	X	X	X		X	X
Wildlife Damage Management			X					X		X	X	X			
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices															
Construct Fish Pond														X	X
Control Aquatic Vegetation														X	X
Fertilize/Lime Fish Pond														X	X
Reduce Turbidity in Fish Pond														X	X
Restock Fish Pond														X	X
Streams: Create Pools															
Streams: Remove Fish Barriers															

Southeast Mixed and Outer Coastal Plain Forest

Physical description



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

Dominant vegetation

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

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

Dwayne Elmore

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

Dwayne Elmore

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

Farming and ranching

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

Plant succession

John Gruchy

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

Craig Harper

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

Mike Hansbrough

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

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

Craig Harper

Craig Harper

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

Craig Harper

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

Wildlife associated with Southeast Mixed and Outer Coastal Plain Forest

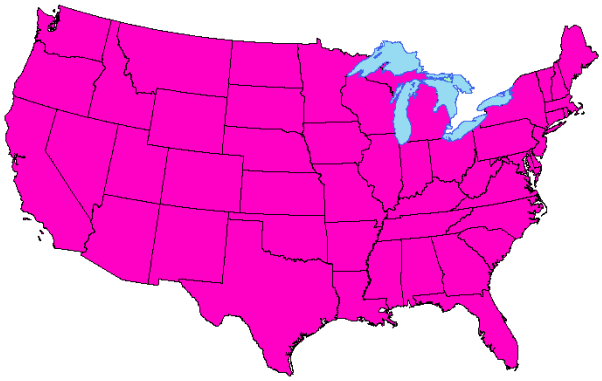
barred owl
loggerhead shrike
mourning dove
northern bobwhite
red-cockaded woodpecker
prothonotary warbler
red-eyed vireo
wild turkey
wood duck
coyote
eastern cottontail
eastern fox squirrel
raccoon
white-tailed deer
wild pig
eastern indigo snake
gopher tortoise
bluegill
largemouth bass

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

Urban

Physical Description

According to the U.S. Census Bureau in 2010, more than 80 percent of the American population lived in or near an urban area. The Census Bureau defines an urban area as a large central place with a total population of at least 50,000. In addition to a large human population, urban areas are characterized by residential and commercial development connected and crisscrossed by infrastructure, such as roads, train tracks, and utilities. Areas such as neighborhood parks offer the best possibility for wildlife habitat within an urban environment.



Dwayne Elmore

Wildlife damage management is an important consideration in urban areas as wildlife frequently conflict with people. Here, netting is preventing gulls from roosting on houses.

Dwayne Elmore

Urban areas provide habitat for some wildlife species. The presence of wildlife is considered beneficial to many people.

Dominant vegetation

It is not possible to identify dominant vegetation common in urban areas because urban areas are found in all ecoregions of the U.S. However, urban ecoregions typically contain gravel and paved areas, annual plantings, perennial grasses and forbs, shrubs, and young and mature trees. The vegetation is as likely to be an introduced species as a native species. Additionally, vegetated areas are typically manipulated in a landscaped manner versus "letting nature take over" as in rural areas. Interspersion is an important concept to understand in urban areas because of the fragmented landscape from residential and commercial development.

Urban areas are often dominated by non-native, invasive vegetation because of the disturbed and fragmented landscape and because many varieties of nonnative ornamentals are planted for aesthetic purposes. Educating the public about native versus nonnative cultivars and monitoring should be implemented in all urban areas.

Wildlife associated with Urban areas

American robin	rock pigeon
common nighthawk	ruby-throated hummingbird
bluebird[1]	song sparrow
European starling	big brown bat
house finch	cottontail[2]
house sparrow	coyote
house wren	eastern gray squirrel
northern flicker	raccoon
peregrine falcon	white-tailed deer

[1]bluebird: may include eastern, mountain, or western
[2]cottontail: may include desert, eastern, or mountain

Considerations for Urban Wildlife Management Practices

Attracting wildlife for viewing is popular among people in urban and suburban areas. However, many wildlife species can quickly become a nuisance, especially when they find protective shelter in unintended areas (under houses, in attics) or begin to damage property (chewing/drilling holes in wooden siding, defecating on property). Care must be exercised when attracting wildlife in urban and suburban areas, especially when using artificial feeders, which can also attract unwanted species, such as mice and rats, and make desirable species more susceptible to unnatural predators (house cats). If you care about small wildlife, **keep your cat indoors!**

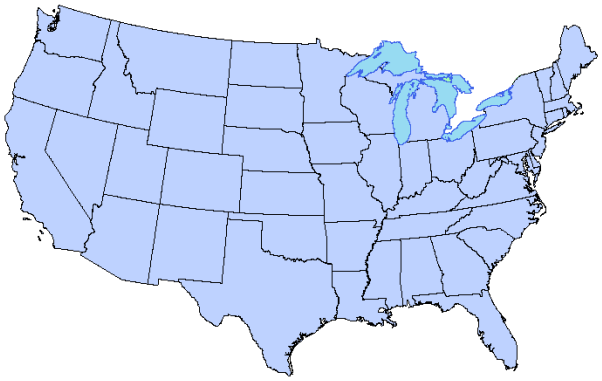
Although there are several active management practices that can be implemented, such as artificial feeders, mowing, planting flowers, and rooftop/balcony gardens, there are also some common-sense considerations that should always be given. For example, when nests of desirable species are found, care should be taken not to disturb them. Otherwise, the nest/nestlings may be abandoned. Another consideration is the use of pesticides. Insects are a great source of protein, calcium, and various vitamins and minerals and are the primary diet item for many birds seen in urban and suburban areas. Thus, it should be obvious that pesticides should be used carefully. When using pesticides, follow all directions on the manufacturer's label and wear protective clothing.

Urban	American robin	bluebird	common nighthawk	European starling	house finch	house sparrow	house wren	northern flicker	peregrine falcon	rock pigeon	ruby-throated hummingbird	song sparrow	big brown bat	cottontail	coyote	eastern gray squrriel	raccoon	white-tailed deer
Habitat Management Practices																		
Conservation Easement																		
Control Nonnative Invasive Vegetation	X	X					X	X			X	X		X	X	X	X	X
Create Snags		X						X					X				X	
Delay Crop Harvest																		
Edge Feathering		X												X	X	X	X	X
Field Borders		X												X	X		X	X
Forest Management								X				X		X	X	X	X	X
Leave Crop Unharvested														X			X	X
Livestock Management		X	X											X	X	X	X	X
Nesting Structures		X					X		X				X					
Plant Food Plots														X		X	X	X
Plant Native Grasses and Forbs		X			X							X		X	X			X
Plant Shrubs	X	X			X		X	X			X	X		X	X		X	X
Plant Trees	X	X			X		X	X			X		X			X	X	X
Repair Spillway/Levee																	X	
Set-back Succession	X	X	X					X				X	X	X	X		X	X
Tillage Management														X			X	X
Water Control Structures																	X	
Water Developments for Wildlife	X				X							X	X				X	X
Population Management Practices																		
Decrease Harvest														X	X	X	X	X
Increase Harvest														X	X	X	X	X
Wildlife Damage Management				X		X		X	X	X			X	X	X	X	X	X
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Mgmt Practices																		
Construct Fish Pond																		
Control Aquatic Vegetation																		
Fertilize/Lime Fish Pond																		
Reduce Turbidity in Fish Pond																		
Restock Fish Pond																		
Streams: Create Pools																		
Streams: Remove Fish Barriers																		
Additional Urban Practices																		
Artificial Feeders					X			X			X	X				X		
Mowing	X	X	X		X			X				X	X					
Plant Flowers											X							
Rooftop/Balcony Gardens											X							

Wetlands

Physical description

Wetlands can be described as the zone between deep water and upland areas. They are characterized by various amounts of open water and vegetation with soil that is often wet or covered with shallow water. There are many types of wetlands, including beaver ponds, potholes, playas, ephemeral (temporary) ponds, small lakes, marshes, rivers, streams, swamps, and others. They are found in all of the ecoregions described in this manual.



Dominant vegetation

Aquatic vegetation can survive in the water or on lands flooded or saturated with water for extended periods. Upland vegetation cannot tolerate saturation for long periods. The vegetation found in association with wetlands varies with permanence of the water, depth of water, salinity, and substrate (bottom). Wetlands with deep, permanent water typically have less emergent (above the water surface) vegetation and more floating or submerged (below the water surface) aquatic vegetation. As the water depth decreases, emergent aquatic vegetation becomes more prevalent. Less vegetation is found on rock and gravel bottoms than on bottoms with more silt, clay, and organic material (dead plants and animals that are decomposed). Emergent aquatic vegetation may include trees, shrubs, grasses, forbs, sedges, and rushes.

Examples of trees often found in wetlands include willows, cottonwood, various oaks, tupelo gum, tamarack, cypress, mangroves, red bay, black spruce, Atlantic white cedar, and pond pine. Shrubs commonly found in and adjacent to wetlands include willows, alders, bog birch, bog laurel, Labrador tea, coastal sweetbells, inkberry, sea myrtle, and marsh elder. Emergent grasses and grass-like vegetation commonly found in wetlands include cattails, bulrushes, saltgrass, cordgrass, saw grass, sedges, arrow grass, shoal grass, eel grass, and wild rice. Water lilies, pondweeds, wild celery, water milfoil, duckweeds, and coontails are examples of floating and submerged aquatic vegetation. Typical invasive plants found in wetlands include purple loosestrife, hydrilla, Eurasian watermilfoil, reed canarygrass, water hyacinth, alligator weed, and phragmites.

The amount of open water and vegetation is important in determining how suitable the wetland is for different wildlife species. For example, young ducks need open water and emergent vegetation for hiding. Floating and submerged vegetation supports large amounts of food high in protein, such as snails, mollusks, and crustaceans, which young ducks need for fast growth. Emergent vegetation may supply nesting areas, such as trees for wood ducks, grass for mallards, and cattails for red-winged blackbirds and muskrats. Exposed mudflats are another critical habitat component for some wildlife species, especially shorebirds, which rely on these areas to search for invertebrates in the mud.

Wetlands with stable, nonflowing water levels go through succession similar to the process in uplands. Open-water areas fill with silt and dead vegetation, which allows emergent aquatic vegetation to become dominant. As the wetland continues to fill, it becomes drier, allowing upland vegetation to become dominant.

Plant succession

Wetland succession typically proceeds in the following stages:
Stage 1: deep water with little vegetation
Stage 2: shallow water dominated by submerged and floating aquatic vegetation
Stage 3: very shallow water or wet ground dominated by any variety of emergent aquatic vegetation
Stage 4: ground becomes drier and upland vegetation similar to the surrounding area becomes dominant.

Succession proceeds slowly in wetlands with large amounts of deep water or a rocky bottom. Fluctuations in water levels can cause the final stage of succession to regress to an earlier stage. For example, if a wetland in Stage 3 succession is flooded with deep water for a period of time, the aquatic emergent vegetation may die, leaving a wetland in Stage 1 or Stage 2 succession. The extent of this regression depends on the length of time the wetland is flooded with deep water, how much the water level changes, and the extent (length of time) the present vegetation can survive in the changed water level.

Management of water levels is an important tool in managing wetlands for wildlife. The succession process described above is often not applicable to wetlands with constantly moving water, such as rivers, streams, and tidal areas.

Craig Harper

Stage 1 wetland—characterized by open water and limited vegetation.

Craig Harper

Stage 2 wetland—This beaver-influenced wetland provides a mosaic of open water with submerged vegetation, as well as floating islands of debris and emergent vegetation.

Craig Harper

Over time, Stage 2 wetlands dominated by floating and submerged aquatic vegetation succeed into Stage 3 wetlands with more emergent vegetation, including sedges, rushes, grasses, and shrubs.

Craig Harper

Stage 3 wetland—This natural emergent freshwater marsh is covered with several species of native grasses and sedges. Over time, these freshwater wetlands become more similar to the adjacent uplands as they slowly fill in.

Craig Harper

Stage 3 wetland – Forested bottomland swamps, such as this cypress swamp in the Lowcountry of South Carolina, are often relatively stable wetlands because of their proximity to major river systems.

Dwayne Elmore

Stage 4 wetland — these wetlands are rarely flooded. Here, a riparian area along the Missouri River has recently flooded and sediment is deposited along the river. However, most of the time, this area is dry.

Wildlife associated with Wetlands

American bittern
Canada goose
mallard
northern pintail
redhead
spotted sandpiper
Virginia rail
Wilson's snipe
American beaver
common muskrat
mink
raccoon
river otter
eastern snapping turtle
American bullfrog
crawfish frog
tiger salamander
bluegill
largemouth bass

Wetlands	American bittern	Canada goose	mallard	northern pintail	redhead	spotted sandpiper	Virginia rail	Wilson's snipe	American beaver	common muskrat	mink	raccoon	river otter	eastern snapping turtle	American bullfrog	crawfish frog	tiger salamander	bluegill	largemouth bass
Habitat Management Practices																			
Conservation Easement																X			
Control Nonnative Invasive Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X			X			
Create Snags												X							
Delay Crop Harvest			X																
Edge Feathering												X							
Field Borders												X							
Forest Management			X									X							
Leave Crop Unharvested		X	X	X								X							
Livestock Management	X	X	X	X	X	X			X	X	X	X			X	X	X	X	X
Nesting Structures																			
Plant Food Plots		X	X	X								X							
Plant Native Grasses and Forbs		X	X	X		X										X	X		
Plant Shrubs									X			X				X	X		
Plant Trees									X			X					X		
Repair Spillway/Levee	X	X	X	X	X	X	X			X	X	X	X	X	X			X	X
Set-back Succession	X	X	X	X	X	X	X	X		X	X	X							
Tillage Management		X	X	X								X							
Water Control Structures	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Developments for Wildlife	X	X	X	X	X	X	X			X	X	X	X	X	X	X	X		
Population Management Practices																			
Decrease Harvest							X	X	X	X	X	X	X	X	X			X	X
Increase Harvest									X	X	X	X	X	X	X			X	X
Wildlife Damage Management		X							X	X		X	X	X					
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices																			
Construct Fish Pond																		X	X
Control Aquatic Vegetation																		X	X
Fertilize/Lime Fish Pond																		X	X
Reduce Turbidity in Fish Pond																		X	X
Restock Fish Pond																		X	X
Streams: Create Pools																			
Streams: Remove Fish Barriers																			

Woodland

Physical description

The Woodland ecoregion is dominated by various types of woodlands. There are woodlands in other ecoregions, but the Woodland ecoregion is distinguished by species composition and structure of the vegetation community. Terrain in the Woodland ecoregion is irregular with large hills and mesas that are often dissected by narrow drainages. The average annual precipitation ranges from 10 to 25 inches. Most of the precipitation is received in winter and late summer. Summers have hot days and cool nights. Winters are cold.

Dominant vegetation

In the Woodland ecoregion, pinyon pine and juniper are most often associated with the final stage of plant succession. In the southern areas of this ecoregion, species of oaks such as live oak, Spanish oak, and shin oak represent the final stage of plant succession. Woodland shrubs include bitterbrush, mountain mahogany, scrub oak, and sumac. In addition, in areas where there has been a disturbance, mesquite may dominate. Areas dominated by sagebrush may be interspersed with tree-dominated areas similar to those described in the Intermountain Sagebrush ecoregion.

A variety of perennial and annual grasses and forbs can be found in the herbaceous layer. The amount of grass, forbs, and shrubs depends on the amount of trees in the area. Canopy cover is one of the primary factors influencing understory vegetation in forest and woodland vegetation. Usually the herbaceous layers decrease as the amount of trees increase.

The vegetation associated with riparian areas is often much different than the surrounding vegetation. The vegetation in riparian vegetation is more abundant and composed of different species. Riparian areas are dominated by cottonwoods, willows, tamarisk, silver buffaloberry, boxelder, and a variety of grasses and forbs. Russian olive is a common nonnative invasive shrub along riparian areas. In the southern part of the Woodland ecoregion, hackberry, Spanish oak, and live oak occur. The variety and abundance of vegetation compared to the surrounding areas makes riparian areas very attractive to wildlife.

Typical invasive plants in the Woodland ecoregion include leafy spurge cheatgrass, Canada thistle, dalmation toadflax, and yellow toadflax.


Dwayne Elmore

Oak savanna and woodlands are maintained by frequent fire and contain abundant grass cover.


Dwayne Elmore

In the absence of fire, juniper often is the dominant plant, which hosts an entirely different set of wildlife species than those in more open woodland.

Farming and ranching

Water for irrigation is limited and necessary to grow crops in this ecoregion. Where available, water is diverted from rivers and streams to grow crops such as corn, wheat, barley, alfalfa, and grass pasture and hay. Farming is important only in small, localized areas in valleys and on flat terrain. Livestock grazing is common in the ecoregion. Livestock management may be used to exclude livestock from sensitive areas, or may be used to benefit wildlife by adjusting stocking rate, season of use, or grazing system.

Plant Succession

Annual forbs and grasses represent the initial stage of succession. Perennial grasses and forbs represent the second stage. Shrubs, along with perennial grasses and forbs are the third successional stage. Oak and/or juniper woodland dominate the fourth successional stage.

Wildlife associated with Woodlands

American wigeon
golden-cheeked warbler
greater roadrunner
ladder-backed woodpecker
mourning dove
northern bobwhite
prairie falcon
red-tailed hawk
western bluebird
wild turkey
black-tailed jackrabbit
Brazilian free-tailed bat
coyote
white-tailed deer
wild pig
western diamond-backed rattlesnake
bluegill
largemouth bass

Woodland	American wigeon	golden-cheeked warbler	greater roadrunner	ladder-backed woodpecker	mourning dove	northern bobwhite	prairie falcon	red-tailed hawk	western bluebird	wild turkey	black-tailed jackrabbit	Brazilian free-tailed bat	coyote	white-tailed deer	wild pig	western diamond-backed rattlesnake	bluegill	largemouth bass
Habitat Management Practices																		
Conservation Easement		X				X												
Control Nonnative Invasive Vegetation	X	X	X	X	X	X		X	X	X	X		X	X		X		
Create Snags				X				X	X									
Delay Crop Harvest					X			X										
Edge Feathering						X		X	X	X			X	X				
Field Borders						X		X	X	X			X	X				
Forest Management		X	X			X		X	X	X			X	X				
Leave Crop Unharvested					X	X				X				X				
Livestock Management	X			X	X	X			X	X	X		X	X			X	X
Nesting Structures							X		X			X						
Plant Food Plots					X	X				X				X				
Plant Native Grasses and Forbs	X				X	X		X	X	X			X	X		X		
Plant Shrubs	X		X			X		X	X	X	X		X	X		X		
Plant Trees		X		X	X			X	X	X				X				
Repair Spillway/Levee	X				X												X	X
Set-back Succession	X	X	X		X	X	X	X	X	X	X		X	X		X		
Tillage Management	X				X	X		X		X				X				
Water Control Structures	X				X												X	X
Water Developments for Wildlife	X				X					X				X				
Population Management Practices																		
Decrease Harvest						X				X	X		X	X			X	X
Increase Harvest										X	X		X	X	X		X	X
Wildlife Damage Management				X				X		X	X	X	X	X	X	X		
Wildlife or Fish Survey	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Pond/Stream Management Practices																		
Construct Fish Pond																	X	X
Control Aquatic Vegetation																	X	X
Fertilize/Lime Fish Pond																	X	X
Reduce Turbidity in Fish Pond																	X	X
Restock Fish Pond																	X	X
Streams: Create Pools																		
Streams: Remove Fish Barriers																		

Wildlife Species

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

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

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

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

Index to Wildlife Species

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

Birds (86)

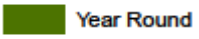
Range map key for birds:

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

Gambel's quail
golden eagle
golden-cheeked warbler
golden-fronted woodpecker
golden-winged warbler
grasshopper sparrow
great horned owl
greater prairie-chicken
greater roadrunner
greater sage-grouse
hairy woodpecker
house finch
house sparrow
house wren
ladder-backed woodpecker
lark bunting
Lawrence's goldfinch
loggerhead shrike
long-billed thrasher
mallard
marbled murrelet
mountain bluebird
mourning dove
northern bobwhite
northern flicker
northern goshawk
northern harrier
northern pintail
Nuttall's woodpecker
ovenbird
peregrine falcon
prairie falcon
prothonotary warbler
pyrrhuloxia
red-cockaded woodpecker
red-eyed vireo
red-tailed hawk
redhead
ring-necked pheasant
rock pigeon
ruby-throated hummingbird
ruffed grouse
sage thrasher
scaled quail
sharp-tailed grouse
song sparrow
sooty grouse
southwest willow flycatcher
spotted sandpiper
spotted towhee
Virginia rail
western bluebird
western kingbird
white-tailed ptarmigan
white-winged dove
wild turkey
Wilson's snipe
wood duck
yellow-rumped warbler

Mammals (34)

Range map key for mammals:

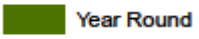


American beaver
American marten
big brown bat
black bear
black-tailed jackrabbit
black-tailed prairie dog
bobcat
Brazilian free-tailed bat
collared peccary
Columbian black-tailed deer
common muskrat
coyote
desert cottontail
eastern cottontail
eastern fox squirrel
eastern gray squirrel
elk
fisher
gray fox
Indiana bat
mink
moose
mountain cottontail
mountain lion

New England cottontail
pronghorn
raccoon
red fox
red squirrel
river otter
Rocky Mountain mule deer
snowshoe hare
white-tailed deer
wild pig

Reptiles (9)

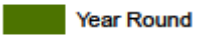
Range map key for reptiles:



eastern box turtle
eastern indigo snake
eastern snapping turtle
Gila monster
gopher tortoise
plains hog-nosed snake
Texas horned lizard
timber rattlesnake
western diamond-backed rattlesnake

Amphibians (7)

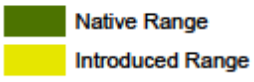
Range map key for amphibians:



American bullfrog
crawfish frog
Monterey salamander
northern red-legged frog
rough-skinned newt
tiger salamander
wood frog

Fish (5)

Range map key for fish:



bluegill
Coho salmon
cutthroat trout
largemouth bass
rainbow trout

Birds

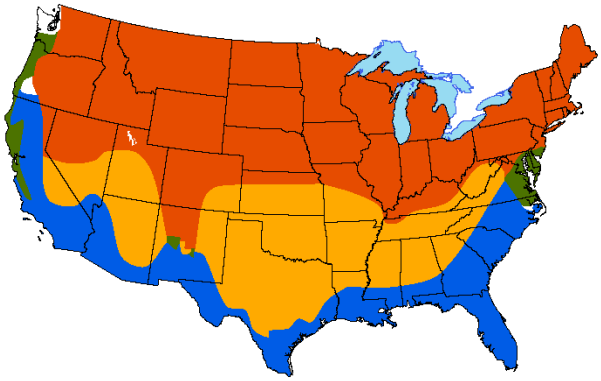
American bittern

General information

Sallie Gentry

The American bittern is a medium-sized heron typically found in dense emergent vegetation in moderately shallow freshwater wetlands. This migratory bird may be found near the coasts during winter in ice-free marshes. It is rarely seen except when flying. It moves slowly through vegetation stalking food and is well camouflaged with brown and white steaks. American bitterns occasionally use adjacent upland grasslands for nesting and foraging. Larger semi-permanent wetland complexes are favored over small, isolated wetlands.

Habitat requirements



Diet: fish, amphibians, snakes, insects, and crustaceans
Water: obtained from food
Cover: dense emergent wetland vegetation, such as reeds, cattails, or sedges, for cover. The nest is built in dense cover a few inches above shallow water. Water depth should be maintained at less than 2 inches throughout the year.

Wildlife Management Practices

Control Nonnative Invasive Vegetation: is necessary when nonnative invasive vegetation begins to outcompete native vegetation, limit food abundance, or alters the hydrology of a wetland favoring dryer land.
Livestock Management: livestock should be excluded from wetlands managed for bitterns
Repair Spillway/Levee: if not functioning properly
Set-back Succession: periodic prescribed fire, disking, and herbicides may be used to maintain appropriate vegetation structure. However, disturbance should be infrequent (2-5 years) as bittern prefer dense cover.
Water Control Structures: should be installed when wetlands do not have control structures to maintain appropriate water depths. Drawdowns can be conducted to favor appropriate vegetation. Drawdowns should be conducted slowly and after the breeding season (mid-August or later).
Water Developments for Wildlife: shallow wetlands can be constructed if adequate habitat is not present.
Wildlife or Fish Survey: Bitterns are typically surveyed by listening for calls. Also, ropes can be dragged across the vegetation between two or more observers to flush the birds.

American black duck

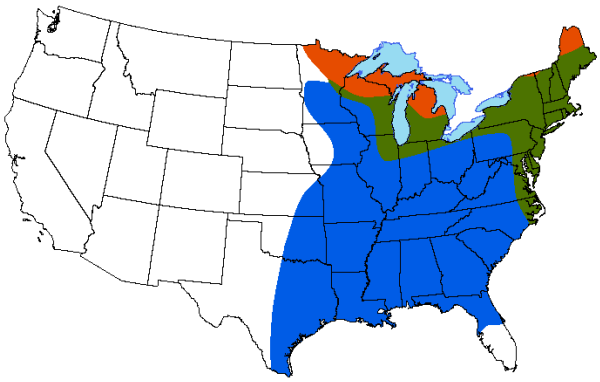
General information

Gene Nieminen

The American black duck is a large dabbling duck similar in size to mallards, ranging from 19 to 25 inches in length. They also resemble the female mallard in color, though their plumage appears darker. The male and female black duck are similar in appearance. They have orange legs and feet and blue wing patches. The male black duck has a yellow to green bill, whereas hens have olive bills. Black ducks interbreed regularly and extensively with mallards. American black ducks frequent forested wetlands, tidewater areas, and coastal marshes of the Eastern United States. They feed in a variety of shallow wetlands and agricultural fields. Their nests are built of vegetation and lined with down, found most often on the ground along edges of heavy cover, and generally close to water.

Habitat requirements

Diet: aquatic plants, invertebrates, waste corn and grain are primary diet items
Water: obtains water through diet
Cover: forested and emergent wetlands for loafing; they will also feed in flooded grain fields



Wildlife Management Practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce wetland habitat quality or when nesting habitat quality is reduced
Leave Crop Unharvested: to provide a winter food source
Plant Food Plots: shallowly flooded grain plots can provide a beneficial food source for migrating and wintering black ducks
Plant Native Grasses and Forbs: where nesting cover is lacking
Repair Spillway/Levee: if not functioning properly
Set-back Succession: prescribed fire to rejuvenate vegetation in nesting areas and to maintain proper water and vegetation interspersion in wetlands
Tillage Management: eliminating fall tillage can provide waste grain in the winter
Water Control Structure: control water level in wetlands managed for waterfowl
Water Developments for Wildlife: shallow impoundments can be important for migrating and wintering waterfowl; flooding grain fields and planting food plots in winter makes food more available
Wildlife or Fish Survey: Black ducks are secretive and are often in woody emergent wetlands where accurate surveys are difficult. Nonetheless, flush counts and aerial surveys are most often used to estimate black duck populations.

American kestrel

General information

Robert Burton

The American kestrel is a common, widespread, small raptor resembling the size and shape of a mourning dove. The males are a colorful slate-blue on the top of the head and on the wings, with a reddish colored back and tail. Females have reddish brown wings, but both sexes have characteristic black slashes on the sides of their face. They can be found in a variety of open environments, including deserts and grasslands. Often spotted perching on power lines or other tall structures searching for prey, they swiftly move their tail to keep balanced in the wind. Because of their small size, American kestrels are predated by larger raptors, such as northern goshawks and red-tailed hawks, and even snakes. They nest in cavities (often old woodpecker holes or natural tree hollows) with loose material on the floor and have been noted to readily use human-made nesting boxes. The males will search out and sometimes even defend a cavity, and later present it to a potential mate. Clutches usually contain 4 to 5 eggs. Chicks are altricial, meaning they are helpless for a couple weeks after hatching and must be fed and cared for. The American kestrel is declining in some areas of North America, including the Pacific Coast and Florida, where it is listed as threatened. The decline in these areas can be attributed to poor habitat quality with a lack of nesting cavities, early successional cover, and food resources.

Habitat requirements

Diet: primarily insects and small mammals associated with open areas
Water: obtain necessary water from diet and do not need water for drinking
Cover: nest in tree cavities and other sites including holes in cliffs, canyon walls and artificial nest boxes

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation competes with native plant species and reduces habitat quality for kestrels or their prey
Create Snags: where needed for perches and increase potential nest cavities
Field Borders: to increase cover for prey around row crop fields
Livestock Management: to prevent overgrazing and maintain sufficient cover for prey and maintain early succession vegetation with scattered shrub cover
Nesting Structures: can be used where a lack of natural nesting cavities is limiting the population; nest boxes can be placed on fence posts in open areas
Plant Native Grasses and Forbs: where necessary to provide desirable cover for prey
Plant Shrubs: in large open areas where shrub cover is limiting
Plant Trees: where trees are lacking for future perching sites and cavities for nesting
Set-back Succession: *Prescribed Fire*, *Chaining*, *Drum-chopping*, and *Herbicide Applications* can maintain shrub cover and stimulate herbaceous cover
Tillage Management: will facilitate hunting prey when waste grain is available
Wildlife or Fish Survey: observation counts, point counts, and nest box usage rates may be used to estimate trends in populations

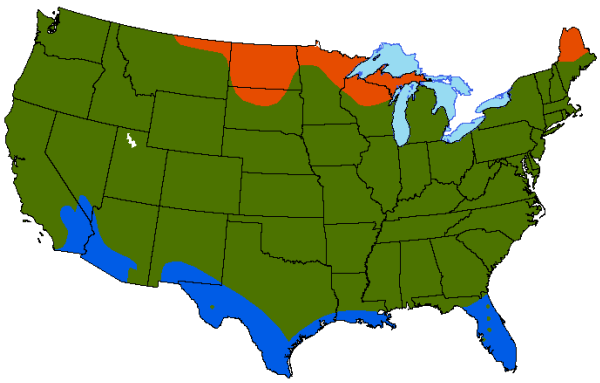
American robin

General information

Lee Karney

American robins use a wide assortment of vegetation types, from mowed grassy areas to forested areas. In urban areas, robins use large open areas and nearby trees and shrubs. Parks, golf courses, and lawns in residential areas are attractive to robins. They are found throughout North America, though they may migrate out of northern latitudes during winters with sustained cold and snow. Robins build a nest of grass and mud on a tree or shrub limb, but will occasionally nest on building ledges. Robins spend considerable time on the ground feeding on earthworms, but also will perch on branches to eat berries, fruit, and insects.

Habitat requirements



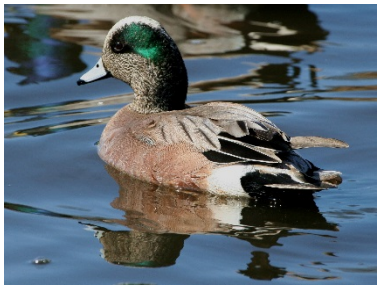
Diet: insects and worms during spring and summer; soft mast from shrubs and trees in winter; seldom use artificial feeders
Water: require water daily in warm seasons; obtain water from low-lying areas, ponds, and rain-filled gutters
Cover: shrubs, evergreen trees, and deciduous trees used for nesting and escape; evergreen trees often used for early nests

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for American robins
Plant Shrubs: where soft mast is lacking; examples might include dogwoods, hollies, golden currant and winterberry
Plant Trees: both deciduous and evergreen; where nesting sites may be limiting
Set-back Succession: prescribed fire, disking, and mowing can be used to set-back succession and provide suitable structure for robins
Water Developments for Wildlife: birdbaths and pans of water can be provided in urban areas; do not place water in areas where cats can catch the birds; cats should be removed
Wildlife or Fish Survey: observation counts and point counts are used to estimate trends in populations
Mowing: to maintain suitable structure for robins in Urban areas

American wigeon

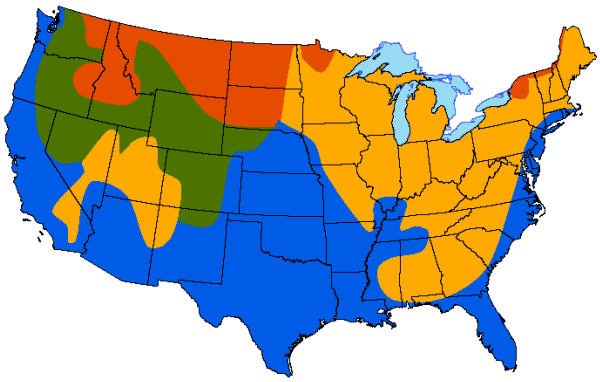
General information



Donna Dewhurst

The American wigeon is a medium-sized dabbling duck. It is easily distinguished from other dabbling ducks by its round head, short neck and small bill. The American wigeon's body ranges from 17 to 23 inches long. The male (drake) has a mask of green feathers around its eyes and a cream-colored cap that runs from its bill to the crown of its head. This cap gives this bird its other common name, baldpate, which means bald head. Drakes can also be identified in flight by a large white shoulder patch on each wing. Hens have primarily gray and brown plumage. Both sexes have bluish-gray black tipped bills and gray legs and feet. The American wigeon has very distinctive calls with the drake producing a three-note whistle and the hens a low growl quack. They nest in areas of tall grass or shrubs, often far from water. The nest is constructed on the ground in a depression lined with grasses and down.

Habitat requirements



Diet: mostly aquatic plants and a few insects, and mollusks
Water: obtains water through diet
Cover: shallow freshwater wetlands, ponds, marshes, and rivers

Wildlife Management Practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for American wigeon
Livestock Management: livestock should be excluded from wetlands managed for waterfowl
Plant Native Grasses and Forbs: where nesting cover is limited
Plant Shrubs: where nesting cover is limited
Repair Spillway/Levee: if not functioning properly
Set-back Succession: to rejuvenate vegetation in nesting areas and to maintain proper water and vegetation interspersion in wetlands
Tillage Management: eliminate fall tillage to encourage vegetation in agricultural fields for grazing opportunities
Water Control Structure: to control water level in wetlands managed for waterfowl
Water Developments for Wildlife: shallow impoundments can be important for migrating and wintering waterfowl; flooding grain fields and planting food plots in winter makes food more available
Wildlife or Fish Survey: flush counts and aerial surveys are used to estimate populations in fall and winter

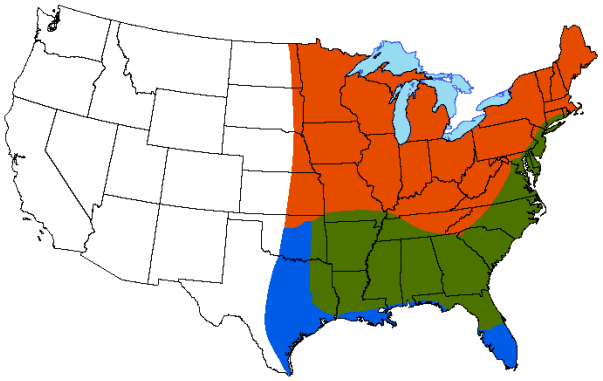
American woodcock

General information

Richard Baetsen

The American woodcock is a ground-dwelling, migratory shorebird of the eastern United States and southeastern Canada that primarily inhabits moist, young forest and shrubland. They breed, nest, and raise their broods from March to June in their northern range. They migrate to their southern range in the fall through winter. This gamebird has declined steadily over the past 25 years as a result of land-use changes that have resulted in forest maturation, fire suppression, and increased human development. High-quality woodcock habitat has a diverse arrangement of dense, young forest (and must include some moist sites) on 80 percent of the area, interspersed with large fields (at least 5 acres in size and one field per 100 acres) and small openings (at least 0.5 acre in size and eight fields per 100 acres) in close proximity.

Habitat requirements



Diet: invertebrates (earthworms equals 60 percent of diet)
Water: obtained through diet
Cover: courtship sites – 0.5+ acre forest openings with sparse herbaceous groundcover and scattered shrubs and/or young trees
Foraging cover – young forest (2- to 15-year-old hardwoods) or shrub cover on moist sites
Nesting cover – 1- to 5-acre areas of young forest (moist or upland; 2- to 25-year-old hardwoods with a dense shrub mid-story in older stands). Nests are located in slight depressions among dead leaves on the forest floor.
Brood-rearing cover – 1- to 5-acre areas of young forest (2- to 25-year-old hardwoods with sparse groundcover and some bare ground)
Roosting cover – 5+ acre openings with herbaceous cover and scattered shrubs or young trees within 0.5 miles of foraging cover

Wildlife management practices

Control Nonnative Invasive Vegetation: may be necessary if habitat quality is degrading and the native plant community is being outcompeted
Edge Feathering: will create a soft edge between openings or agricultural fields and the forest that will encourage shrub and/or young tree growth
Forest Management*:* can produce a diverse-age forest canopy. On larger properties, forest regeneration cuts, especially *Clearcut* and *Group Selection*, can provide a mosaic of openings and successional stages
Livestock Management: exclude livestock from areas managed for American woodcock

Plant Shrubs: where there is a lack of interspersed shrubs for foraging, nesting, courtship, or roosting cover
Plant Trees: where there is a lack of forest cover
Set-back Succession: Because smaller properties may not be practical for a forest rotation and woodcock do not use hardwood forests older than about 25 years, it may be necessary to use chainsawing/feller-bunching, prescribed burning, and/or herbicide applications to maintain shrub and young tree growth. These methods and root-plowing may also be used to create and maintain forest openings on large or small properties.
Decrease Harvest*:* may be necessary when surveys show a decline in the local population
Wildlife or Fish Survey*:* surveys on singing-grounds provide an index to the relative size of the woodcock breeding population

Barred owl

General information

Mark Musselman

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

Habitat requirements

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

Wildlife Management Practices

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

Black-backed woodpecker

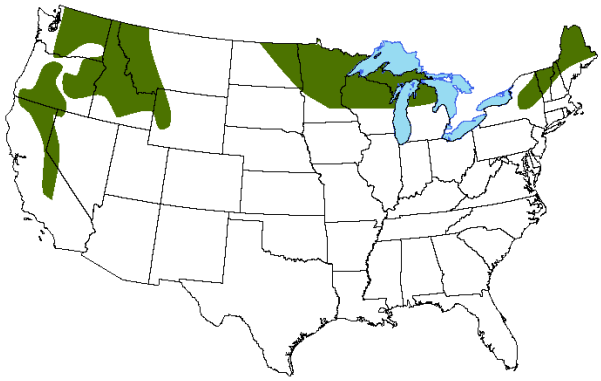
General information

Glen Tepke

Black-backed woodpeckers are primarily found in recently burned forests, specifically coniferous forests. Black-backed woodpeckers eat bark beetles and other wood-boring beetles in recently burned, old-growth coniferous forests. Abundance of black-backed woodpeckers declines with time since fire. Habitat generally remains for 7-8 years post fire.

Habitat requirements

Diet: bark beetles and wood-boring beetles in recently burned, old growth coniferous forests
Water: water is obtained from food
Cover: nest in the sapwood of relatively hard, dead trees with little decay that have been recently burned with high concentrations of beetle larvae.

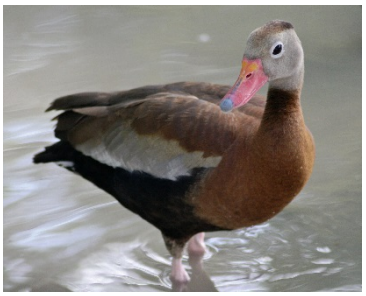


Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to reduce habitat quality for black-backed woodpeckers
Plant Trees: in areas where forest regeneration is not occurring, trees may be planted to provide future habitat for the black-backed woodpecker. However, it will be many decades before these trees are of sufficient size to provide habitat for this woodpecker.
Set-back Succession: relatively intense fire in old-growth coniferous forests is necessary for the occurrence of black-backed woodpeckers. However, logging post-fire significantly decreases their occurrence.
Wildlife or Fish Survey: point counts can be conducted to listen for the distinctive drumming of the black-backed woodpeckers during the mating season

Black-bellied whistling duck

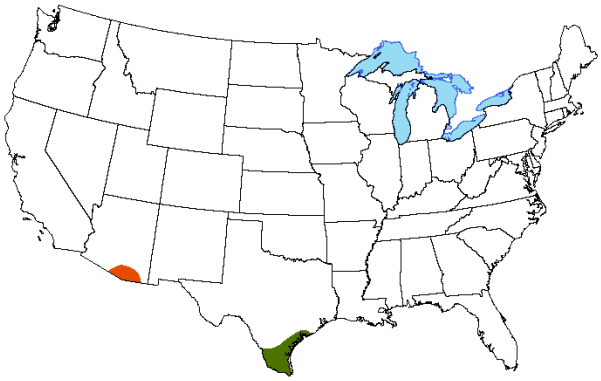
General information



Robert Burton

The black-bellied whistling duck is a medium-sized duck that ranges in body length from 19 to 22 inches. The males and females look alike. They have a long red bill, long gray head with a gray face and long pink legs. The belly and tail are black, and the body, back of neck and cap are chestnut brown. The black-bellied whistling duck has a distinctive white wing bar that is unique among whistling ducks. Their call is a high-pitched, soft wheezy whistle of four to six notes, accented on the second or third syllable. Black-bellied whistling ducks are primarily cavity nesters and will use nesting boxes, but may nest on the ground if no cavities are present. The black-bellied whistling duck is unique among ducks in that they exhibit a strong bond between pairs, often staying together for many years. This duck is mainly non-migratory with only birds living in the extreme northern portion of their range moving south in winter.

Habitat requirements



Diet: aquatic plants, grass, grain, insects and mollusks
Water: obtains water through diet
Cover: tree-lined bodies of water, prefer shallow freshwater ponds, lakes, marshes, cultivated fields and reservoirs with plentiful vegetation; prefer to nest in tree cavities

Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and reducing habitat quality
Create Snags: to provide potential cavity nesting sites
Leave Crop Unharvested: provide grain food source
Livestock Management: livestock should be excluded from wetlands managed for waterfowl to maintain water quality and prevent sedimentation
Nesting Structures: nest boxes should be erected where there is a lack of nesting cavities
Plant Food Plots: grain plots can provide food source
Plant Trees: trees planted adjacent to wetlands can provide perching and nest cavity opportunities
Repair Spillway/Levee: if not functioning properly
Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially fields that can be shallowly flooded
Water Control Structures: control water level in wetlands managed for waterfowl
Water Developments for Wildlife: shallow impoundments can be important for migrating and wintering waterfowl; flooding grain fields and planting food plots in winter makes food more available
Wildlife or Fish Survey: flush counts and aerial surveys are used in fall and winter to estimate populations; nest box usage in summer can provide an index to population

Black-capped chickadee

General information

Donna Dewhurst

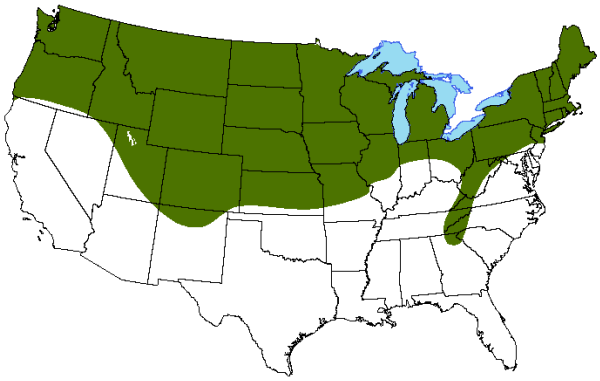
Black-capped chickadees occur throughout the upper two-thirds of the U.S. They are found in shrublands and forests. They nest in cavities in dead or hollow trees. Black-capped chickadees eat insects and spiders from the branches and bark of trees and shrubs. They also will visit bird feeders. They are often seen on the edges of forested areas.

Habitat requirements

Diet: ants, caterpillars and spiders from branches, leaves and bark of trees and shrubs; also seeds from bird feeders and soft mast from shrubs

Water: obtain necessary water from snow and surface water

Cover: nest in cavities, usually in a dead or hollow tree; they can excavate a cavity only in soft wood or rotted wood and will use woodpecker holes, natural cavities, and man-made boxes; thick shrub and tree canopies provide necessary cover



Wildlife management practices

Create Snags: trees may be killed where nesting cavities are limited to stimulate creation of additional cavities

Forest Management: *Timber Stand Improvement* practices can improve understory structure by increasing shrub cover within a stand when canopy cover exceeds 80 percent

Livestock Management*:* should prevent livestock from degrading shrub cover

Set-back Succession: *Prescribed Fire* can maintain shrubby areas and thick understory cover in woods

Nesting Structures**:** can be provided in areas where nesting cavities are limiting

Plant Shrubs: in large open areas to provide shrub cover

Plant Trees: where additional forest cover is needed

Wildlife or Fish Survey: point counts are used to estimate population trends

Black-throated sparrow

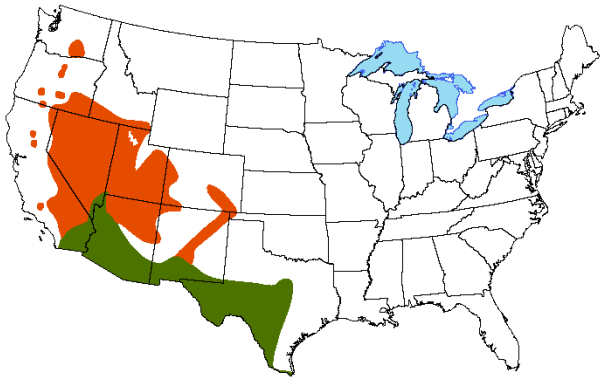
General information

James W. Arterburn

Black-throated sparrows are associated with shrublands, specifically sparsely vegetated desert shrubland, including mesquite, cacti, chaparral, and juniper in the southwest U.S. Their diet is mainly seeds and insects. Black-throated sparrows nest low to the ground in small shrubs.

Habitat requirements

Diet: insects, seeds and green herbaceous vegetation
Water: require water frequently during dry and cool seasons, especially when green herbaceous vegetation and insects are not available
Cover: nests are made from small twigs, grass, and stems placed in small shrubs near the ground; shrubs and cacti are used for hiding cover

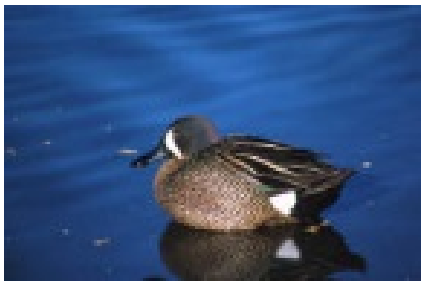


Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to compete with native species and degrade habitat quality
Livestock Management: should prevent overgrazing within shrub cover
Set-back Succession: *Prescribed Fire*, *Chaining*, and *Drum-chopping* can be used to rejuvenate shrublands when they become overgrown and limit herbaceous groundcover
Water Developments for Wildlife: can be beneficial where water is limiting
Wildlife or Fish Survey: point counts are used to estimate population trends

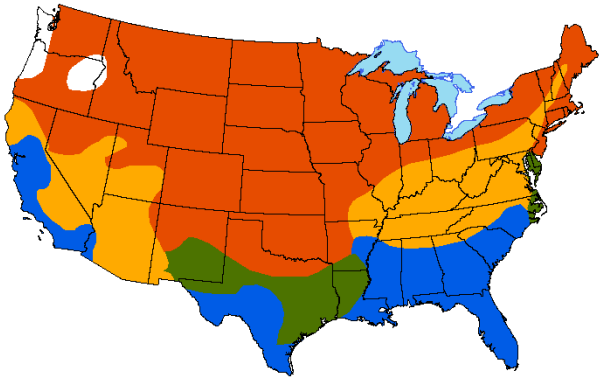
Blue-winged teal

General information



Dave Menke

The blue-winged teal is a relatively small dabbling duck associated with ephemeral wetlands, inland marshes, lakes and ponds. They inhabit shorelines more than open water and primarily nest within a few hundred feet of wetlands in the prairie pothole ecoregion of the Northern Great Plains. Nests are found primarily in dense grassland cover. Hayfields will sometimes be used for nesting, assuming adequate grass stubble remains. Blue-winged teal are surface feeders and prefer to feed on mud flats or in shallow water where floating and shallowly submerged vegetation is available, along with abundant small aquatic animal life. Shallow wetlands with both emergent vegetation and open water are required for brooding cover. During spring and fall migration, shallow wetlands and flooded fields are used for loafing and feeding. Blue-winged teal begin fall migration before any other waterfowl. They winter along the Gulf Coast in the Deep South and in Central and South America.



Habitat requirements

Diet: aquatic vegetation, seeds and aquatic insects; feeding primarily confined to wetlands
Water: relatively shallow wetlands required for brood rearing, feeding and loafing
Cover: dense native grass cover used for nesting; brooding cover consists of a mix of open water and emergent vegetation

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and degrade habitat quality
Leave Crop Unharvested: to provide additional food if the grain can be shallowly flooded
Livestock Management: livestock should be excluded from nesting areas and from wetlands managed for waterfowl
***Plant Food Plots*:** can provide additional food resources during migration and winter if the area is shallowly flooded when the ducks arrive
Plant Native Grasses and Forbs: for nesting cover where suitable cover is lacking
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* can be used to maintain wetlands and associated upland nesting cover in the desired structure and composition
***Tillage Management*:** delaying cropland tillage, especially wheat, in spring may allow nesting in standing stubble
***Water Control Structure*:** allows managers to manipulate water levels in wetlands as needed
Water Developments for Wildlife: flooded fields provide important areas for teal during migration; constructing small dikes for temporary flooding provides shallow sheet-water teal prefer for feeding and loafing
Wildlife or Fish Survey: flush counts can provide estimates of nesting teal

Brewer's sparrow

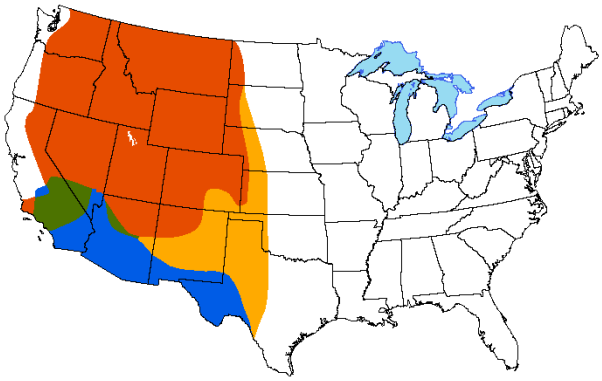
General information

Brewer's sparrows are found in the Great Basin south to southern California and New Mexico and in the northern Rocky Mountains of the Yukon and British Columbia. Their habitat contains sagebrush in the Great Basin and alpine meadows in the Rocky Mountains. They are associated with relatively large areas of shrubland; shrub-dominated areas less than one-half acre are not usually used.

Dave Menke

Habitat requirements

Diet: a variety of insects and spiders from leaves and branches of shrubs; seeds of forbs and grasses
Water: necessary water is obtained from diet, but will use other water sources when available
Cover: nest in dense sagebrush 20 inches to 30 inches tall; amount and height of shrub is important; shrubs also used for hiding



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and degrade habitat quality
***Livestock Management*:** grazing regimes should promote shrub growth
Plant Shrubs: in large open areas where shrub cover is limiting
Set-back Succession: *Herbicide Applications* may be used to adjust species composition of the plant community
Wildlife or Fish Survey: point counts can be used to estimate population trends

Broad-winged hawk

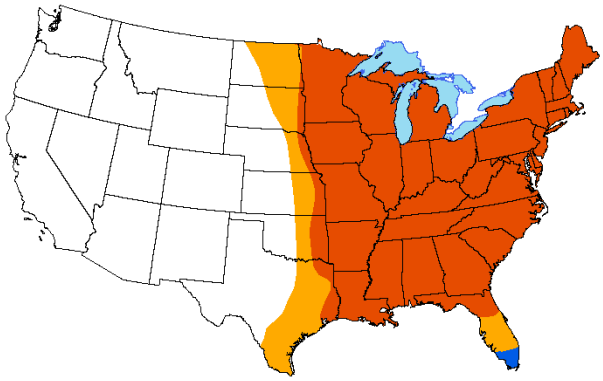
General information

Broad-winged hawks use mixed upland hardwood forest and woodlands (oaks, hickories, maples, beech) and mixed conifer-hardwoods. Broad-winged hawks are normally solitary and inconspicuous. They hunt within the forest near small openings in the canopy.

Greg Lavaty

Habitat requirements

Diet: rodents and other small mammals (such as mice, chipmunks, squirrels, shrews, moles) but also snakes, lizards, caterpillars, grasshoppers, beetles, crickets, crawdads, and some small birds
Water: obtain necessary water from diet
Cover: nest among tall trees in the woods with openings and water nearby; will sometimes nest in old crow, hawk, or squirrel nests; they hunt throughout the forest, especially where small canopy gaps occur



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to compete with native species and degrade habitat for prey and broad-winged hawks
Forest Management: *Group Selection* harvest and *Timber Stand Improvement* should encourage understory development and enhance habitat for a variety of prey species
Livestock Management: should exclude cattle from forested areas to retain an understory that provides cover for a variety of small prey mammals
***Plant Shrubs*:** in areas where tree cover is lacking such as large open fields
***Plant Trees*:** in relatively large open areas where additional forest cover is needed
Set-back Succession: *Prescribed Fire* may be used to maintain diverse understory structure in forests with broken canopies that allow sufficient sunlight
Water Developments for Wildlife: will enhance habitat for a variety of prey species
Wildlife or Fish Survey: observation surveys are commonly used to estimate population trends

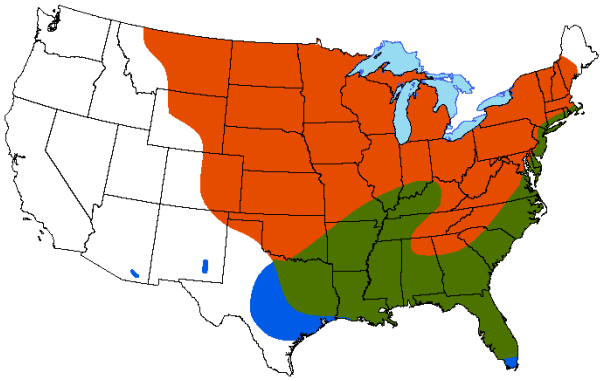
Brown thrasher

General information

Dan Sudia

Brown thrashers occur in the eastern two-thirds of the U.S. They are normally found in shrub and bramble thickets, hedgerows, shelterbelts, young forests, forest edges, and brushy riparian areas. Brown thrashers forage primarily on the ground, using their beaks to turn-over leaves and debris looking for food. More food is available when there is substantial ground litter (leaves and debris). Nests are usually found in bushes or small trees 1 to 10 feet aboveground.

Habitat requirements



Diet: invertebrates and plant seeds are main items in diet, but soft and hard mast are also eaten
Water: water requirements are not known
Cover: dense shrubs and brambles interspersed with some trees are used for nesting and escape cover; will use areas that have only shrubs; need a minimum of 2.5 acres of habitat to support a breeding population

Wildlife management practices

Control Nonnative Invasive Species: when nonnative invasive species begin to compete with native species and degrade habitat for brown thrashers
Edge Feathering: will enhance habitat around the edge of fields
Field Borders: of brambles and shrubs will provide additional nesting and foraging cover
Forest Management: *Forest Regeneration*, especially *Clearcut*, *Shelterwood*, and *Seedtree* will improve vegetation structure for nesting and foraging; *Timber Stand Improvement* can improve habitat by stimulating understory development
Livestock Management: should exclude livestock from riparian areas, shrublands and forests to allow shrubs and trees to regenerate
Plant Shrubs: in open areas of at least 2.5 acres to create additional cover for nesting/foraging
Set-back Succession: *Prescribed Fire*, *Chaining*, and *Herbicide Applications* can be used to maintain and rejuvenate shrub cover when habitat quality begins to decline; *Chainsawing* can be used to clear woods and create additional brushy cover
Wildlife or Fish Survey: point counts can be used to survey populations

California quail

General information

Gary Kramer

California quail are found most commonly in chaparral, sagebrush, and oak savannas and woodlands. They require shrubby cover for roosting, escape cover, loafing, and foraging. Ideal California quail habitat is a mixture of shrub cover well interspersed with annual and perennial forbs and grasses. Adult California quail eat mostly seeds, leaves, and flowers from grasses, shrubs, and trees. The diet of juveniles, however, consists largely of invertebrates.

Habitat requirements

Diet: about 70 percent of diet consists of seeds and green foliage from forbs and grasses, particularly annual grasses; diet supplemented with soft mast and seeds from a variety of shrubs; juveniles less than 3 weeks old eat insects; by 12 weeks of age, diet is same as adults
Water: obtain necessary water through diet except during periods of heat and drought when free-standing water is required for drinking
Cover: require cover near feeding areas or habitat quality declines dramatically; shrubby cover used for roosting, escape cover, and loafing; nest on the ground in grasses and forbs

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality; nonnative sod grasses are particularly problematic
Edge Feathering: will provide escape cover and increased foods
Field Borders: to increase usable space around crop fields
Leave Crop Unharvested: to provide additional foods
Livestock Management: proper grazing can be used to maintain adequate groundcover for nesting and forage, and prevent livestock from destroying cover near water sources
Plant Food Plots: grain will be eaten by quail when available
Plant Native Grasses and Forbs: to improve nesting cover and food availability in areas where groundcover is lacking or needs to be improved
Plant Shrubs: in relatively large open areas where shrub cover is lacking
Plant Trees: where woody cover is lacking, species such as oaks may be planted
Set-back Succession: *Prescribed Fire* and *Disking* are recommended to maintain herbaceous cover and enhance food plants; *Prescribed Fire*, *Chaining*, *Drum-chopping*, and *Herbicide Applications* can maintain and rejuvenate shrubby areas
Tillage Management: delayed tillage of cropland in spring may allow nesting if residual standing cover is available
Water Developments for Wildlife: guzzlers, catchment ponds, windmills, and spring developments can be beneficial to California quail where water may be limiting
Decrease Harvest: may be necessary when surveys show a decline in the local population and hunting pressure has been substantial
Wildlife or Fish Survey: call counts and flush counts may be used to estimate population density

California thrasher

General information

Glen Tepke

California thrashers are found in shrubby chaparral cover in the Mediterranean ecoregion. The shrub cover they use requires fire for maintenance, but thrashers are not typically found in recently burned areas until desirable shrub structure develops following fire.

Habitat requirements

Diet: spiders, beetles, Jerusalem crickets, and other insects may constitute more than 90 percent of diet during breeding season; during the rest of the year, a variety of seeds and hard and soft mast from shrubs are eaten

Water: exact water requirements are unknown, but because California thrashers occur throughout arid ecoregions, it is unlikely they require free-standing water; they will, however, drink freestanding water when available

Cover: dense shrubby cover is required for nesting

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and habitat quality begins to decline

Forest Management: forest regeneration, particularly *Clearcut*, *Shelterwood*, and *Seed-Tree*, provides dense shrub cover for nesting and foraging

Livestock Management: should prevent livestock from damaging or limiting shrub cover

Plant Shrubs: in relatively large open areas where shrub cover is lacking

Set-back Succession: *Prescribed Fire*, *Drum-chopping*, and *Chaining* can maintain and rejuvenate shrub cover

Wildlife or Fish Survey: point counts may be used to estimate population trends

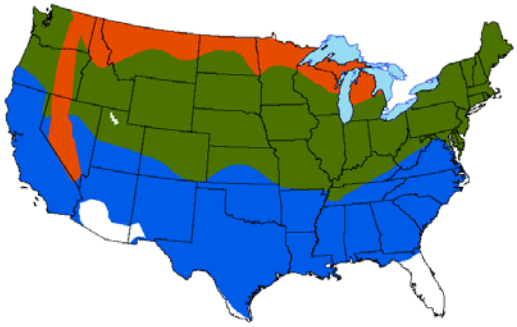
Canada goose

General information

Ryan Hagerty

The breeding range of the Canada goose extends across the northern half of the U.S. across Canada and Alaska. Although an increasing number of Canada geese choose to winter in Canada, the majority fly south to southern areas of the U.S. and Mexico. Many southern areas of the U.S. have year-round resident populations of Canada geese. Canada geese nest and rear young in or near Stage 2 wetlands interspersed with some Stage 3 wetlands. Riparian areas and wetlands containing 20 percent tall emergent aquatic vegetation and 80 percent open water are usually preferred areas for Canada geese.

Habitat requirements



Diet: variety of forbs and grasses, grains, and some aquatic insects
Water: relatively open water wetlands, ponds, and lakes are used for brood-rearing, feeding and loafing
Cover: nest in a variety of places, such as mats of bulrushes, tops of muskrat houses, and most of all, in relatively thick cover on islands, usually within 200 feet of the water's edge

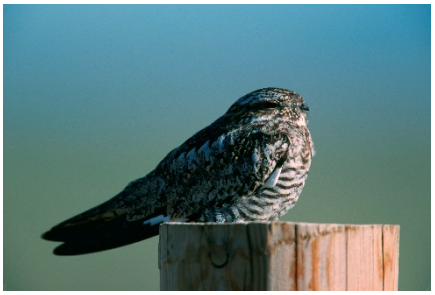
Wildlife management practices

Control Nonnative Invasive Vegetation: applies to both uplands and wetlands; nonnative invasive vegetation can degrade nesting cover in uplands and make wetlands unattractive to Canada geese
Leave Crop Unharvested: to provide additional food during winter
Livestock Management: proper grazing can maintain lush vegetation for foraging Canada geese; restricting livestock grazing from areas where geese may nest can increase nesting success
Plant Food Plots: both forage (green growing wheat) and grain (corn) food plots can provide additional food where food is limited
Plant Native Grasses and Forbs: where forage for geese is lacking and to provide nesting cover where limiting
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* sets back succession in cattail-choked wetlands and stimulates lush vegetation in uplands where geese may feed
Tillage Management: fall tillage in grain crops can be delayed until spring to provide supplemental food source
Water Control Structure: allows water level manipulation to maintain 80 percent open water and 20 percent emergent vegetation
Water Developments for Wildlife: can be used to temporarily flood fields for feeding and raising broods
Wildlife Damage Management: may be needed where Canada geese damage lawns, golf courses, and crop fields, and other areas in cities and suburban areas
Wildlife or Fish Survey: broods counts and visual surveys can provide estimates of goose abundance

Common nighthawk

General information

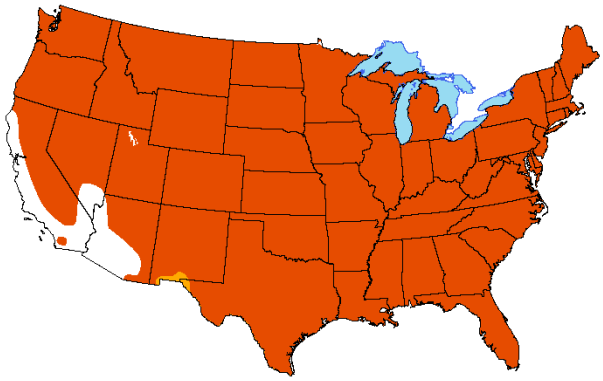
Common nighthawks are found throughout the U.S. during summer, but migrate to South America during winter. Common nighthawks are found in grasslands, open woodlands, cities, and towns. In cities and towns, they are often seen flying over city parks and other open areas in late evening and early morning. Common nighthawks nest on bare soil or gravel areas common in fields or on rooftops. They use open fields for foraging. They are nocturnal and feed "on-the-wing" on flying insects.



Gary Kramer

Habitat requirements

Diet: flying insects, including flying ants, mosquitoes, moths, and June bugs
Water: obtain ample water from diet, but water sources attract insects, which provide food for nighthawks
Cover: riparian areas, ridge tops, flat rooftops, and other places with numerous sand and gravel areas are favorite nesting locations



Wildlife management practices

Livestock Management: grazing regimes that maintain open herbaceous areas provide foraging sites for common nighthawks
Set-back Succession: *Prescribed Fire*, *Disking*, and *Mowing* can maintain early successional areas for foraging; *Disking* and *Herbicide Applications* can promote bare ground for nesting; *Chainsawing* can convert wooded areas to open, early successional areas
Wildlife or Fish Survey: observation counts can be used to estimate trends in populations
Mowing: can be used to maintain open areas in Urban environments

Crested caracara

General information

Robert Burton

The crested caracara is a falcon sometimes referred to as the "Mexican eagle," as it is Mexico's national bird. They are often seen with vultures, eating carrion in open country, such as grasslands, pastures, croplands, and semi-deserts. Crested caracaras may prefer open areas, but are often adjacent to shrublands or areas with trees. Caracaras have long, featherless, and yellow legs. The body is mostly black, a black cap on its head with a small crest, red skin on the face, and a white and black tail. Their wide wingspan is used for soaring and for flying low while hunting for prey or carrion. They nest in trees and have clutch sizes of 1 to 4 eggs. They breed from January to September and fledge from mid-March to early May. They nest in trees or shrubs with average heights around 19 feet. Breeding pairs will defend their territory year-round and may even re-use or re-build a nest from the previous year. Both sexes contribute to building the nest out of sticks and finer vegetation. The female typically lays 2 eggs and the fledglings are cared for by both parents. At one time, crested caracaras were declining, but currently the population is stable or slightly increasing. Florida is the only state that currently has the crested caracara listed as threatened and Texas has the largest breeding population. There is future concern for the species as more and more of its natural grasslands are being developed for human or agricultural use.

Habitat requirements

Diet: mostly carrion, but also insects, small vertebrates (fish, reptiles, amphibians, birds, and mammals), and eggs
Water: free-standing water is used, but watering sites are not typically limiting because of the crested caracara's ability to fly long distances and some water needs may be met through the diet
Cover: open grasslands for hunting/scavenging; nests in trees or shrubs, often in the top of cabbage palms

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and degrade habitat
Livestock Management: grazing pressure should be reduced when overgrazing begins to degrade habitat for prey
Plant Shrubs: where trees and shrubs are lacking to provide nesting cover
Plant Trees: where trees are lacking to provide nesting cover
Set-back Succession: *Disking*, *Prescribed Fire*, *Herbicide Applications*, and *Mowing* are options for maintaining grasslands and early successional areas; *Prescribed Fire*, *Herbicide Applications*, *Chaining* and *Root Plowing* are used to reduce shrub cover and stimulate more herbaceous groundcover
Wildlife or Fish Survey: observation counts are commonly used to estimate trends in populations

Crissal thrasher

General information

Crissal thrashers are found in the southwestern ecoregion of the U.S. south to Mexico. They prefer dense, low shrub cover in desert, foothill, and riparian areas. Crissal thrashers nest in shrubs 2 to 8 feet above ground. Nest is constructed of twigs.

Greg Lavaty

Habitat requirements

Diet: forage on the ground and eat a variety of insects, spiders, seeds, and soft mast
Water: free-standing water is essential and needed daily
Cover: thick shrub cover for nesting and loafing

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to reduce habitat quality for crissal thrasher
Livestock Management: should restrict overgrazing and ensure shrub cover is present to provide food and cover; this is particularly important in riparian areas where thick shrub cover is found adjacent to drainage ways (arroyos); usually, dormant-season grazing can result in more use of woody vegetation; livestock water facilities should be placed in upland areas to discourage congregation of livestock and over-use in riparian areas

Plant Shrubs: especially around agricultural and riparian areas where needed
Set-back Succession: *Chaining* and *Drum-chopping* can rejuvenate shrub cover where is has grown too tall
Water Developments for Wildlife: catchment ponds, windmills, spring developments, and guzzlers can benefit crissal thrashers
Wildlife or Fish Survey: point counts are used to estimate population trends

Dickcissel

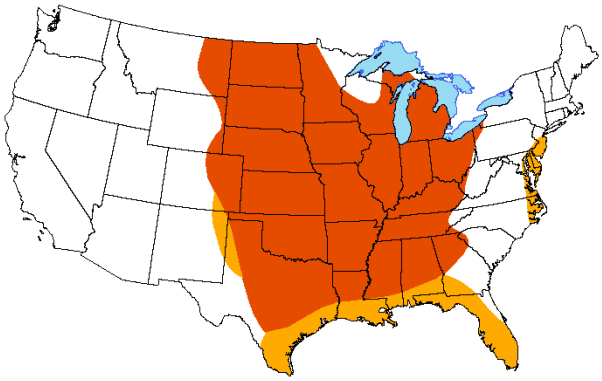
General information

James W. Arterburn

Dickcissels are songbirds that occur primarily in native grasslands and savanna in the central one-third of the U.S. Relatively large open areas of grasses, forbs, and scattered shrubs are favored. Dickcissels use agricultural areas heavily during winter in Central America.

Habitat requirements

Diet: insects and grass seeds are eaten year-round; agricultural crops are eaten more during migration and on wintering grounds
Water: water obtained from food
Cover: early successional areas with a mixture of grasses and forbs and scattered shrubs; grain fields frequented during winter



Wildlife management practices:

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to compete with native vegetation and reduce habitat quality for dickcissel
Delay Crop Harvest: delayed hay harvest in areas with insufficient native grassland will allow nests to hatch and hatchlings to leave nests prior to harvest
Field Borders: to increase usable space around crop fields
Leave Crop Unharvested: will provide additional food during migration
Livestock Management: should prevent overgrazing to maintain a minimum grass/forb height of 12 – 18 inches
Plant Native Grasses and Forbs: in relatively large open areas where there is insufficient groundcover; forb component is important
Set-back Succession: *Prescribed Fire* is recommended to maintain grasslands and other early successional areas; *Herbicide Applications* may be used to kill undesirable plants and adjust species composition in early successional areas; *Chainsawing* may be used to reduce forested cover and increase early successional cover
Tillage Management: may provide additional food during migration
Wildlife or Fish Survey: point-count surveys can be used to monitor dickcissel abundance

Dusky grouse

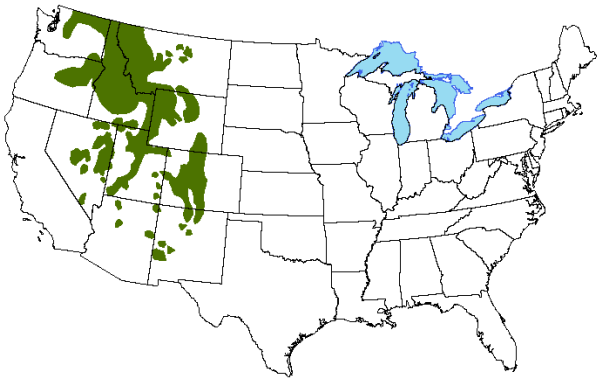
General information

Dusky grouse occur predominantly in mountainous areas in the western U.S. and Canada. They require forested cover, interspersed with herbaceous openings and shrub cover. Their nests are usually on the ground, often under shrubs or near fallen logs. Dusky grouse roost in forest edges near shrub vegetation where they forage.

Todd Black

Habitat requirements

Diet: soft mast, seeds, buds, forbs, and insects from spring to fall; needles of coniferous trees may be eaten in winter
Water: obtain necessary water from dew and diet
Cover: nest on the ground near forest edges, often under shrubs or next to fallen logs; roost and loaf in trees



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for dusky grouse
Edge Feathering: will increase nesting and foraging cover where woods are adjacent to openings
Field Borders: may increase nesting and foraging cover if shrub cover is allowed to develop
Forest Management: forest regeneration, particularly *Group Selection* and *Single-Tree Selection*, will increase herbaceous and shrubby cover for foraging near nesting and roosting areas; *Timber Stand Improvement* can be used in stands not ready for regeneration to increase herbaceous groundcover and shrubby structure
Livestock Management: should prevent areas from being grazed where dusky grouse nest
Plant Native Grasses and Forbs: particularly in agricultural fields going out of production
Plant Shrubs: to provide soft mast, buds, and nesting cover, especially near forest edges where lacking
Plant Trees: in relatively large open areas, coniferous trees may be planted to provide cover and a winter food source where needed
Set-back Succession: *Prescribed Fire* and *Herbicide Applications* can maintain herbaceous openings and shrub cover
Decrease Harvest: may be necessary when surveys show a decline in the local population
Wildlife or Fish Survey: call counts can be used to monitor dusky grouse populations

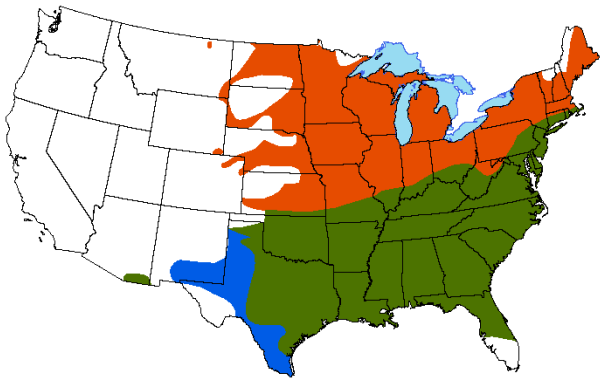
Eastern bluebird

General information

Dave Menke

Eastern bluebirds are found across the eastern U.S. They use herbaceous openings, savannas, pastures, parks, backyards, edges of hayfields and cropfields, and other early successional communities well-interspersed with trees and shrubs, for perching, foraging and nesting (where cavities are available). Large open areas without interspersion of hedgerows, fencerows, and scattered trees may not receive as much use by bluebirds as those areas with more structural diversity. Bluebirds forage in open areas, but typically near trees, shrubs, or a fence that provide perches. Insects dominate the diet during spring and summer, whereas various fruits are most prevalent during fall and winter. Eastern bluebirds nest in cavities, especially old woodpecker cavities, as well as nest boxes. Clutches are normally 3-6 eggs. Eastern bluebirds may have 1-3 broods per year. Nest box programs have had a major impact in restoring eastern bluebird populations.

Habitat requirements



Diet: insects, especially grasshoppers, crickets, adult beetles and larvae, as well as other invertebrates, such as spiders; various fruits, such as black cherry, sumac, blueberry, blackberry, blackgum, hollies, dogwoods, pokeweed, and hackberry
Water: necessary water obtained from diet, but may use free-standing water when available
Cover: nest in cavities of trees and fence posts

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduces habitat quality for eastern bluebirds
Create Snags: where cavities are limited to provide potential nest sites and perching sites in open areas (not in woods because eastern bluebirds do not use woods)
Edge Feathering: to increase foraging opportunities, perching sites, and potential cavity trees (if trees are killed and left standing) around fields
Field Borders: to increase foraging opportunities around crop fields
Livestock Management: livestock must be excluded from recently planted trees and shrubs
Nesting Structures: should be erected where a scarcity of natural cavities may be limiting the population; nest boxes should be approximately 5 feet high with an entrance hole 1½ inches in diameter; nest boxes should be placed no closer than 80 yards apart to limit territorial fighting among males
Plant Native Grasses and Forbs: to aid in establishing herbaceous groundcover where planting is necessary; forb component is important to attract insects

Plant Shrubs: in relatively large open areas where perching sites or winter foods may be limiting
Plant Trees: in relatively large open areas where perching sites are limiting; may provide potential nest sites in distant future
Set-back Succession: *Prescribed Fire*, *Disking*, *Herbicide Applications*, *Mowing*, *Chaining*, and *Drum-chopping* can be used to maintain and rejuvenate early successional areas and prevent them from becoming dominated by young trees and shrubs; *Chainsawing* and *Root Plowing* can be used to convert forested areas to savannas and early successional communities
Wildlife or Fish Survey: point counts can be used to monitor bluebird populations; nest boxes should be checked to monitor use and nest success
Mowing: can be used to maintain open areas in Urban environments

Eastern meadowlark

General information

James W. Arterburn

Eastern meadowlarks are medium-sized songbirds that live in grasslands throughout the eastern U.S. They have a bright yellow breast with a black chevron marking on the chest. They are often seen singing from fencepost, power lines, or hay bale perches during spring. Eastern meadowlarks are grassland obligates; that is, they require and are only found in grasslands. Males require grassy fields of at least 6 acres to establish territories and, even then, they may not be present if the surrounding landscape is forested. They prefer native grasslands, but will use pastures and hayfields of nonnative grasses. Eastern meadowlarks nest on the ground and the female builds the nest of dead grass leaves. Nests contain 2-7 eggs and eastern meadowlarks may have 2 broods per year. Females will usually abandon their nests if they are disturbed off the nest while they are incubating. Although males boldly sing in the spring, eastern meadowlarks are relatively shy, slinking away from intruders within the grass cover. Eastern meadowlarks primarily eat insects, but also consume various seed during winter. They forage while walking on the ground. Haying, overgrazing, and conversion of grasslands to row-crop agriculture or human development are major problems for reproductive success and population maintenance. Eastern meadowlark populations have declined 70 percent since 1970.

Habitat requirements

Diet: insects, especially grasshoppers, crickets, and caterpillars (moth larvae) and grubs (beetle larvae); various seed and grain in winter
Water: obtained in diet
Cover: grasslands at least 6 acres in size

Wildlife management practices

Conservation Easement: may protect relatively large tracts of native grasslands in the eastern U.S. where habitat for eastern meadowlark is declining
Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to degrade habitat for eastern meadowlark
Livestock Management: grazing pressure should be managed to maintain an average grass height of at least 18 inches
Plant Native Grasses and Forbs: when grassland cover is limiting; little bluestem, broomsedge bluestem, and sideoats grama provide excellent nesting structure; native grasses and forbs should be planted when converting agricultural fields or forested areas to eastern meadowlark habitat to ensure optimum grass coverage and structure
Set-back Succession: *Prescribed Fire* is strongly recommended to maintain and rejuvenate grasslands; *Prescribed Fire* and *Herbicide Applications* can be used to reduce unwanted encroachment of woody species; *Chaining* can be used to reduce shrub cover; *Chainsawing* and *Root Plowing* can be used to convert forests to grasslands
Wildlife or Fish Surveys: point counts are used to estimate trends in populations

European starling

General information

Thomas G. Barnes

European starlings are found throughout North America. They were introduced to the U.S. from Europe and are considered pests. They commonly cause damage to crops and in urban areas. They exclude native species from cavities and deplete food resources for native wildlife. As a consequence, wildlife damage management is necessary to reduce starling populations and exclude them from areas where they are causing damage. Starlings prefer older suburban and urban residential areas with large trees and shrubs interspersed with open areas but are also abundant in agricultural areas. Starlings are cavity nesters and nest in large trees or old buildings. Starlings feed on the ground and eat a variety of insects, seeds, grain, and soft mast. Practices to attract or benefit starlings should not occur in any situation.

Habitat requirements

Diet: insects, soft mast, seeds, earthworms, grain, human garbage, and even dog and cat food
Water: require free-standing water during warm seasons
Cover: nest in tree cavities, old buildings

Wildlife management practices

Wildlife Damage Management: exclusion practices to prevent access to buildings and other areas where they are not wanted; food, water, and cover available to starlings around buildings should be removed; various harassment practices may be effective; trap and euthanasia are appropriate to reduce starling populations
Wildlife or Fish Survey: observation counts, point counts, and wildlife damage management questionnaires are used to monitor starling populations

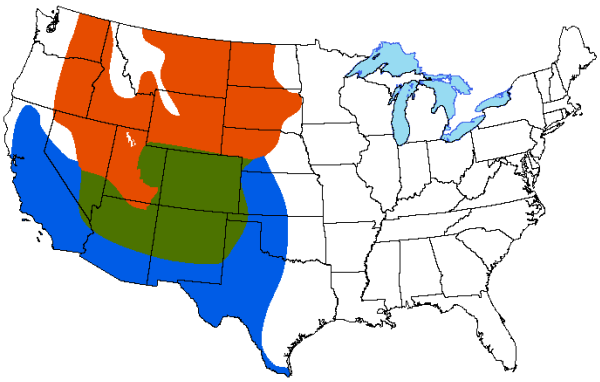
Ferruginous hawk

General information

John Cholod

The ferruginous hawk is the largest hawk in North America. There are 2 common color phases of ferruginous hawks. Some display a light phase with mostly white heads, rufous shoulders, backs, and legs, and pale underparts. Dark-phased individuals are dark brown with a whitish tail and wing tips. Ferruginous hawks' legs are feathered to the toes. Ferruginous hawks are found in open country. They nest in trees, usually along riparian areas or on steep slopes. They primarily prey upon small mammals.

Habitat requirements



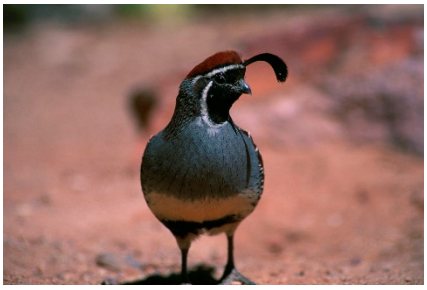
Diet: rabbits, ground squirrels, prairie dogs
Water: necessary water obtained from diet
Cover: open plains and shrublands; nest in trees

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for ferruginous hawks
Livestock Management: when overgrazing begins to degrade habitat for prey
Plant Native Grasses and Forbs: where groundcover is limited and planting is necessary
Plant Trees: along riparian areas where trees are not present to create nest sites
Set-back Succession: *Prescribed Fire* and *Herbicide Applications* can be used to maintain early successional communities that support prey; *Chaining*, *Root Raking*, and *Drum-chopping* may be used to set-back succession in areas dominated by shrubs where more open space is needed
Tillage Management: to facilitate hunting prey when waste grain is available
Wildlife or Fish Survey: observation counts are used to estimate trends in populations

Gambel's quail

General information



Gary Kramer

Gambel's quail are upland game birds found in arid regions of Arizona, New Mexico, southern Colorado, Utah, southern Nevada and California. Gambel's quail are usually found in brushy and thorny vegetation with scattered grasses and forbs, typical of southwestern deserts. Gambel's quail are also found along the edge of agricultural fields, especially those adjacent to arroyos and irrigation ditches. Dense shrubs and cacti intermingled with small open areas are also used. The amount of late winter and early spring precipitation largely determines the quality and quantity of spring foods. In essence, more rain equals more quail.

Habitat requirements

Diet: succulent green plants; seeds of forbs (especially legumes), grasses, shrubs and trees; saguaro, cholla and prickly pear cacti fruits; a variety of soft mast and insects
Water: require free-standing water during warm seasons if succulent green plants are not available for food; will usually not travel more than one-third mile for water
Cover: nest in the thickest shrub and/or herbaceous vegetation available; roost in tall shrubs and trees such as mesquite, scruboak, desert hackberry, cholla, one-seed juniper, littleleaf sumac, catclaw acacia, and various yuccas; shrubs provide important cover for loafing during the day

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for Gambel's quail
Leave Crop Unharvested: to provide additional food resource in fall/winter
Livestock Management: over much of the ecoregion where Gambel's quail are found, there are few wildlife management practices considered practical for improving food other than proper livestock grazing management; grazing management is important to ensure enough residual herbaceous vegetation is available for nesting cover
Plant Food Plots: grain plots can provide additional food and cover; best when located next to high-quality cover
Plant Shrubs: where shrubby cover is lacking
Water Developments for Wildlife: guzzlers, catchment ponds, windmills, and spring developments can be beneficial where water is limiting
Decrease Harvest: may be necessary when surveys show a decline in the local population where hunting is conducted
Wildlife or Fish Survey: call counts and flush counts are used to estimate trends in Gambel's quail populations

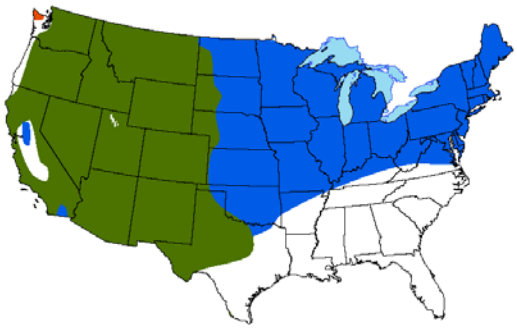
Golden eagle

General information

Dave Menke

The golden eagle is one of the largest birds of prey in North America. Its agility and speed coupled with a strong beak and talons allow it to capture a variety of prey items and fiercely protect its kills from other, often larger predators. The golden eagle occurs almost exclusively in the western half of the United States, primarily in the mountain and inter-mountain regions from Canada southward into Mexico. They occupy tundra, shrublands, grasslands, coniferous forests, farmlands, and riparian areas along rivers and streams. Adults are dark brown with gold feathers on the back of their head and neck. Adults weigh 7 to 13 pounds with a wingspan of 6 ½ to 7 feet. Females are about one-third larger than males. They prefer partially open country, especially open lands adjacent to rough terrain, such as hills, mountains, and cliffs. A pair of adult golden eagles can be monogamous (stay together as a pair) for several years and in some cases remain together for life. Golden eagles are protected by federal legislation. It is against the law to harass, harm, pursue, trap, or capture them. Only the United States Department of Interior can grant exceptions for killing golden eagles (for specific purposes, such as scientific studies, Native American religious ceremonies, and livestock depredation).

Habitat requirements



Diet: birds and small mammals, including jackrabbits, cottontails, prairie dogs, and ground squirrels. Sometimes larger animals, such as deer and pronghorns and occasionally livestock (especially lambs, kid goats, and calves), are attacked and consumed.
Water: water requirements are met through consumption of prey.
Cover: golden eagles roost and nest in large, tall trees, rock formations in mountainous regions and on tall cliffs. They may use the same nest for several years, adding additional structure (such as sticks, limbs) every year.

Wildlife Management Practices

Conservation Easement: may protect habitat for golden eagle and prey, especially where urban development is encroaching
Control Nonnative Invasive Vegetation: when nonnative invasive species begin to degrade habitat for prey
Livestock Management: when overgrazing begins to degrade habitat for prey
Set-back Succession: *Prescribed Fire* and *Herbicide Applications* can be used to maintain early successional communities that support prey
Wildlife Damage Management: livestock depredation permits may be issued in severe cases with control activities carried out by federal agency personnel
Wildlife or Fish Survey: observation counts are used to estimate trends in populations

Golden-cheeked warbler

General information

Steve Maslowski

The golden-cheeked warbler has been listed as a federally endangered species since May 1990. This songbird is about 5 inches long and is mainly black with a bright yellow face divided by a black eye stripe. Golden-cheeked warblers are found exclusively in central Texas during the breeding season. They nest in mature Ashe juniper (commonly referred to as "cedar") and oak woodlands. Nests contain 3 to 4 eggs and are made of shredded Ashe juniper bark (usually from mature trees that are 20+ years old) and spider webs. Nesting is more successful within mature forest stands of 250 acres or more. Mating pairs are monogamous and a male will typically defend a territory of about 10 acres. By July, these birds migrate south to southern Mexico, Honduras, Nicaragua, and Guatemala to spend the winter. Urbanization and agricultural practices have reduced the amount of tall juniper and oak woodlands golden-cheeked warblers rely on for nesting cover. In addition, the development of large man-made lakes has caused flooding in areas traditionally used by these warblers. Nest parasitism by brown-headed cowbirds also contributes to a decrease in reproductive success, but the extent is unknown. Within Texas, the golden-cheeked warbler traditionally inhabited more than 40 counties, but this area has shrunk to 25 counties or fewer. The largest contiguous habitat is maintained on Fort Hood by the U.S. Army.

Habitat requirements

Diet: primarily feed upon insects and spiders on trees; caterpillars (moth larvae) are an important food source for young warblers
Water: although this warbler is usually found near creeks or intermittent streams, water requirements are met through the diet
Cover: mature (17-20 feet) Ashe juniper for nesting and oak woodlands for foraging insect larvae in the canopy; mixed deciduous and evergreen forest, often dominated by pines during winter

Wildlife management practices

Conservation Easement: can protect critical habitat from development
Control Nonnative Invasive Vegetation: when nonnative invasive species begin to compete with native vegetation and degrade habitat
Forest Management: in pure stands of juniper, selective thinning is a *Timber Stand Improvement* practice that can be useful for encourage oak regeneration
Plant Trees: Ashe juniper and oak may be planted in suitable areas where trees are lacking
Set-back Succession: *Herbicide Applications* may be used to prevent encroachment of undesirable woody species or to remove some trees in solid juniper stands; *Chainsawing* may be used when converting areas to Ashe juniper and oak woodlands
Wildlife or Fish Survey: point counts are used to estimate populations

Golden-fronted woodpecker

General information

Thomas G. Barnes

Golden-fronted woodpeckers occur in central Texas, into southwest Oklahoma, and the Texas panhandle. They are most commonly found in mesquite woodlands, but also occur in cottonwood, willow and cypress riparian areas, as well as mixed oak-juniper-mesquite woodlands. Golden-fronted woodpeckers also take advantage of urban sprawl, using fence posts, utility poles, and various ornamental tree species.

Habitat requirements

Diet: an omnivore that eats large numbers of grasshoppers, as well as corn, acorns, wild fruits, and berries
Water: obtains water from food
Cover: nests in mesquite woodlands as well as utility poles, fence posts, and ornamental tree species.
Nests are generally constructed near the ground up to about 30 feet. Golden-fronted woodpeckers build cavities and will use existing cavities.

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation is competing with native vegetation and reducing habitat quality
Create Snags: in areas lacking sufficient snags, for both foraging and nesting
Plant Trees: in large open areas lacking sufficient woody cover to create future habitat
Set-back Succession: *Prescribed Fire* and *Herbicide Applications* can be used to create scattered snags for foraging and nesting
Wildlife Damage Management: woodpeckers occasionally damage wooden homes, fences, and other structures. Harassment techniques may be used to limit damage.
Wildlife or Fish Survey: point counts can be conducted to listen for the distinctive drumming or for vocalizations during the mating season

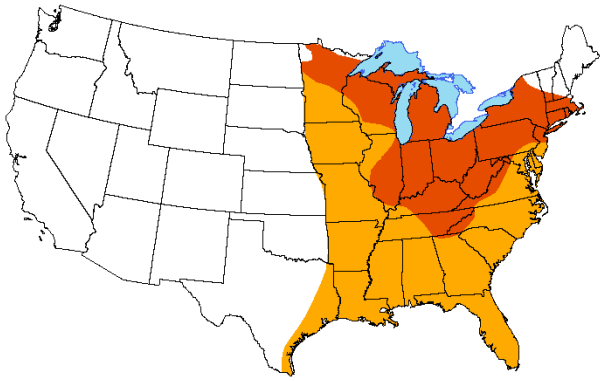
Golden-winged warbler

General information

Laurie Smaglick Johnson

The golden-winged warbler is a ground-nesting songbird that requires herbaceous groundcover with scattered shrubs and young trees. They breed during summer in the Appalachian Mountains from north Georgia to southern New York and their winter range is in Central America and northern South America. Golden-winged warbler populations have been declining 2.3 percent per year since the 1960s, which can be attributed to loss of habitat through forest maturation and competition and hybridization with the blue-winged warbler. The USDA-NRCS included golden-winged warblers in its *Working Lands For Wildlife* initiative in 2012. Successful recruitment is dependent on habitat above 900+ feet elevation to avoid areas where blue-winged warblers occur. During the breeding season, golden-winged warblers are found in relatively small areas (1-12 acres) of young regenerating forest, reclaimed mine land, emergent wetlands, and old-fields within a landscape of contiguous forest (>70 percent of the landscape).

Habitat requirements



Diet: insects
Water: necessary water obtained from diet
Cover: requires herbaceous groundcover (10-25 percent) for nesting, with an interspersed patchwork of bare ground (up to 30 percent), shrub cover (30-50 percent), and young trees (10-20 percent) for foraging sites and song perches. Nests are usually located at the base of forbs and brambles (such as goldenrod and blackberry) near thickets of shrubs and young trees. Leaves and vine or shrub bark are important for nest-building material. Perches are important for males to establish territories through song displays.

Wildlife management practices

Conservation Easement: can protect critical habitat from development
Control Nonnative Invasive Vegetation: sod-forming grasses, such as tall fescue, and other invasive species may limit coverage of more desirable forbs
Create Snags: creating snags around an opening may be desirable for temporary song perches, especially if perches are not present in the opening
Edge Feathering: will create a soft edge of forbs, brambles, shrubs, and young trees between openings or agricultural fields and the forest
Forest Management: *Forest Regeneration*, especially *Clearcut*, provides young forest (approximately 3-10 years old) structure desired by golden-winged warblers. Retaining single trees or groups of trees (10-15 trees per acre) for song perches is desirable. The more interspersed the retained trees are, the more breeding territories can be established in the recently harvested stand.

Livestock Management: may be necessary where livestock are present to prevent grazing nesting and shrub cover
Plant Shrubs: may be needed where there is a lack of interspersed shrub cover (or developing shrub cover) in an opening
Plant Trees: may be needed where there is a lack of interspersed trees (or young trees developing naturally) in an opening for song perches, or in large open areas where trees are lacking
Set-back Succession: necessary to maintain herbaceous groundcover and scattered shrubs and young trees in openings. *Prescribed Fire*, *Herbicide Applications*, and *Chainsawing* are commonly used
Wildlife or Fish Survey: point-count surveys can be used to monitor populations

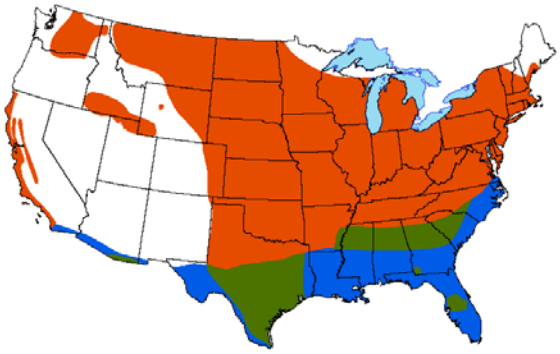
Grasshopper sparrow

General information

James W. Arterburn

Grasshopper sparrows are migratory songbirds that prefer open grasslands with scattered shrubs and bare ground interspersed throughout the area. Areas with more than 35 percent shrubby cover constitute poor habitat for grasshopper sparrows. Nests are well concealed on the ground with overhanging grasses and a side entrance. Nests are constructed of dead grass leaves in the shape of a cup and contain 3-6 eggs. Grasshopper sparrows forage on the ground, making bare ground within native grass cover important for mobility and searching for prey (grasshoppers). Grasshopper sparrows are found throughout the Great Plains, Midwest, and Mid-South during the breeding season. They winter in the Deep South, Mexico, and Caribbean. Grasshopper sparrows are declining throughout their range because of habitat loss and fragmentation of once contiguous grasslands. Grasshopper sparrows are aptly named with their insect-like song and a diet dominated by grasshoppers.

Habitat requirements



Diet: diet shifts dramatically through the year; in spring and summer (breeding season), grasshopper sparrows rely heavily on insects, comprising 60 percent of the diet; not surprisingly, given the bird's name, grasshoppers can account for 30 to 40 percent of the diet during this time; during fall and winter, diet shifts to 70 percent seeds
Water: water requirements are unknown but probably obtained through diet
Cover: Perennial grasses and forbs are used for escape and nesting cover; nest on the ground, usually in overhanging native warm-season grasses

Wildlife management practices

Conservation Easement: can protect critical habitat from development
Control Nonnative Invasive Vegetation: although grasshopper sparrows may successfully nest in a variety of grassland types, sod grasses, such as tall fescue, may limit mobility and bare ground. Nonnative invasive vegetation should be controlled when it begins to compete with native vegetation and degrade habitat.
Delay Crop Harvest: delay mowing/harvesting hay in spring to help ensure successful nesting
Livestock Management: is crucial to prevent overgrazing; overall average grass height should be grazed below 18 inches
Plant Native Grasses and Forbs: where necessary to provide nesting cover
Set-back Succession: *Prescribed Fire* can enhance habitat by rejuvenating grasslands, controlling woody cover, and creating patches of bare ground; *Herbicide Applications* may be used to control unwanted encroachment of woody species
Wildlife or Fish Survey: point counts are used to estimate trends in populations

Great horned owl

General information


Dave Menke

The great horned owl is a large, thick-bodied grey-brown bird with a white patch on the throat and characteristic ear-like tufts on its head. It is found throughout North America in a wide variety of environments, including forests, woodlands, farm woodlots, orchards, deserts, rocky canyons, grasslands, wetlands, and city parks. The great horned owl is mostly nocturnal, evident by its large eyes, and roosts during the day in trees or on sheltered rocky ledges. As a large raptor, it has large talons used to capture prey during a dive. The great horned owl's call is a familiar, deep, 4 to 5 hoots. These owls nest in larger trees where they find cavities or previously used nests, laying 1 to 4 eggs. They are monogamous breeders and usually establish a territory near a nest site before laying eggs. The great horned owl remains abundant and widespread, most likely because of its ability to live in a wide range of environments.

Habitat requirements

Diet: extremely varied, but commonly includes small- to medium-sized mammals including rabbits, skunks, squirrels and others, as well as reptiles, amphibians, large insects, and fish
Water: water obtained from diet
Cover: nest in abandoned nests of hawks, crows, or herons, and in large tree cavities, stumps, caves, and ledges

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to compete with native species and degrade habitat for prey
Create Snags: where large snags (>12 inches diameter) are limiting to provide possible nesting and roosting sites
Edge Feathering: to increase usable space for prey around fields
Field Borders: to increase usable space for prey around fields
Forest Management: *Forest Regeneration* in large areas of mature forest may provide additional cover for a variety of prey species; *Timber Stand Improvement* will encourage understory development and enhance habitat for a variety of prey species
Livestock Management: where overgrazing may be limiting cover for prey
Plant Native Grasses and Forbs: where necessary to provide cover for prey
Plant Shrubs: where shrub cover is lacking and needed to enhance habitat for prey, especially cottontails
Plant Trees: where perching sites are limited and where nesting cover does not exist
Set-back Succession: *Prescribed Fire*, *Disking*, *Herbicide Applications*, *Chaining*, *Root Plowing*, *Drum-chopping*, and *Mowing* may be used to maintain early successional communities that provide habitat for a variety of prey species; *Chainsawing* can be used to create small forest openings and enhance habitat for several prey species
Tillage Management: will facilitate hunting prey when waste grain is available
Wildlife Damage Management: may be necessary where an owl is killing poultry
Wildlife or Fish Survey: call counts are most often used to estimate trends in populations

Greater prairie-chicken

General information

Dave Menke

Greater prairie-chickens require very large tracts of native rangeland containing diverse grass and forb communities that is free of tall vertical structures (including trees). They prefer flat to gently rolling terrain with some cropland, which can provide seasonal foods. Less than 25 percent of the landscape should be composed of crops. Low areas with dense vegetation of grasses, forbs, and low-growing shrubs are used for roosting year-round. Prairie-chickens require sites with short vegetation that offer good visibility for breeding displays. They gather on these sites in the spring, and males display in front of females to win a mate. These areas are called "booming grounds."

Habitat requirements

Diet: seeds, grains, insects and herbaceous greens; during the first few weeks after hatching, the young eat insects
Water: water is obtained from diet
Cover: thick, tall grass cover is used for nesting and winter cover; if not periodically disturbed, grasses often become too thick and are less valuable for nesting cover

Wildlife management practices

Conservation Easement: can protect critical habitat from development
Control Nonnative Invasive Vegetation: sod grasses and other nonnative invasive vegetation should be controlled when habitat quality begins to decline
Delay Crop Harvest: time crop harvest so nests will not be disturbed
Field Borders: to increase usable space around row crop fields
Leave Crop Unharvested: unharvested grain can provide a supplemental food source for prairie-chickens
Livestock Management: should ensure the entire prairie or grassland is not uniform in structure or plant composition; areas of dense nesting cover adjacent to forb and insect-rich areas are ideal; some areas should be left ungrazed during the nesting season (May through June)
Plant Food Plots: grain food plots can provide a supplemental food source for prairie-chickens, especially when native foods may be lacking
Plant Native Grasses and Forbs: needed where large expanses of high-quality grassland are not available
Set-back Succession: fire is an essential aspect of prairie ecology and must be applied to the landscape for long-term stability of prairie-chickens; *Prescribed Fire* every 3 to 5 years improves plant vigor and reduces excessive buildup of old vegetation in areas not grazed; *Chaining*, *Prescribed Fire*, and *Herbicide Applications* can revert shrubland to grassland; *Chainsawing* can be used to remove trees
Tillage Management: to leave grain stubble in fall where croplands are adjacent to grasslands
Decrease Harvest: may be necessary if hunting pressure has been excessive and populations are declining
Wildlife or Fish Survey: observation counts on booming grounds are commonly used to estimate trends in prairie-chicken populations

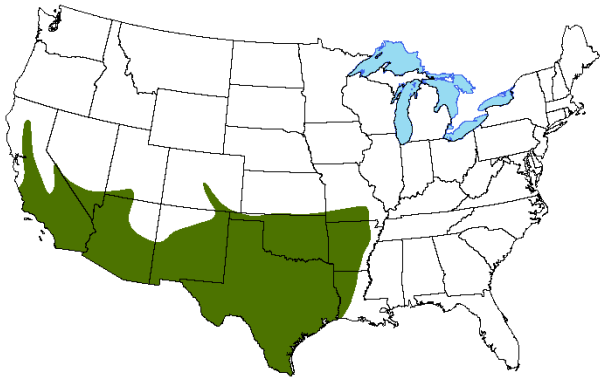
Greater roadrunner

General information

Robert Burton

The greater roadrunner is a long legged bird, 20 to 24 inches in length, with a wingspan of 17 to 24 inches. Adults have a bushy crest on their heads and a long, thick, dark bill. They are called roadrunners because of their habit of running down the road and darting to safety into underbrush and trees adjacent to the road. They can run up to 20 mph to chase down prey. They will beat larger captured prey items against the ground or a rock to kill them. Although they are capable of flying, roadrunners spend most of their time on the ground. Threats to roadrunners include predation by feral cats, urbanization, and habitat loss.

Habitat requirements



Diet: omnivorous; principal food items include insects, fruits, and seeds, but small reptiles, mammals and birds, bird eggs, and carrion is also eaten; some quail hunters believe roadrunners kill and eat recently hatched quail chicks, but that has never been documented
Water: water is largely obtained from diet, but roadrunners will drink free-standing water if available
Cover: arid deserts to semi-arid shrubby areas; open or disturbed areas adjacent to shrubland; in the eastern portion of their range, roadrunners inhabit dry sandy upland sites with patches of bare ground interspersed with low-growing brush, shrubs, and trees.

Wildlife management practices

Control Nonnative Invasive Vegetation: when invasive nonnative grasses and shrubs begin to compete with native plant cover and degrade habitat
Forest Management: in the eastern forested portion of the greater roadrunner's range, *Timber Stand Improvement* can encourage shrub cover can enhance cover and support food where understory vegetation has been shaded out
Plant Shrubs: low-growing shrubs can provide cover and food where lacking
Set-back Succession: *Prescribed fire*, *Disking*, *Herbicide Applications*, *Chainsawing*, *Chaining*, and *Drum-chopping* can be used to renovate or maintain shrubby cover when trees begin to dominate or where additional bare ground is needed
Wildlife or Fish Survey: roadside counts can provide an index to roadrunner populations

Greater sage-grouse

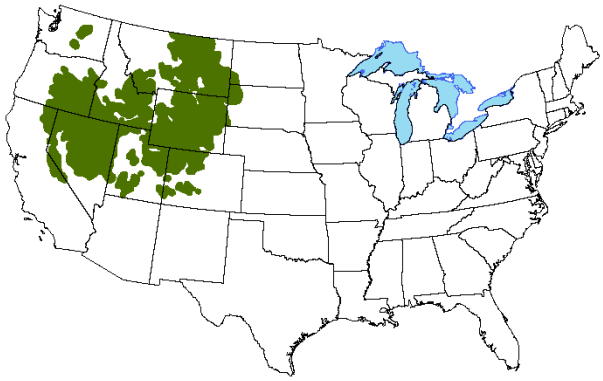
General information

Stephen Ting

The greater sage-grouse is a ground-dwelling game bird of the American West that uses very large tracts of sagebrush-dominated rangeland. Sage-grouse populations have declined over many areas as a result of habitat loss and fragmentation related to land conversion, energy development, conifer encroachment, and invasive species (particularly cheat grass). Sage-grouse currently occur throughout much of the Intermountain ecoregion. A diverse plant community of native grasses, forbs, and especially sagebrush are critical for sage-grouse. Male sage-grouse display and compete for females on leks, which are small open areas surrounded by sagebrush. The USDA-NRCS included greater sage-grouse in its *Working Lands For Wildlife* initiative.

Habitat requirements

Diet: spring and summer – insects and green forbs; late fall and winter – sagebrush
Water: water requirements are obtained through diet, but sage-grouse will use free-standing water if available
Cover: nests are constructed on the ground, often under sagebrush; sagebrush is critical for thermal and escape cover during winter



Wildlife management practices

Conservation Easement: can protect critical habitat from development
Control nonnative invasive vegetation: when nonnative invasive species begin to compete with the native plant community and reduce habitat for sage-grouse
Livestock Management: grazing should be prescribed at a level that maintains an adequate grass and forb component for nesting and brood-rearing cover. Improper grazing can increase the sagebrush canopy to the point there is inadequate understory and shift the plant community to species of lesser value, which removes important cover for sage-grouse and decreases forage for livestock.
Plant Shrubs: in areas with less than 15 percent sagebrush cover that are used for nesting or winter cover
Decrease Harvest: may be necessary if the local population is declining or cannot withstand harvest
Wildlife or Fish Survey: lek counts are conducted to monitor populations and evaluate management effectiveness, especially since sage-grouse are in decline.

Special: identify and mark fences where sage-grouse collisions are likely, such as near leks (open areas surrounded by sagebrush for courtship displays) to reduce accidental mortality caused by fence strikes. Sage-grouse typically use the same leks every spring. Leks are maintained in herbaceous groundcover for long periods of time because of gravelly or wet soils or because of feeding and watering activities of livestock.

Hairy woodpecker

General information

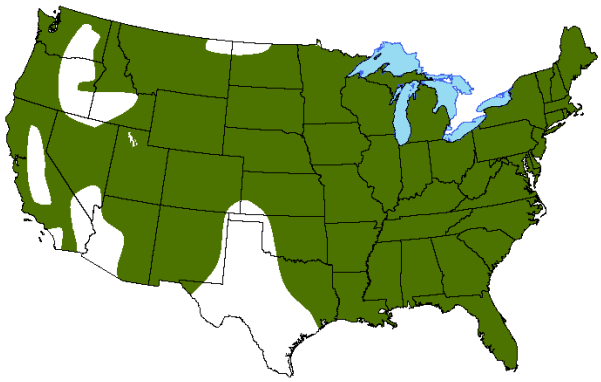
Donna Dewhurst

Hairy woodpeckers are medium-sized woodpeckers with a bill almost as long as their head. They forage primarily on tree trunks, but also on stumps, snags, downed logs, and on the ground. Hairy woodpeckers are most commonly found in mature forest, but may also frequent younger developing forests, wooded riparian areas, woodlands, backyards, and parks. They nest in cavities, which are usually in dead trees or in dead limbs of live trees. Nests contain 3-6 eggs.

Habitat requirements

Diet: insects such as ants, beetle larvae, caterpillars, and adult beetles; diet is supplemented with hard and soft mast, as well as various seeds, including sunflower seeds
Water: obtained from diet
Cover: cavity nesters; holes are excavated in mature and dying trees and snags; management efforts should focus on maintaining or creating areas with large mature and dying trees, especially in open areas; within wooded areas, at least one large snag per acre should be available

Wildlife management practices



Control Nonnative Invasive Species: when nonnative invasive species begin to negatively impact tree regeneration or reduce the ability of hairy woodpeckers from foraging along tree trunks
Create Snags: for a food source and potential nest cavities where snag availability is limiting
Livestock Management: livestock either should be excluded from forests and riparian areas or managed so that grazing pressure is not limiting tree regeneration
Plant Trees: especially softwood deciduous trees where trees are lacking for potential nesting cavities
Wildlife Damage Management: when woodpeckers are causing damage to human structures
Wildlife or Fish Survey: call counts and point counts are used to estimate population trends

House finch

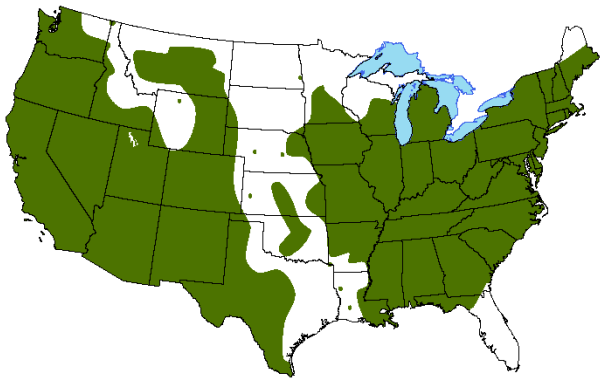
General information

House finches are native to the western U.S., but were introduced in the eastern U.S. in 1940. Since, they have spread throughout the eastern U.S. and have become one of the most common birds in the U.S. They are found in a wide variety of urban, suburban, and agricultural areas that have trees, shrubs, and some herbaceous openings. They are also found in canyons and semi-arid regions in the western part of the country. House finches nest in a variety of raised locations and make a nest from weed stems, small branches, and leaves. House finches are vegetarians and eat a variety of seeds, soft mast, and buds, both from the ground and in trees.

Gary Kramer

Habitat requirements

Diet: soft mast, buds, and weed seeds; in the warm season, house finches eat some insects
Water: free-standing water is needed daily in the warm season
Cover: nest 5 feet to 7 feet aboveground on low branches of trees, branches of bushes, in natural cavities, old holes excavated by woodpeckers, and any projection or ledge they can find on houses and buildings



Wildlife management practices

Plant Native Grasses and Forbs: to provide forb seed in rural areas where forbs are lacking
Plant Shrubs: for nesting and hiding cover adjacent to open areas where shrubs are lacking
Plant Trees: for nesting cover in areas where trees are lacking
Water Developments for Wildlife: birdbaths and pans of water can be provided, or a low area in the yard can be filled with water; do not place water in areas where cats can catch birds
Wildlife or Fish Survey: point counts are used to estimate trends in populations
Artificial Feeders: may be used to attract finches in Urban areas; millet and sunflower seeds are favorites
Mowing: can be used to maintain open areas in Urban areas

House sparrow

General information

James W. Arterburn

House sparrows are found throughout the U.S. They are an introduced species from England (they are also called English sparrows) and are found throughout the US, and are very common in Urban areas. House sparrows are also very common in and around buildings in agricultural areas where grain is available. They are a nuisance, and management objectives are often needed to reduce the quality and quantity of food and cover. *Wildlife Damage Management* is often needed and commonly implemented. House sparrows are cavity nesters and will frequently occupy buildings and houses to nest within the eaves or other areas with a cavity or opening. House sparrows feed on the ground and in woody vegetation for seeds, insects, and soft mast. House sparrows outcompete bluebirds for cavity nesting space and compete with several other native birds for food and space.

Habitat requirements

Diet: variety of insects, soft mast, buds, forbs, weed seeds, and waste grain
Water: free-standing water is required daily in warm seasons
Cover: nest in natural cavities, low branches of trees, and bushes 5 feet to 7 feet aboveground, and on any projection or ledge they can find on buildings or other structures

Wildlife management practices

House sparrow populations often grow to levels where they cause wildlife damage or will cause detrimental conditions for native wildlife by out competing native species for habitat requirements; therefore, wildlife damage management will most likely be necessary in almost all situations, especially in suburban/urban and agricultural areas. Habitat management to attract house sparrows should never occur.
Wildlife Damage Management: trap and euthanasia are often appropriate to reduce house sparrow populations; exclusion practices may prevent house sparrows from accessing an area; remove food, water, and cover available to house sparrows; various harassment practices may be effective
Wildlife or Fish Survey: observation counts, call counts, and questionnaires related to wildlife damage management are useful in estimating trends in populations

House wren

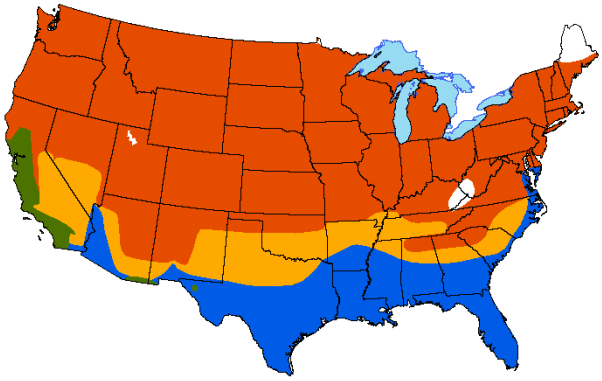
General information

House wrens are found throughout the U.S. during the breeding season, and migrate to the Deep South during winter months. In Urban areas, house wrens prefer older residential areas with large shrubs and trees. House wrens are also found in forests with herbaceous openings at higher elevations, as well as in aspen stands. House wrens nest in a variety of elevated cavities, as high as 30 feet aboveground. They forage both on the ground and aboveground.

Dave Menke

Habitat requirements

Diet: spiders, grasshoppers, crickets, beetles, caterpillars, ants, bees, ticks, earthworms and millipedes; artificial feeders are usually not used
Water: necessary water is obtained from the diet
Cover: nest in natural cavities in trees old buildings and other structures



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative species begin to compete with native vegetation and degrade habitat for house wrens
Nesting Structures: nest boxes may be provided where adequate nesting sites are lacking; boxes should be placed high on a tree trunk or under the eaves of a house; the hole should be small to prevent house sparrows and starlings from entering an excluding house wrens; for specifics on nest box design and placement, visit your local Extension office
Plant Shrubs: where lacking for cover while feeding and for nesting
Plant Trees: where trees are lacking for cover and nesting
Wildlife or Fish Survey: point counts are used to estimate trends in populations

Ladder-backed woodpecker

General information

Robert Burton

Ladder-backed woodpeckers are small woodpeckers of the southwestern U.S. and Mexico. They get their name from the black and white barring on their backs that resemble a ladder. Ladder-backed woodpeckers are found in wooded canyons, cottonwood groves, pine and pine oak woodlands, and desert grasslands and shrublands dominated by mesquite throughout the southwestern U.S. south to British Honduras. They are also found in riparian areas and other areas with trees. In the Hot Desert and Prairie Brushland ecoregions, they use areas with large mesquite, palo verde, agave, cholla cactus, and yuccas. They are sometimes called the cactus woodpecker as they commonly nest in various cacti where they occur.

Habitat requirements

Diet: insects including ants, beetle larvae, caterpillars, and cotton worms found on small trees, shrubs, and various cacti
Water: necessary water obtained from diet
Cover: nest in cavities in trees, shrubs, and stalks of agave and yucca cactus

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to compete with native vegetation and degrade habitat for ladder-backed woodpeckers
Create Snags: to increase potential nesting sites where limiting
Livestock Management: grazing management should maintain vigor of existing trees; in riparian areas, grazing in spring and summer when herbaceous vegetation is actively growing results in less use of woody vegetation than at other times of year; grazing management in dry regions often includes development of livestock watering facilities in upland areas to discourage over-use of riparian areas
Plant Trees: in riparian areas for cover and a future food source where trees are lacking
Wildlife Damage Management: when woodpeckers are causing damage to human structures
Wildlife or Fish Survey: point counts may be used to monitor populations

Lark bunting

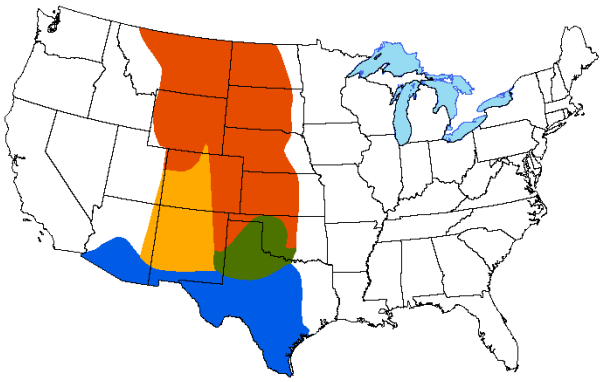
General information

Lark buntings are found in the Great Plains and the arid southwest. They prefer shortgrass prairies during the breeding season, but are also found in mixed grass prairies. They nest on the ground, usually under a shrub. Nests contain 2-6 eggs. Lark buntings feed on the ground in open areas, and avoid foraging under cover. Lark buntings migrate into the southern Great Plains and Mexico during winter where they frequent grasslands, deserts, shrublands, and cultivated fields.

James W. Arterburn

Habitat requirements

Diet: insects are the primary item in the diet, but seeds, soft mast and grain are consumed as well, especially during winter
Water: necessary water is obtained from food
Cover: adequate grass cover is necessary, particularly during the nesting season



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative vegetation begins to compete with native vegetation and reduce habitat quality for lark buntings; sod-grasses are problematic because they can limit mobility of lark buntings while foraging
Delay Crop Harvest: delaying hay harvest until after nesting season is beneficial
Livestock Management: grazing should be managed so that adequate nesting cover is available
Plant Native Grasses and Forbs: may be necessary to restore native cover where native grasslands have been converted to nonnative species
Set-back Succession: *Prescribed Fire* is critical for maintaining native prairie for this and many other grassland birds; *Chainsawing* may be used to clear trees; Herbicide Applications may be used to kill trees; *Prescribed Fire*, *Chaining*, *Root Plowing*, and *Drum-chopping* may be used to set-back shrub cover and stimulate herbaceous groundcover
Wildlife or Fish Survey: point counts are used to monitor populations

Lawrence's goldfinch

General information


Glen Tepke

Lawrence's goldfinch is a small and rather uncommon finch that spends the breeding season in the oak woodlands of California and Baja California and winters in southern Arizona and northern Mexico. Thus, unlike most other migratory birds, it migrates east and west, rather than north and south, between seasons. It is a nomadic species within seasons, moving about from place to place, with little predictability or loyalty in which location it will spend the breeding season from year to year. Erratic movements of the species make it difficult to monitor. Its nomadic nature is considered a response to water and food availability, which is largely seed of native annual plants that the goldfinch glean while perching on the plant. They nest about mid-way up trees; nests contain 3-6 eggs.

Habitat requirements

Diet: seeds of annual plants, such as fiddleneck, chamise, red-stem filaree, shepherd's-purse, and peppergrass
Water: free-standing water is required; Lawrence's goldfinch may drink from creeks, water tanks, dripping faucets
Cover: blue oak savannas, digger pine-oak woodlands, wooded riparian areas

Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species
Control Nonnative Invasive Vegetation: when nonnative invasive species compete with native vegetation and reduce habitat quality for Lawrence's goldfinch
Forest Management: *Timber Stand Improvement* can promote open-canopy conditions where closed-canopy conditions occur
Plant Trees: in large open areas where oak woodlands are lacking
Set-back Succession: *Disking* can promote annual plants for foraging; *Prescribed Fire* should be used to maintain and promote oak woodlands and savannas; *Herbicide Applications* may be used to reduce tree density where needed
Tillage Management: will allow annual forbs to remain standing through winter for foraging
Water Developments for Wildlife: may be useful where free-standing water is limiting
Wildlife or Fish Survey: point counts may be used in an effort to monitor population trends

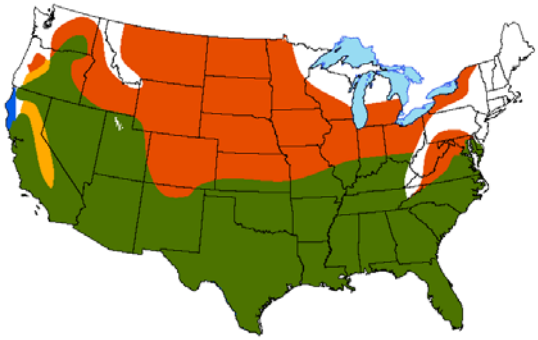
Loggerhead shrike

General information

Dave Menke

The loggerhead shrike is a migratory bird of prey that requires relatively large openings or fields to hunt prey. Some shrikes remain in the southern tier of the U.S. all year, whereas others migrate from as far south as northern Mexico to southern Canada to breed. The loggerhead shrike population is declining because of habitat degradation and loss from conversion of grasslands and shrublands to row-crop agriculture or overgrazed, nonnative grass pastures, and aesthetic mowing. The most important vegetation component is nesting cover (dense, thorny shrubs and trees), but open areas with herbaceous vegetation and some bare ground are also critical for hunting prey. Shrikes will readily build nests and perch in shrubby areas less than 16 feet tall, but prefer taller trees where available. Scattered, thorny tree and shrub species, such as honey locust, are selected over non-thorny species. Taller trees are selected for perching during courtship displays and while hunting. Loggerhead shrikes uniquely utilize thorns, barbs, and barbed wire fences to impale prey.

Habitat requirements



Diet: insects and spiders, small mammals, small birds, reptiles, and amphibians
Water: water requirements are obtained through diet
Cover: nest in dense shrubs and trees; taller, thorny species are preferred; courtship sites are elevated, exposed perches over open areas; foraging sites are elevated, exposed perches over open areas with herbaceous vegetation and some bare ground; evergreens may be used in winter when available

Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species
Control Nonnative Invasive Vegetation: when nonnative species are beginning to compete with native vegetation and reduce habitat quality for loggerhead shrike
Edge Feathering: to increase shrub cover around fields
Field Borders*:* to increase usable space around row-crop fields
Livestock Management: grazing should be managed to provide lush herbaceous groundcover and shrub cover
***Plant Native Grasses and* Forbs**: when necessary to provide herbaceous vegetation in proximity to shrub cover
Plant Shrubs: where there is a lack of shrubs for nesting/perching sites
Plant Trees: where there is a lack of trees for nesting/perching sites
Set-back Succession: *Disking* and *Prescribed Fire* are recommended to maintain early successional openings; *Chainsawing* can reduce tree cover in forests to promote savanna conditions; *Herbicide Applications* may be used to reduce tree cover; *Chaining* and *Drum-chopping* may be used to maintain shrub cover
Wildlife or Fish Survey: walking transects to find nests, point counts, and breeding bird surveys can monitor population trends

Long-billed thrasher

General information

Robert Burton

The long-billed thrasher is only found in southern Texas and eastern Mexico where it prefers dense, brushy areas, such as riparian woodlands and mesquite thickets. Long-billed thrashers construct nests in big trees within thick brush, making nests difficult to find. Nests resemble a big cup made of thorny twigs. Long-billed thrashers are grayish brown on top with white below, characteristically streaked with black dashes. As the name implies, it has a longer bill than its close relative, the brown thrasher, which can be found in the same ecoregion. Interestingly, there are other thrashers with even longer bills. The long bill is used to forage or "thrash" in leaf litter on the ground for insects, spiders, snails, or berries. Although the long-billed thrasher is not threatened, parts of south Texas have seen a decline over the last century as a result of clearing brush for agriculture. Long-billed thrashers are most commonly seen along the Rio Grande River and have been noted to move to the more northern areas of south Texas during winter.

Habitat requirements

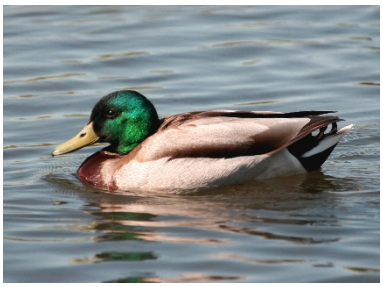
Diet: insects and berries, but also spiders and snails
Water: water needs are likely met through their diet
Cover: areas of dense brush; nest in larger trees within areas of dense, thorny brush

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for long-billed thrasher
Field Borders: can provide nesting and escape cover in areas lacking patches of dense brush
Plant Shrubs: in open areas where shrub cover is limiting and planting is necessary for shrub establishment
Plant Trees: can provide nesting structures where taller trees are lacking
Water Developments for Wildlife: water sources could be developed to provide free water, especially during winter months
Wildlife or Fish Survey: point counts are used to estimate population trends

Mallard

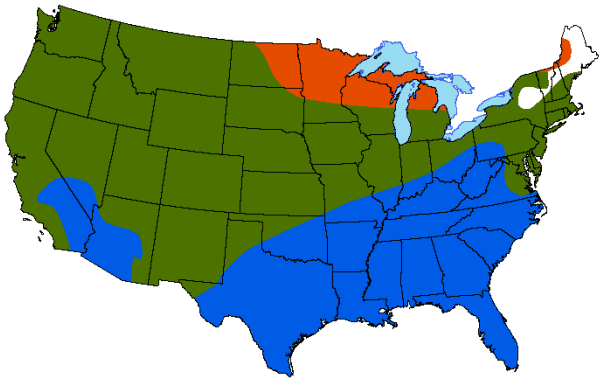
General information



Donna Dewhurst

The mallard is a migratory waterfowl with one of the most extensive breeding ranges of any duck in North America, extending across the northern one-third of the U.S., and up to the Bering Sea. Mallards winter south of Canada, throughout the U.S. and south to Central America. Mallards nest in tall grasses and forbs or in shrubby cover. They need open water with associated emergent aquatic vegetation to raise young. They may be found in any type of wetland with standing water and also use various upland vegetation types for foraging, especially harvested grain fields. Mallards are dabbling ducks, which means they feed at or near the surface of the water by filtering food items, such as invertebrates, seeds, and other plant material. Dabbling ducks are often seen tipping upside down in the water to reach food at the bottom of a wetland. Unlike diving ducks, they feed in much shallower water and do not dive to obtain food. Mallards have become a nuisance in some areas, particularly urban and suburban parks with ponds where they are fed. Mallards may breed with domestic ducks and with other wild duck species, especially the American black duck.

Habitat requirements



Diet: aquatic plants, insects and other invertebrates, hard mast (especially acorns), grains and other seed are primary components in the diet; ducklings eat mostly aquatic insects
Water: see cover requirements below
Cover: nest in grass and forbs and sometimes in shrub cover, preferably within one-half mile of a wetland that provides open water with some emergent aquatic vegetation; brooding cover is open water with considerable emergent aquatic vegetation for protection from predators; ideally, wetlands have a minimum of 50 percent open water and 10 to 20 percent emergent vegetation; in wintering areas, mallards often loaf on more open water, such as warm-water sloughs, streams, rivers, and flooded fields

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species, such as purple loosestrife, water hyacinth, parrotfeather, hydrilla, and reed canarygrass, begin to reduce habitat quality for mallards
Delay Crop Harvest: (in some ecoregions) hay and crop harvest adjacent to wetlands should be conducted after nesting season
Forest Management: *Timber Stand Improvement* can favor mast-producing species, especially oaks, in bottomland hardwoods that can be flooded to increase mast production
Leave Crop Unharvested: unharvested grains, such as corn and wheat, to provide a winter food source; this does not apply to hay forages or soybeans

Livestock Management: livestock should be excluded from nesting areas
Plant Food Plots: shallowly flooded grain plots can provide an important food source for migrating and wintering mallards
Plant Native Grasses and Forbs: (in some ecoregions) where nesting cover is limiting and planting is necessary to increase coverage of native grasses and forbs
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* should be used to rejuvenate dense vegetation in nesting areas and to increase or maintain proper water and vegetation interspersion in emergent wetlands that become dry in summer; *Disking* emergent wetlands and fields that will be flooded later will stimulate annual grasses and forbs that are important food plants; *Herbicide Applications* can be used to control unwanted woody species; *Chainsawing* can be used to create openings in bottomland forests that can be flooded
Tillage Management: eliminating fall tillage can provide waste grain in the winter
Water Control Structures: should be used to control water level in wetlands managed for mallards and other wildlife
Water Developments for Wildlife: shallow impoundments can be used to flood grain fields and bottomland hardwoods in winter to provide a valuable food source and loafing areas
Wildlife or Fish Survey: aerial surveys are commonly used to estimate trends in the mallard population

Marbled murrelet

General information

R. Lowe

The marbled murrelet is a small seabird that spends most of its life within a few miles of the coastline in the Pacific Northwest. Marbled murrelets nest in large expanses of old-growth (180 years old or more) coniferous forests. Nests are located on horizontal branches in large coniferous trees up to 50 miles from the coast. The nest is not concealed, but merely positioned in a depression of moss on the limb. Marbled murrelets have low reproductive potential as a female produces only one egg per nesting attempt. Incubation duties are shared by the female and the male. Historically, logging old-growth coastal coniferous forests eliminated large tracts of nesting cover for marbled murrelets. As old growth forests have become more fragmented, nest predation is thought to have increased, primarily from ravens and jays. The murrelet is also at risk from coastal oil spills and depletion of forage fish stocks.

Habitat requirements

Diet: small fish, such as anchovies, herring, and smelt, from the ocean within 1-2 miles of the coastline; small crustaceans are also eaten occasionally
Water: obtains most water from food
Cover: open ocean for most of the year; when threatened, murrelets dive or fly to avoid capture; horizontal limbs on large conifer trees for nesting

Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species
Control Nonnative Invasive Vegetation: if nonnative invasive vegetation is reducing habitat quality for marbled murrelet
Forest Management: long timber rotations that favor old growth forest should be prescribed; *Timber Stand Improvement*, such as selective thinning that increases growth rates of remaining trees, can be used when a forest stand is not of sufficient age and structure for nesting cover
Plant Trees: conifers can be planted in areas that are not forested, but have the potential to provide future nesting cover
Set-back Succession: *Prescribed Fire* may be used in some situations to consume built-up fuels and reduce chance of wildfire, which could kill trees valuable for nesting
Wildlife or Fish Survey: transects conducted via boat parallel to the coastline counting murrelets on the water are useful to determine estimates of abundance.

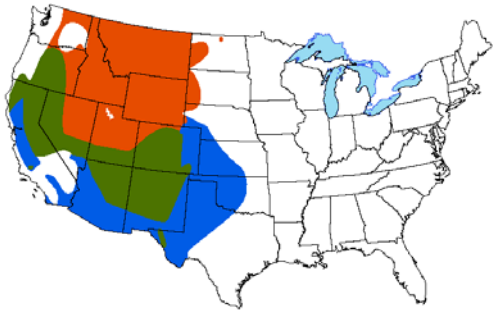
Mountain bluebird

General information

Dave Menke

Mountain bluebirds are found across the western U.S. They use open savannas, pastures, parks, backyards, edges of hayfields and cropfields, and other herbaceous openings with scattered trees, which are used for perching and nesting (where cavities are available). Mountain bluebirds forage in open areas with short vegetation, but typically near trees or a fence that provide perches. Insects dominate the diet during spring and summer, whereas various fruits are most prevalent during fall and winter. Mountain bluebirds nest in cavities, especially old woodpecker cavities, as well as nest boxes. Clutches normally consist of 4-8 eggs.

Habitat requirements



Diet: invertebrates, especially grasshoppers, crickets, beetles, and spiders; various fruits in fall and winter
Water: necessary water obtained from diet
Cover: nest in cavities of trees and fence posts

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduces habitat quality for mountain bluebirds
Create Snags: where cavities are limited to provide potential nest sites and perching sites in open areas (not in forests)
Edge Feathering: to increase foraging opportunities, perching sites, and potential cavity trees (if trees are killed and left standing) around fields
Field Borders: to increase foraging opportunities around crop fields
Livestock Management: livestock must be excluded from recently planted trees and shrubs
Nesting Structures: should be erected where a scarcity of natural cavities may be limiting the population; nest boxes should be approximately 5 feet high with an entrance hole 1½ inches in diameter; nest boxes should be placed no closer than 80 yards apart to limit territorial fighting among males
Plant Native Grasses and Forbs: to aid in establishing herbaceous groundcover where planting is necessary
Plant Shrubs: in large open areas where perching sites or winter foods may be limiting
Plant Trees: in large open areas where perching sites are limiting; may provide potential nest sites in distant future
Set-back Succession: *Prescribed Fire*, *Disking*, *Herbicide Applications*, *Mowing*, *Chaining*, and *Drum-chopping* can be used to maintain and rejuvenate grasslands and reduce shrub cover where necessary; *Chainsawing* and *Root Plowing* can be used to convert forested or shrub-dominated areas to savannas and early successional communities
Wildlife or Fish Survey: point counts can be used to monitor bluebird populations; nest boxes should be checked to monitor use and nest success
Mowing: can be used to maintain open areas in Urban environments

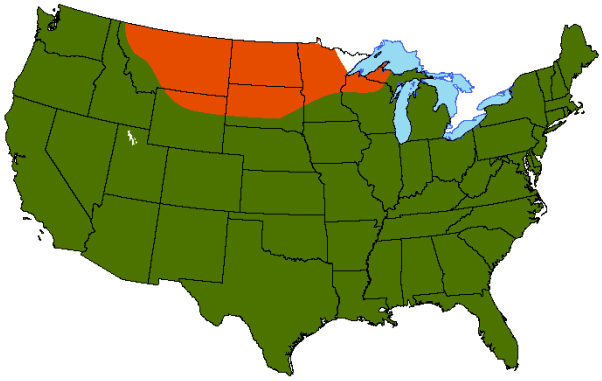
Mourning dove

General information

Dave Menke

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

Habitat requirements



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

Wildlife management practices

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

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

Northern bobwhite

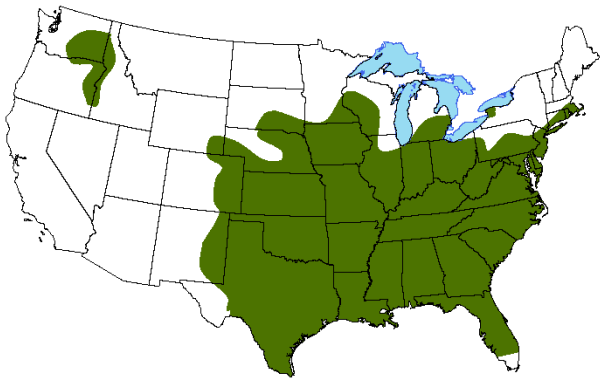
General information

Steve Maslowski

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

Habitat requirements

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



Wildlife management practices

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

Forest Management: in pine forests, *Forest Regeneration*, especially *Clearcut* and *Seed Tree*, will enhance habitat for a few years until regenerating pines close canopy; *Timber Stand Improvement* can be used to reduce tree density in pine stands down to 50 square feet of basal area and enhance habitat; see ***Set-back Succession*** for managing hardwood forests for bobwhite

Leave Crop Unharvested: to provide additional food through fall and winter; corn, soybeans, wheat, and grain sorghum are readily eaten

Livestock Management: grazing pressure should be managed so sufficient groundcover remains for nesting and brood rearing; grazing management should discourage a uniform structure of plants across the landscape; cattle grazing in combination with prescribed fire can mimic historic natural disturbance events; grazing management should maintain dense shrub cover in some areas; up to one-third of an area can be grazed more intensively to encourage annual forb production for brood rearing cover, assuming the same areas are not repeatedly grazed the same way; livestock should be excluded from food plots

Plant Food Plots: relatively small linear food plots (one-fourth acre) may be established adjacent to escape cover where food is a limiting factor (this is rare; shrubby cover for escape and forb cover with bare ground are more often limiting factors)

Plant Native Grasses and Forbs: where nesting and brood cover is limiting and planting is necessary to develop nesting and brooding cover (suitable nesting and brooding cover usually establishes naturally after undesirable plants are controlled and after tree cover is removed or thinned)

Plant Shrubs: where shrub cover is limiting; if shrub patches are within 50 to 75 yards of each other, additional shrub cover is not needed

Set-back Succession: *Prescribed Fire* is strongly recommended to maintain and rejuvenate grasslands, native prairie, shrublands, savanna, and woodlands; fire consumes dense litter, limits succession of woody species, and encourages herbaceous groundcover; *Disking* can be used to reduce litter build-up, encourage annual forbs and grasses, and provide increased bare ground; *Chaining* can be used to set-back shrub cover when it becomes too dense and tall; *Chainsawing* and *Root Plowing* may be used remove trees and convert hardwood forest to early succession or savanna; *Herbicide Applications* may be used to remove undesirable woody encroachment

Tillage Management: eliminate fall tillage to provide waste grain

Decrease Harvest: may be necessary if populations are declining in areas of good habitat and where hunting pressure has been excessive

Wildlife or Fish Survey: covey counts, whistle counts, point counts, and hunter harvest and observation data are used to estimate trends in populations

Northern flicker

General information

Dave Menke

Northern flickers occupy all of North America, and inhabit most of the U.S. year-round. Flickers are found in forests and woodlands interspersed with herbaceous openings. Northern flickers are often found along riparian zones and Urban areas. They prefer older urban residential areas with large trees, golf courses, and parks. Flickers create cavities in trees for nesting; these cavities later become nesting and roosting sites for other species. Thus, flickers are considered an important species for biological diversity. Flickers eat insects, especially ants, as well as soft mast and seeds. Flickers can become problematic in urban areas where they may create holes in wood siding on houses or damage ornamental trees. *Wildlife Damage Management* may be necessary. European starlings often take-over flicker cavities for their own nests. Appropriate action should be taken to prevent starlings from occupying nesting cavities of flickers and other cavity-nesting wildlife.

Habitat requirements

Diet: ants are a favorite food and make up about 50 percent of the diet; seeds, soft mast, and earthworms are also eaten; flickers are partial to poison ivy fruit and may use artificial feeders
Water: daily water requirements unknown; sufficient water is probably obtained from diet
Cover: tree cavities are used for nesting; old, mature trees that show signs of senescence (old age) or decay are often used; softwood trees, such as yellow poplar, cottonwood, and willow, are preferred; flickers will nest in posts, holes in banks, and holes in houses and structures where trees are unavailable

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative species begin to compete with native vegetation and degrade habitat for flickers
Create Snags: to enhance possible sites for cavities where snags are limiting
Forest Management: *Forest Regeneration* will provide more open area and possibly snags for a short time; *Timber Stand Improvement* can open the structure of the forest and provide snags; snags should be retained during forest management activities
Plant Shrubs: several soft mast-bearing shrubs can provide additional food resource when limiting in open areas
Plant Trees: in large open areas without trees
Set-back Succession: *Prescribed Fire* will consume the litter layer and facilitate foraging on the ground
Wildlife Damage Management: may be necessary to prevent damage from foraging, drumming, and excavating wooden buildings; exclusion practices can prevent access to buildings; harassment can repel flickers from an area
Wildlife or Fish Survey: point counts are used to estimate trends in populations
Artificial Feeders: may be used to attract flickers in Urban areas; suet is preferred
Mowing: can be used to maintain openings in Urban areas

Northern goshawk

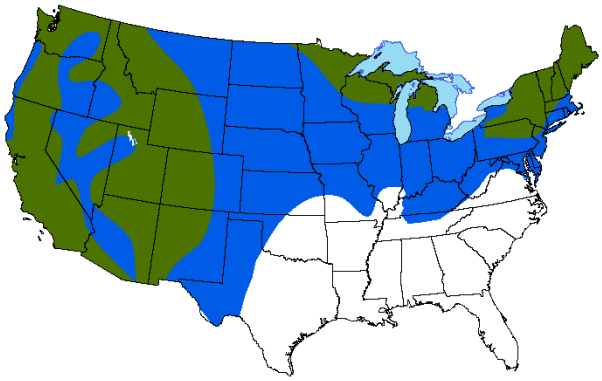
General information

Karen Laubenstein

Northern goshawks are relatively large raptors found throughout the northern, central, and western regions of the U.S. They prefer dense, mature woodlands where they nest 20 to 80 feet aboveground on a large horizontal limb of a mature tree. Nests are often used for up to five consecutive years. As a raptor, goshawks are fierce predators, commonly eating large birds, squirrels, rabbits, and hares. Goshawks perch while hunting and descend on prey. They will pursue prey for quite a distance when necessary. Goshawks do not prefer to be around human establishments.

Habitat requirements

Diet: mostly small- and medium-sized birds and mammals
Water: obtain necessary water from diet
Cover: mature forest and woodland; nest in mature trees



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for northern goshawk and their prey
Create Snags: when perching sites are limiting; at least one large snag per acre may be provided
Forest Management: *Forest Regeneration* (*Single-tree Selection*) and *Timber Stand Improvement* can enhance habitat for prey; snags should be retained during forest management
Plant Trees: in large open areas to eventually provide habitat for goshawks
Wildlife or Fish Survey: observational counts are used to estimate population trends

Northern harrier

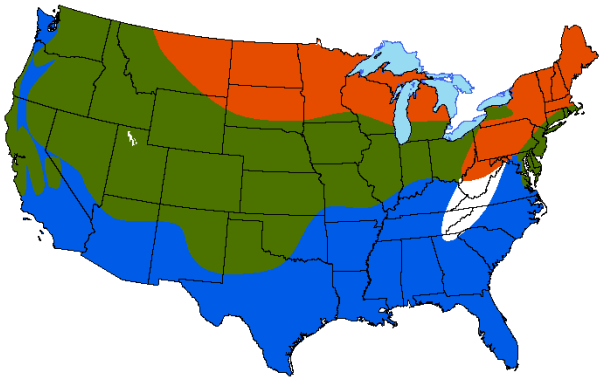
General information

Northern harriers are medium-sized hawks that occur throughout North America. They nest throughout Canada and Alaska and much of the western U.S., and winter throughout most of the U.S. Northern harriers are found gliding low over grassland, croplands, and open wetlands searching for prey. They nest on the ground in grasslands and emergent marshes. The nest contains 4-5 eggs and they raise one brood per year. Males are mostly gray, whereas females are mostly brown.

Greg Lavaty

Habitat requirements

Diet: small mammals, especially rodents, but also rabbits; songbirds and sometimes ducks
Water: necessary water obtained from diet
Cover: large, undisturbed grasslands and emergent wetlands



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for northern harriers and their prey
Delay Crop Harvest: in spring to avoid ground nests
Leave Crop Unharvested: to encourage prey availability in fall and winter
Livestock Management: grazing should be managed to maintain a diverse vegetation structure conducive to prey and hunting efficiency for northern harrier
Plant Native Grasses and Forbs: where native grassland cover is limiting and planting is necessary
Set-back Succession: *Prescribed Fire* should be used to rejuvenate and maintain grasslands and wetlands when conditions permit; *Chaining* and *Drum-chopping* can be used to reduce shrub cover and encourage more herbaceous groundcover; *Chainsawing* and *Root Plowing* can be used to convert forest and extensive shrubland to more open grassland; *Herbicide Applications* can be used to reduce shrub and tree cover and encourage more open grassland
Tillage Management: delay fall tillage to facilitate hunting prey when waste grain is available
Wildlife or Fish Survey: observation counts are used to estimate population trends

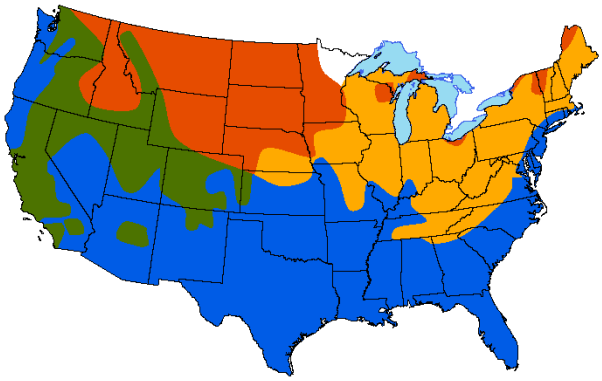
Northern pintail

General information

Dave Menke

The northern pintail is a large dabbling duck that ranges from 23 to 30 inches in length. Both sexes have blue-gray bills and gray legs and feet. The drake has a thin white stripe running from the back of its chocolate-brown head down its neck to a mostly white undercarriage. He also has gray, brown, and black patterning on his back and sides and long central tail feathers, which give the species its name. The northern pintail female appears to have drab brown feathers, much like those of other female dabbling ducks. Hens make a course quack, whereas drakes make a flute-like whistle. Northern pintails prefer open wetlands. They nest on the ground, and nests are hidden among vegetation in a dry location. Nest construction is a simple shallow scrape in the ground lined with plant material and down.

Habitat requirements



Diet: aquatic plant seeds and rhizomes; grain and other seeds found in fields; aquatic insects, mollusks and crustaceans
Water: water is obtained through diet
Cover: open freshwater wetlands and intertidal marshes

Wildlife Management Practices

Control Nonnative Invasive Vegetation: a number of nonnative aquatic weeds can reduce habitat quality for northern pintail
Leave Crop Unharvested: to provide a winter food source
Livestock Management: livestock should be excluded from nesting areas
Plant Food Plots: shallowly flooded grain food plots can provide a beneficial food source for migrating and wintering northern pintails
Plant Native Grasses and Forbs: where nesting cover is limiting and planting is necessary
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* should be used to maintain and rejuvenate nesting cover and maintain proper water and vegetation interspersion in wetlands
Tillage Management: eliminating fall tillage can provide waste grain in the winter
Water Control Structures: should be used to manipulate water levels in wetlands managed for waterfowl
Water Developments for Wildlife: shallow impoundments can flood fields and provide important foraging and loafing areas for migrating and wintering northern pintails
Wildlife or Fish Survey: observation counts and aerial surveys are used to estimate population trends

Nuttall's woodpecker

General information

Greg Lavaty

Named after naturalist Thomas Nuttall, Nuttall's woodpecker is a small woodpecker that inhabits the oak woodlands and associated riparian areas of California in the Mediterranean ecoregion. Nuttall's woodpeckers use cavities for nesting; nests contain 3-6 eggs. Nuttall's woodpeckers eat insects that they glean mostly from oak, willow, and cottonwood trees.

Habitat requirements

Diet: 80 percent insects and other invertebrates and 20 percent plant material, including seeds and soft mast
Water: water requirements unknown
Cover: oak woodlands; cavities are excavated in softwoods (willow, cottonwood)

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species begin to compete with native vegetation and reduce habitat quality for Nuttall's woodpecker
Create Snags: to increase potential cavity sites where limiting; softwood deciduous trees are particularly important
Forest Management: *Timber Stand Improvement* can reduce tree density where needed and promote desirable species; existing snags should be retained when implementing forest management
Plant Trees: in large open areas to provide future habitat
Wildlife Damage Management: may be needed in residential areas
Wildlife or Fish Survey: point counts are used to estimate population trends

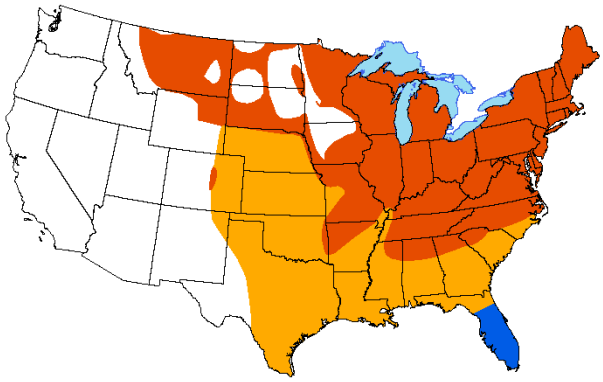
Ovenbird

General information

Greg Lavaty

The ovenbird is a ground-dwelling warbler found in uplands of closed-canopy, mature deciduous or mixed deciduous-coniferous forests throughout the eastern third of the U.S. Territorial males are quite vocal with their characteristic "*teacher-teacher-teacher*" song. Ovenbirds are typically found in mature forests with relatively little underbrush and plenty of leaf litter that harbors abundant insects and other invertebrates. They often forage in the leaf litter, but may also glean insects from leaves and tree bark. They construct a dome nest of dead leaves, grasses, bark, and hair with an oval side entrance that usually faces downhill, all in the shape of an outdoor bread oven; hence the name. The nest is usually well hidden in herbaceous vegetation on the forest floor, often near a fallen tree or regrowth within a canopy gap. Ovenbirds are rather unique in that after the clutch hatches, the female takes half the brood and parts ways with the male, who remains with the other half of the brood. Ovenbirds may produce 1-2 broods per year.

Habitat requirements:



Diet: adult beetles and larvae, caterpillars, ants, and flies
Water: usually obtain necessary water from diet, but may also use free-standing water when available
Cover: mature deciduous forest with sufficient leaf litter for nesting and foraging

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for ovenbirds; several nonnative species, such as Japanese stiltgrass, threaten to reduce habitat quality for ovenbird in the Eastern Deciduous Forest
Forest Management: *Forest Regeneration* (*Single Tree Selection*) may produce scattered small canopy gaps that enhance nesting cover
Livestock Management: livestock should be excluded from forests managed for ovenbirds
Plant Trees: in large open areas to produce future habitat
Wildlife or Fish Survey: point counts are used to estimate population trends

Peregrine falcon

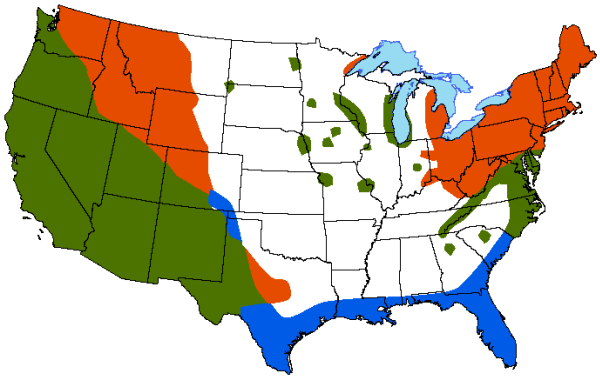
General information

USFWS

Peregrine falcons are found primarily along the coasts and mountain ranges of North America where congregations of shorebirds, songbirds, and waterfowl occur. They also may be found in urban and industrial areas with skyscrapers, smokestacks, bridges, and other tall structures and where abundant rock dove and European starling populations occur. Nests are often located on the ledges of cliffs or buildings from 25 to more than 1,300 feet high. They are one of the fastest birds on the planet, with a cruising speed of 25-34 mph to more than 200 mph in pursuit of prey.

Habitat requirements

Diet: mostly birds, but also bats, which falcons catch during flight
Water: requirements largely unknown; likely obtain water needs from foods they consume
Cover: require tall cliffs, buildings, and other tall structures for nesting and perching



Wildlife Management Practices

Nesting Structures: nesting platforms can be added to cliffs and skyscrapers
Wildlife Damage Management: peregrine falcons can prey upon domestic birds, such as homing pigeons; exclusion practices should be used to discourage damage
Wildlife or Fish Survey: visual surveys near known nesting areas can be used to monitor population trends

Prairie falcon

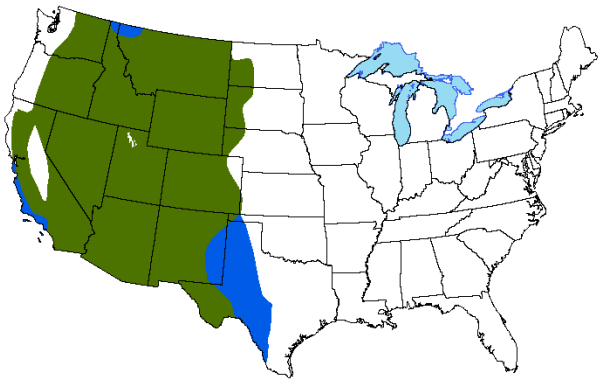
General information

Prairie falcons are large, pale brown falcons with pointed wings and a distinct dark mustache marking on their face. Prairie falcons are found in arid grasslands, shrublands, and deserts. They nest primarily on cliffs, laying their eggs in small depressions. They prey primarily on ground squirrels, but also on other small mammals and birds and occasionally lizards and insects.

USFWS

Habitat requirements

Diet: ground squirrels, small mammals, birds, and occasionally lizards and insects
Water: water is obtained from the diet
Cover: nest in cliffs, rock outcrops, canyon walls, ridges, and cave walls; overhanging rocks serve as cover from the sun and weather.



Wildlife Management Practices

Nesting Structures: nesting platforms may be added to cliffs
Set-back Succession: *Prescribed Fire* can be used to maintain an open landscape that prairie falcons require when searching for prey; *Chaining* and *Drum-chopping* may be used to limit shrub and tree encroachment, such as juniper, and promote increased herbaceous groundcover
Wildlife or Fish Survey: monitoring active nests and observation counts along road transects are used to estimate population trends

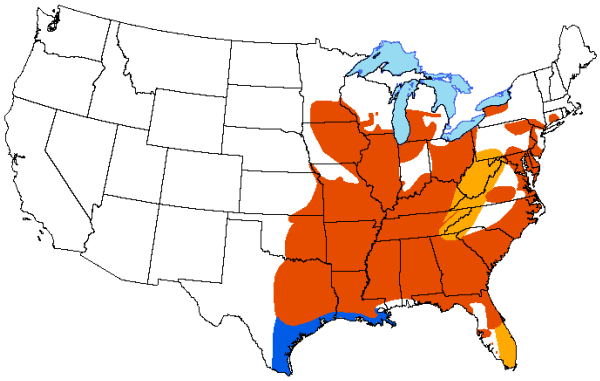
Prothonotary warbler

General information

Mark Musselman

Prothonotary warblers occur in mature bottomland hardwood forests near water, primarily in the southern U.S. They are most often found in forested wetlands, such as cypress swamps, and along blackwater creeks and rivers. Prothonotary warblers are cavity nesters, so large, overmature trees and standing dead trees are important. They often use old cavities excavated by downy woodpeckers, but will also use nest boxes, even those designed for wood ducks. Cavities are often found in sweetgum, tupelo gum, willow, and bald cypress. Nests usually contain 3-7 eggs. Prothonotary warblers may have 1-3 broods per year. Prothonotary warblers feed primarily on insects in the lower canopy or at ground level. Thus, mature hardwood forest with complex vertical structure provides the structure necessary for insect populations that prothonotary warblers require. Prothonotary warblers winter in Central and South America.

Habitat requirements



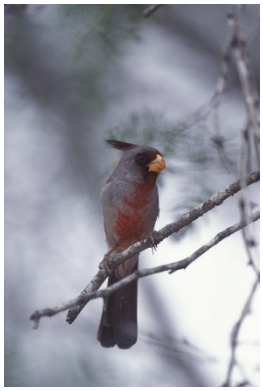
Diet: insects, especially ants, beetles, butterflies, moths, mayflies, aquatic larvae; snails and isopods; occasionally various seeds and fruits
Water: necessary water is obtained through the diet
Cover: mature bottomland hardwood forests; cypress swamps; dead standing timber help ensure presence of cavities

Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and reducing habitat quality for prothonotary warblers
Create Snags: where natural cavities are limiting to provide possible cavity sites
Forest Management: *Timber Stand Improvement* can stimulate vertical structure where absent
Livestock Management: should exclude livestock from bottomland hardwoods
Nesting Structures: nest boxes are readily used and will provide suitable nesting cover where natural cavities are limiting
Plant Trees: in large bottomland fields where forest cover is lacking and natural regeneration is not sufficient or of desirable composition
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be used to manipulate water levels in wetlands managed for prothonotary warblers
Water Developments for Wildlife: shallow impoundments can be established in bottomland hardwoods for habitat enhancement
Wildlife or Fish Survey: point counts are used to estimate population trends

Pyrrhuloxia

General information



Gary Kramer

Pyrrhuloxias are found year-round in arid regions of the Southwest, including Texas, New Mexico, Arizona, and Mexico. They prefer desert vegetation types, such as shrubby, dry grasslands, mesquite savannas, shrub-cactus, riparian woodlands, and farm-field hedgerows. They are also commonly seen at bird feeders. Most of their water during the spring and summer months comes from the insects they eat, but in the winter they often relocate closer to free water sources. Pyrrhuloxias are a close relative to the northern Cardinal with a characteristic tall crest and stout, curved, parrot-like bill for cracking seeds. These grey or grey-brown birds have distinct red markings on their face, crest, breast, and tail, though the female will look grayer. Pyrrhuloxias are very territorial during the breeding season, calling their sharp notes from perches and making short flights between scrub patches. The females construct their cup-like nest out of twigs, bark, and grass. The nest is often placed up in a tree 5-15 feet off the ground and away from the main trunk. They usually lay a clutch of 2-4 eggs and may have 1-2 broods per year. During winter, Pyrrhuloxias come together in large flocks that may number as many as 1,000 birds. Predators include feral and domestic cats, ferruginous pygmy-owls, and greater roadrunners. Although it is not threatened, pyrrhuloxia has experienced some decline because of conversion of shrubland to agriculture and urbanization.

Habitat requirements

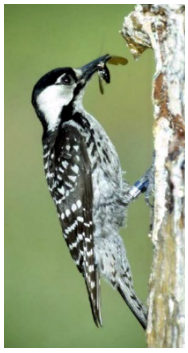
Diet: seeds, including doveweed, sandbur, panicum, and pigweed; fruit, such as cactus and nightshade; insects, including grasshoppers, caterpillars, beetles, cicadas, and weevils
Water: get the majority of their water from their diet, but will drink free-standing water
Cover: shrubs, mesquite savannas, woodlands near streams, farm hedgerows; dense brush (mesquite, elderberry, paloverde) is often used for nesting cover

Wildlife management practices

Control Nonnative Invasive Vegetation: controlling areas of invasive vegetative can help maintain a diverse source of food resources and ensure food availability throughout all seasons
Edge Feathering: can enhance structure for nesting and foraging
Field Borders: can provide nesting and escape cover in areas lacking patches of dense brush
Plant Shrubs: can enhance escape cover and food sources in areas lacking adequate brush
Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* can be used to maintain open areas for foraging and scattered brush
Water Developments for Wildlife: small ponds, guzzlers, and windmills may provide free-standing water, especially during winter months
Wildlife or Fish Survey: point counts are used to estimate population trends

Red-cockaded woodpecker

General information



James Hanula

The red-cockaded woodpecker (RCW) is about 7 to 8 inches in length and lives in mature pine forests across the South. Historically, RCWs ranged from east Texas to Florida and northward to Missouri, Kentucky, and Maryland, but its range has been sharply reduced because of fire suppression and hardwood encroachment. The species was federally listed as an endangered species in 1970. RCWs have an unusual social organization. They live in a group called a clan. Each clan typically contains 2 to 9 birds, but there is never more than one pair of breeding birds. Some clans have non-breeding birds called helpers, which generally consist of male offspring 1 to 3 years of age that help incubate eggs, feed young, make new cavities, and defend the clan's territory against other RCWs. A clan nests and roosts in a group of as many as 20 cavity trees (called a cluster). RCWs have very specific habitat requirements. Cavity trees are live pine trees, rarely less than 30 to 40 years old and are often more than 70 years old. Older pines inflicted with red-heart fungal disease makes it easier for RCWs to excavate cavities.

Habitat requirements

Water: necessary water is obtained through diet
Diet: ants, beetles, roaches, caterpillars, wood-boring insects, spiders, and occasionally fruits and berries
Cover: mature stands of Southern yellow pines, especially longleaf and shortleaf; relatively open stands with very little midstory and a diverse herbaceous understory are most desirable for foraging; a cluster site is the stand of trees surrounding and containing cavity trees and should be at least 100 acres

Wildlife management practices

Conservation Easement: can protect longleaf pine and shortleaf pine systems for this declining species
Control Nonnative Invasive Species: when nonnative species begin to compete with native vegetation and reduce habitat quality for RCWs
Forest Management: *Forest Regeneration* (*Single-tree Selection*) is the preferred method to regenerate and manage longleaf pine; *Timber Stand Improvement* can be used to thin pine stands, especially shortleaf and loblolly pine, and thus enhance structure for foraging
Nesting Structures: artificial cavity inserts can be installed into mature pine trees at cluster sites where cavity trees are limiting
Plant Trees: loblolly and shortleaf pine can be planted where lacking to provide habitat for RCWs; this may be where there are large open areas or where hardwoods dominate
Set-back Succession: *Prescribed Fire* is required to reduce hardwood encroachment, limit midstory development, and encourage herbaceous groundcover; *Chainsawing* and *Herbicide Applications* may be necessary where hardwoods have become too large to effectively reduce with fire; *Chainsawing*, *Herbicide Applications*, and *Root Raking* and may be used to clear sites and prepare for planting longleaf or shortleaf pine
Wildlife or Fish Survey: observational counts and cluster monitoring are used to monitor RCWs

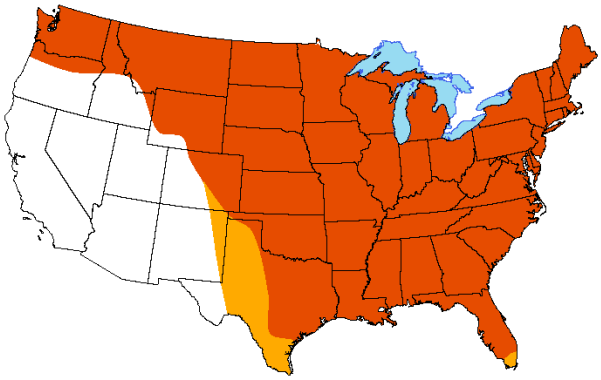
Red-eyed vireo

General information

Greg Lavaty

The red-eyed vireo is a common migratory songbird found in mature deciduous forests throughout eastern North America and the upper Midwest. They are also found in forested urban parks. They are more often heard than seen, with their persistent song that sounds like they are saying “where-are-you, here-I-am, over-here.” Red-eyed vireos have olive-green backs with a pale breast and dark red eyes. Red-eyed vireos usually forage in the middle to upper layer of the forest canopy, but often nest in the understory or midstory. The nest is made of twigs, bark, and grasses, usually in an open cup shape and suspended from a branch. They eat insects and fruits.

Habitat requirements



Diet: mostly insects and spiders during spring and summer; more soft mast during winter
Water: necessary water is obtained from diet
Cover: midstory and overstory of mature mixed deciduous forest

Wildlife management practices

Control Nonnative Invasive Vegetation: when it begins to reduce habitat quality for red-eyed vireos; a common example in the South is kudzu, which can reduce forest cover by overtaking and killing trees
Forest Management: *Forest Regeneration* (*Single-tree Selection* and *Group Selection*) can encourage insect and soft mast availability; *Timber Stand Improvement* (light thinning) can also stimulate understory and midstory development to enhance nesting cover in relatively open woods and encourage additional soft mast availability
Plant trees: in large open areas, trees may be planted to provide future habitat
Wildlife or Fish Survey: point counts are most often used to estimate population trends

Red-tailed hawk

General information


Mark Bohn

Red-tailed hawks are one of the most abundant hawks in the U.S. They are large raptors with a pale breast, brown back, and red-topped tail, for which they are named. They usually have a dark band across their breast, but the overall plumage can vary. Red-tailed hawks are often seen soaring or perching near open grasslands, pastures, and fields where they search for prey. They dive and catch prey with sharp talons. Red-tailed hawks most often nest in tall trees where they have a good view of the surrounding land. Nests are primarily made of dry sticks that can create piles over 6 feet tall. A pair will continue to build upon nests where 1 to 5 eggs are subsequently laid.

Habitat requirements

Diet: small mammals, such as squirrels, rabbits, and mice, reptiles, and other birds
Water: necessary water is obtained from diet
Cover: nests are usually built 30 to 90 feet aboveground, often in the fork of a tree branch; cliffs may be used for nest sites when trees are not present; small trees, electric poles, and similar structures are used for perching

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and degrade habitat for red-tailed hawks or their prey
Create Snags: in open areas where live trees are available and perching sites could be enhanced
Delay Crop Harvest: (in some ecoregions) to provide additional food for prey and thus increase potential for increased prey
Edge Feathering: to increase usuable space for prey, especially around row crop fields
Field Borders: to increase usable space for prey, especially around row crop fields
Forest Management: *Forest Regeneration* (*Clearcut*) to improve habitat for prey and increase usuable space for red-tailed hawks in large expanses of mature forest
Plant Native Grasses and Forbs: to enhance early successional cover where limiting and where planting is necessary
Plant Shrubs: in large open areas where trees and shrubs are not present to create perching sites and provide cover for various prey species
Plant Trees: (in some ecoregions) in large open areas where trees are not present to create perching and nest sites
Set-back Succession: *Prescribed Fire*, *Disking*, and *Mowing* may be used to maintain early successional communities for various prey species; *Chaining*, *Root Raking*, and *Drum-chopping* may be used to set-back succession in areas dominated by shrubs where more open space is needed
Tillage Management: to facilitate hunting prey when waste grain is available
Wildlife Damage Management: such as exclusion and fencing, may be necessary where livestock predation, such as chickens, is problematic
Wildlife or Fish Survey: observational surveys are used to estimate population trends

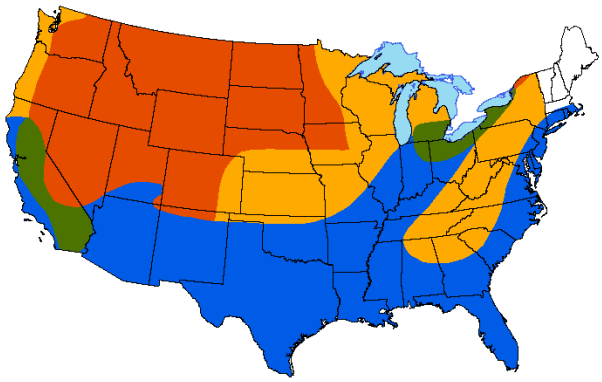
Redhead

General information

Donna Dewhurst

Redheads are diving ducks found across the U.S. and Mexico. They winter in southern areas of the U.S. and into Mexico. Redheads use open water wetlands (especially for loafing) as well as those with a mosaic of open water with floating islands of organic material and some emergent vegetation. Redheads do not build nests, but instead use old nests of other ducks and wetland birds that are above water or very near the shore in dense emergent vegetation providing concealment. Like other waterfowl, chicks are precocial. That is, they are feathered with down and are able to swim about and forage upon hatching.

Habitat requirements



Diet: chicks primarily eat aquatic invertebrates (mollusks, snails, crustaceans) during late spring and early summer; during the rest of the year, redheads eat aquatic plants, such as pondweeds, muskgrass, bulrush seeds, wild celery, water lily seeds, and coontail
Water: see cover requirements below
Cover: during spring and summer, dense emergent vegetation for nesting; open-water wetlands are used for loafing and foraging; wetlands with a mosaic of open water with submerged and emergent aquatic vegetation are used for foraging

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive aquatic vegetation begins to reduce habitat quality for redheads; this is most common when mats of nonnative species begin to form over the water surface and limit diving and foraging by redheads
Livestock Management: livestock should be excluded from wetlands managed for redheads during the nesting season to prevent deterioration of nesting cover
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate vegetation when wetlands dry sufficiently to burn (most common in ephemeral wetlands or impoundments where water levels can be manipulated)
Water Control Structures: should be installed in dams or levees if not present to enable water level manipulation and promote growth of tall emergent aquatic vegetation adjacent to wetlands with an abundance of floating and submerged aquatic vegetation (3 feet to 5 feet deep)
Water Developments for Wildlife: shallow impoundments may be constructed to temporarily flood areas dominated by tall emergent aquatic vegetation during the nesting season
Wildlife or Fish Survey: observation surveys and aerial surveys are most often used to estimate population trends

Ring-necked pheasant

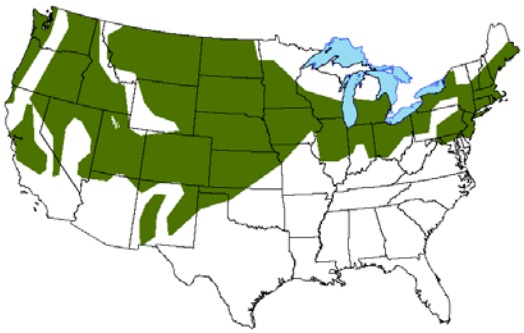
General information

Ring-necked pheasants are nonnative game birds introduced into North America from Asia. They are most prevalent across the northern Great Plains, but also occur across portions of the Intermountain West and northeastern U.S. They are most often found in relatively dense grasslands, marshes, and shrub cover adjacent to agricultural fields, woodlands, and along ditches with dense vegetation. They are especially numerous in areas with abundant grain agriculture adjacent to nesting and escape cover.

Dave Menke

Habitat requirements

Diet: various seeds, grains, grasses, leaves, fruits, and nuts; grains are used heavily in agricultural areas; insects constitute an important food item for females during the breeding season and young pheasants during the first several weeks after hatching
Water: necessary water is obtained in the diet
Cover: dense residual grass and forb cover for nesting and escape; shrubs and trees may be used for roosting; dense cattails adjacent to and within wetlands



Wildlife management practices

Delay Crop Harvest: to avoid nest destruction when appropriate
Edge Feathering: to increase usable space around crop fields bordered by woods
Field Borders: to increase usable space around crop fields
Leave Crop Unharvested: to provide additional food through winter
Livestock Management: grazing management should prevent overgrazing to maintain nesting and escape cover
Plant Food Plots: to provide additional food source where food is limiting
Plant Native Grass and Forbs: where nesting and escape cover are limiting and planting is necessary
Plant Shrubs: where roosting and escape cover is limiting in open and agricultural areas
Plant Trees: where roosting cover is limiting in open and agricultural areas
Set-back Succession: *Prescribed Fire* to rejuvenate dense, grassland and wetland (especially dense cattails) cover and reduce woody encroachment where needed; *Herbicide Applications* and *Chainsawing* can be used to reduce trees and shrub cover
Tillage Management: to provide cover and waste grain through fall and winter
Decrease Harvest: may be necessary if populations are declining in areas where hunting pressure has been excessive
Increase Harvest: where populations can sustain additional harvest pressure for hunting recreation and/or where populations need to be lowered, such as where pheasants (a non-native species) compete with native grassland species for habitat resources
Wildlife or Fish Survey: call counts, observation surveys, and point counts are used to estimate population trends

Rock pigeon

General information

James W. Arterburn

Rock pigeons (commonly called pigeons) are an introduced species found year-round throughout urban and agricultural areas in the U.S. They are considered pests because they are generally protected in urban areas where they develop dense populations and damage buildings and other structures with accumulations of droppings. They also cause severe problems in agricultural areas by contaminating feed. Pigeons also can carry and spread diseases, including salmonella, encephalitis, Newcastle disease, and others, to people and livestock through their droppings. Droppings of rock pigeons may also contain histoplasmosis, a fungal disease that can cause respiratory problems in humans. **Wildlife Damage Management** practices are often required to control overabundant rock pigeon populations. Rock pigeons are regularly found around large buildings, parks, and open areas. They create a shallow nest of sticks, leaves, and other vegetation, and nest aboveground and on or around buildings. Rock pigeons primarily feed on the ground and eat small grains, seeds, crumbs, and garbage.

Habitat requirements

Diet: waste grain and weed seeds; in urban areas, rock pigeons commonly eat human handouts
Water: free-standing water is required frequently during warm seasons
Cover: barn lofts, window ledges, roof tops, bridges, and a variety of other structures

Wildlife management practices

Wildlife Damage Management: shooting (including pellet guns in urban areas), toxicants, and trapping are recommended direct control techniques; exclusion practices prevent access to livestock feed; food, water, and desirable cover should be removed when possible and when it does not impact desirable wildlife species; harassment practices may be effective; habitat management to attract rock pigeons should never occur
Wildlife or Fish Survey: observation counts and questionnaires related to wildlife damage management are used to estimate trends in populations

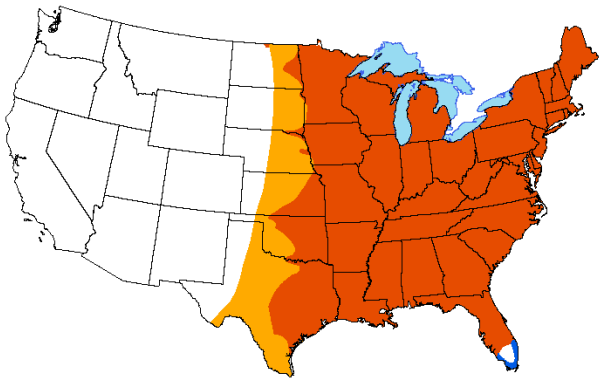
Ruby-throated hummingbird

General information

Greg Lavaty

There are 18 species of hummingbirds found in North America. The ruby-throated hummingbird is the most widespread species. Other than a couple of exceptions, hummingbirds migrate into Central and South America during winter. Hummingbirds use areas with flowering plants from which they can feed on the nectar. In urban settings, they prefer areas with large trees and nearby flowering plants. A hummingbird's nest is constructed in the shape of a small cup and is built of lichens and other vegetation. Hummingbirds require high energy foods. Nectar is high in sugars that supply needed energy. Insects are an important source of protein.

Habitat requirements



Diet: nectar from flowers and insects found on flowers
Water: necessary water obtained from diet
Cover: trees and shrubs for nesting; flowers for feeding

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for ruby-throated hummingbirds
Plant Shrubs: flowering shrubs and vines that provide nectar may be planted where nesting sites and food resources are limited; favorites include hibiscus, trumpet vine, and lilac
Plant Trees: where potential nesting sites are limited; flowering dogwood and various fruit trees are favorites
Wildlife or Fish Survey: observation counts, especially visitation at feeders, are used to estimate trends in populations
Artificial Feeders: artificial feeders filled with sugar-water (1 part sugar to 4 parts boiled water) may be used where flowers are limited; multiple feeders may reduce problems with territoriality; never give honey-water to hummingbirds because honey ferments faster than sugar and quickly develops a mold that can kill hummingbirds
Plant Flowers: preferred flowers include petunias, gladiolus, nasturtiums, begonias, morningglory, evening primrose, columbine, and cardinal flower
Rooftop/Balcony Gardens: can provide source of nectar if appropriate flowers are planted

Note: ***Plant Flowers*** should not be recommended to establish ***Rooftop/Balcony Gardens***

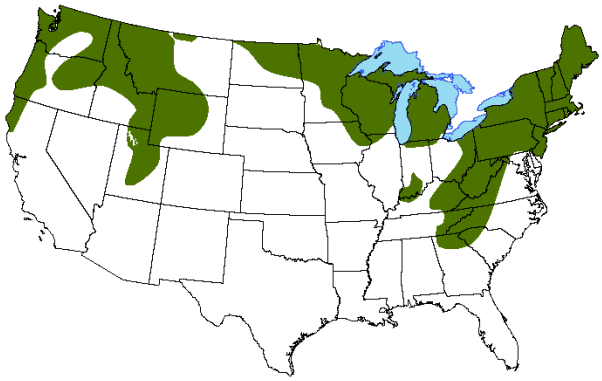
Ruffed grouse

General information

Dwayne Elmore

The ruffed grouse is a relatively large game bird that occurs across southern Canada, the more northern latitudes of North America, and down the Appalachian range. Ruffed grouse are found in a variety of deciduous forest types as well as mixed deciduous-conifer forest, but are particularly closely associated with aspen, especially young stands with relatively dense structure. Male ruffed grouse attract females during the mating season in spring by standing on downed logs, usually in dense cover, and flapping their wings to their breast, which causes a low drumming sound. This activity is called drumming. Ruffed grouse populations are decreasing across their range where forest management has been limited.

Habitat requirements



Diet: buds, hard and soft mast, insects and other invertebrates, and leaves of forbs
Water: necessary water obtained from diet
Cover: 6- to 20-year-old stands are required for cover provided by the high stem density; mature forest in close proximity to young stands may be used for feeding on acorns and other hard mast; a variety of forest types and age classes are used for nesting

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative vegetation reduces habitat quality for ruffed grouse
Create Snags: where drumming logs are limiting, large-diameter (18+ inches), non-mast producing trees may be killed or felled
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) within mature forest will stimulate regeneration that will provide optimum cover within 6 years; *Timber Stand Improvement* practices can be used to stimulate desirable structure and stem density and enable crowns of desirable trees to grow and produce additional mast
Livestock Management: livestock should be excluded from areas managed for ruffed grouse
Plant Shrubs: where additional soft mast is needed and to develop thickets and woody cover in openings
Plant Trees: in relatively large openings where planting is necessary and where mast-producing trees are limiting
Set-back Succession: *Prescribed Fire* can be used to maintain and rejuvenate high stem densities and enhance herbaceous cover important for brooding cover, particularly in aspen stands; *Chainsawing* can be used to remove trees and increase stem density in the forest understory
Decrease Harvest: may be necessary if populations are declining in areas where hunting pressure has been excessive
Wildlife or Fish Survey: drumming counts are most often used to estimate population trends

Sage thrasher

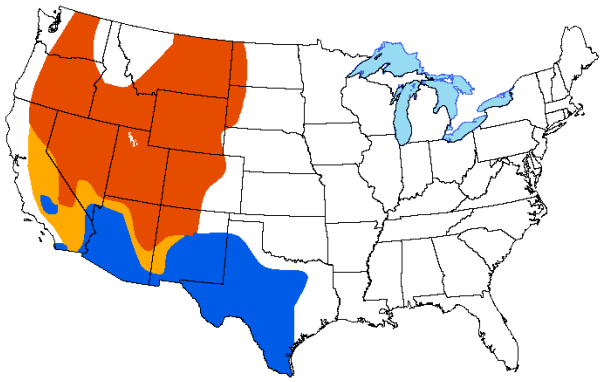
General information

Sage thrashers are found mostly in shrub-dominated valleys and plains of the western U.S. They prefer sagebrush and generally are dependent on large patches and expanses of sagebrush during the breeding season. Sage thrashers usually nest within sagebrush or other shrub close to the ground. Nests are constructed of twigs and lined with fine grasses and hair. Clutch size is 1-5 eggs. Sage thrashers forage for insects on the ground and usually run on the ground when disturbed, rather than flying.

Dave Menke

Habitat requirements:

Diet: spiders, crickets, caterpillars, beetles, and grasshoppers; some soft mast from deciduous shrubs also are eaten
Water: necessary water is obtained from the diet
Cover: sagebrush required for nesting and escape cover; nest constructed of twigs and grass



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for sage thrashers
Plant Shrubs: where shrub cover is less than 60 percent
Set-back Succession: *Chaining*, *Drum-chopping*, *Chainsawing*, and *Herbicide Applications* can be used to maintain low shrub growth
Wildlife or Fish Survey: point counts are used to estimate population trends

Scaled quail

General information

Greg Lavaty

Scaled quail are found in arid grasslands with a shrub, cactus, and yucca component in the southwestern U.S. The arid environment is characterized by sparse herbaceous cover in most years. However, areas with abundant cover have higher scaled quail densities. A variety of shrub species provide important escape and loafing cover, though scaled quail will avoid areas where shrubs exist in high densities. Proper grazing management is an important component in maintaining habitat for scaled quail. They nest on the ground, usually under relatively dense, low-growing shrub or grass cover

Habitat requirements

Diet: various seeds of forbs and shrubs are major component of diet; insects are also readily consumed and are critical for chick survival; green herbaceous material and soft mast of various native plants are also consumed
Water: necessary water may be obtained from diet; however, free-standing water from ponds, tanks, and streams may increase survival during drought years
Cover: brushy cover (shrubs or cacti) overhead with an open structure at ground level is critical, particularly for nesting; scattered patches of shrub and cactus with a good cover of native warm-season grasses provide excellent cover

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for scaled quail; cheat grass and other bromes, weeping and Lehman lovegrass, and Old World bluestems are various plants that may be problematic
Field Borders: to increase usable space around crop fields
Leave Crop Unharvested: to provide additional food source through winter
Livestock Management: should not allow overgrazing to limit herbaceous cover
Plant Native Grasses and Forbs: where nesting and brood cover is lacking and planting is necessary
Plant Shrubs: where there is less than 60 percent shrub cover
Set-back Succession: *Prescribed Fire* may increase herbaceous cover needed for food and cover; *Chaining*, *Drum-chopping*, and *Disking* can be used to reduce or thin shrub cover if needed and if increased herbaceous groundcover is needed
Tillage Management: to provide waste grain
Water Developments for Wildlife: guzzlers and dugouts can provide supplemental water, especially in drought years
Decrease Harvest: may be necessary if populations are declining and hunting pressure has been excessive
Wildlife or Fish Survey: aerial or ground transects are used to estimate population trends

Sharp-tailed grouse

General information

Sharp-tailed grouse are game birds of the northern Great Plains. Ideal habitat contains about two-thirds native grassland interspersed with shrubs, cropland, and scattered trees. Sharp-tailed grouse require bare or grassy ridges and natural rises that offer good visibility for breeding displays. Sharp-tailed grouse gather on these sites in the spring where males dance in front of the females to attract a mate. These areas are called "dancing grounds." It is important to maintain areas of thick grass and shrub cover within several miles of dancing grounds.

Richard Baetsen

Habitat requirements

Diet: young grouse eat insects and small seeds; adults eat a variety of leaves, buds, seeds, and grains; buds of shrubs and small trees are most important during winter
Water: necessary water is obtained from diet
Cover: nests are on the ground in grass or sparse shrub cover; thick shrubs and tall herbaceous vegetation is required for winter cover; tall dense vegetation associated with wetland edges is also used for winter cover

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for sharp-tailed grouse
Delay Crop Harvest: until after nesting season to avoid disrupting nests
Field Borders: to increase usable space around crop fields
Leave Crop Unharvested: to provide additional food source through winter; alfalfa, sunflowers, and grain sorghum are often used
Livestock Management: should maintain a diverse structure throughout the grassland; some dense grassland areas should be maintained to provide nesting cover; more sparse areas containing forbs and insects should be adjacent to nesting areas for brood cover; on sandy soils, both of these conditions may be present together; proper stocking rate is critical; delay grazing on portions of grasslands to provide tall undisturbed cover during the primary nesting season (May-June)
Plant Food Plots: food plots containing alfalfa or sunflowers may be planted where winter foods may be limiting or to enhance hunting opportunities
Plant Native Grasses and Forbs: where high-quality native grassland habitat does not comprise at least 60 percent of the area; should be recommended only on sites where planting is necessary to establish native grass cover
Plant Shrubs: small groups of shrubs may be planted in natural draws and idle land areas where cover and winter food may be limiting; woody cover should not be planted on upland sites that historically did not support woody cover
Set-back Succession: *Prescribed Fire* is recommended to increase grassland vigor, which will increase availability of insects and seeds; *Chainsawing* and *Herbicide Applications* can be used to remove trees

Tillage Management: grain stubble should be left through winter to provide a food source; stubble heights of 6 inches or more is preferred
Decrease Harvest: may be necessary if populations are declining and hunting pressure has been excessive
Wildlife or Fish Survey: observational surveys, especially on dancing grounds in the spring, are used to estimate population trends

Song sparrow

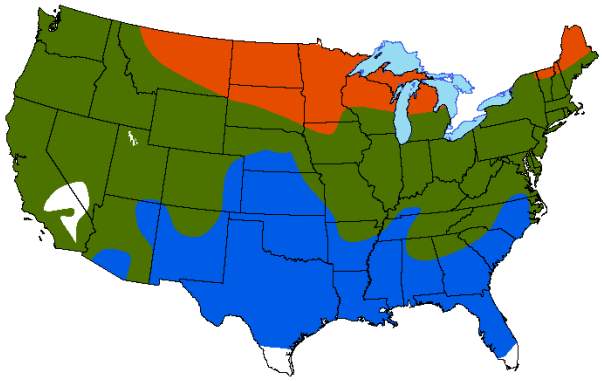
General information

Song sparrows inhabit all of the U.S., but will migrate from extreme northern areas during the colder months of the year. Song sparrows typically use shrubby areas interspersed with herbaceous openings and forest, especially along riparian areas. Song sparrows often nest along forest edges. The nest is made of grass and leaves and in the shape of a cup. Nests are often placed on the ground under a shrub or in thick herbaceous cover. Song sparrows primarily feed on the ground and eat seed, insects, and fruit.

Lee Karney

Habitat requirements

Diet: weed seeds, insects, soft mast
Water: free-standing water is required frequently during the warm seasons
Cover: thick shrubs and herbaceous cover for nesting, loafing, and escape



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and degrade habitat for song sparrows
Forest Management: *Timber Stand Improvement* practices can stimulate increased brushy cover where lacking
Plant Native Grasses and Forbs: where lacking to provide cover for nesting
Plant Shrubs: to provide soft mast where there is little soft mast available
Set-back Succession: *Chainsawing* can create additional brushy cover
Water Development for Wildlife: drinking water may be provided in birdbaths or pans of water
Wildlife or Fish Survey: point counts are used to estimate trends in populations
Artificial Feeders: for use in Urban areas; millets and sunflower seeds are favorites
Mowing*:* can be used to maintain openings in Urban areas

Sooty grouse

General information

Glen Tepke

The sooty grouse is a relatively large grouse that occurs predominantly in coastal mountainous areas from northern California north through British Columbia. Sooty grouse are found in coniferous forest with scattered small herbaceous openings and shrub cover. Sooty grouse roost in forest edges near shrub vegetation where they forage. Their nests are usually on the ground, often under shrubs or near fallen logs. Sooty grouse typically forage on the ground spring through fall, but may spend most of time foraging on buds and needles in trees during winter. Males often vocalize with a deep booming call that can be difficult to locate while perched in trees.

Habitat requirements

Diet: soft mast, buds, seeds, forbs, and insects from spring to fall; needles of coniferous trees may be eaten in winter
Water: necessary water obtained from dew and diet
Cover: nest on the ground near forest edges, often under shrubs or next to fallen logs

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for sooty grouse
Forest Management: *Forest Regeneration* (*Group Selection*, *Single-tree Selection*) will increase herbaceous groundcover for foraging near nesting and roosting areas; *Timber Stand Improvement* can be used in stands not ready for regeneration to enhance herbaceous groundcover
Livestock Management: livestock should be excluded from areas where sooty grouse may be nesting mid-April through mid-June
Plant Native Grasses and Forbs: particularly for agricultural fields going out of production and where early successional habitat is limiting
Plant Shrubs: to provide soft mast and buds where needed
Plant Trees: coniferous trees may be planted to provide a winter food source where needed
Set-back Succession: *Chainsawing* and *Prescribed Fire* can be used to maintain herbaceous groundcover and improve cover for nesting; *Herbicide Applications* can reduce woody encroachment in small herbaceous openings
Decrease Harvest: when surveys show a decline in the local population, especially where hunting has been excessive
Wildlife or Fish Survey: call counts and point counts may be used to estimate population trends

Southwest willow flycatcher

General information

Jim Rorabaugh

The Southwest willow flycatcher is a neotropical migrant that breeds in riparian areas of the arid southwestern United States and northwestern Mexico and winters in the rain forests of Mexico, Central America, and northern South America. This subspecies of the willow flycatcher is a federally listed threatened species because of habitat degradation and brood-rearing parasitism by brown-headed cowbirds. Habitat loss is caused by changes in the flood and fire regime (from water diversion and groundwater pumping, impoundments, and stream channelization), aesthetic mowing, and unmanaged livestock grazing. Riparian corridors with dense patches of trees (such as willows and cottonwoods) and shrubby vegetation (such as buttonbush and blackberry) with interspersed openings are preferred habitat. This type of cover is found near rivers, swamps, lakes, and reservoirs. Nests are typically built low at the outer edge of shrubs, usually near water.

Habitat requirements

Diet: insects
Water: obtained through diet
Cover: vegetation 3-15 feet tall, including relatively tall herbaceous plants, shrubs, and trees; nests are made of bark and grass

Wildlife management practices

Conservation Easement: can protect critical habitat for this declining subspecies of willow flycatcher
Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for southwest willow flycatchers
Livestock Management: livestock should be excluded from riparian areas when managing for southwest willow flycatchers; overgrazing removes vegetation at the height necessary for nesting and may reduce shrub cover
Plant Shrubs: along riparian areas where there is a lack of shrub cover for nesting
Plant Trees: along riparian areas where cover is lacking
Set-back Succession: *Chainsawing*, *Prescribed Fire*, or *Herbicide Applications* may be necessary if the tree canopy in the riparian zone is minimizing sunlight and preventing a desirable herbaceous understory and midstory
Wildlife or Fish Survey: point counts are used to estimate population trends

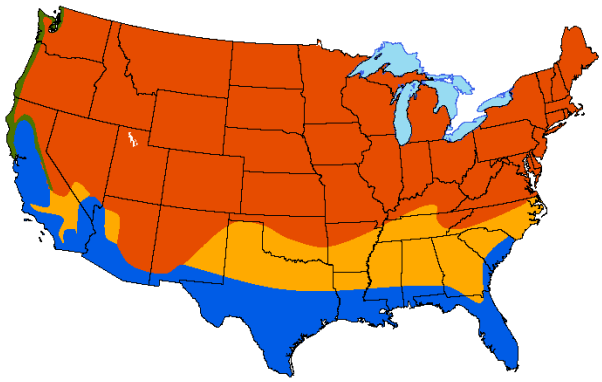
Spotted sandpiper

General information

madlyinlovewithlife

Spotted sandpipers are medium-sized shorebirds that occur all across North America. During the breeding season, they have pale breasts with brown spots, hence the name. They are found in very shallow water areas and along mudflats where they search for freshwater invertebrates and other foods. They are active foragers and walk in meandering paths, darting for prey. Nests are placed in a small depression on the ground, often under a canopy of vegetation, and lined with fine grasses. Spotted sandpipers exhibit an unusual breeding strategy where the female establishes and defends her territory and may breed with several males. The male incubates the eggs and takes care of the nestlings.

Habitat requirements



Diet: flies and their aquatic larvae (midges), grasshoppers, beetles, worms, snails, small crustaceans
Water: acquire necessary water while foraging and from diet
Cover: shallow, freshwater wetlands and mudflats; sometimes dense herbaceous vegetation for nesting

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for spotted sandpipers
Livestock Management: should not allow overgrazing to limit herbaceous vegetation that is used for nesting; livestock may be excluded from areas managed for spotted sandpipers
Plant Native Warm-Season Grasses: where groundcover is lacking and planting is necessary
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate herbaceous groundcover around wetlands for nesting cover
Water Control Structures: should be installed if one is not present in a wetland that has a dam or levee to allow the water level to be manipulated
Water Developments for Wildlife: small impoundments and ponds may be constructed if habitat is limiting
Wildlife or Fish Survey: observation counts are used to estimate population trends

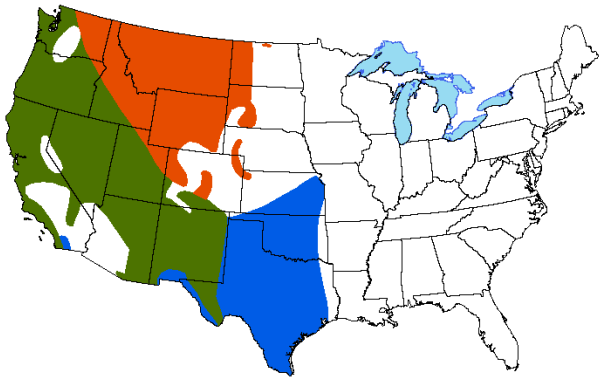
Spotted towhee

General information

Dave Menke

Spotted towhees are relatively large songbirds that occur in the western U.S. They are fairly widespread and abundant and found in dense shrub cover, typical of woodland edges, shrub thickets, chaparrel, canyon drainages, and old-fields. Nests are made of leaves, twigs, strips of bark, and grasses, and usually placed on the ground among the shrub cover against a log, clump of grass, or base of a shrub for further concealment. Nests contain 2-6 eggs. Spotted towhees may have 1-3 broods per year. Spotted towhees forage on the ground among leaf litter, where they hop and scratch for invertebrates and various seed. Spotted towhees are sensitive to habitat loss, thriving in in disturbed areas where agricultural and residential developments are minimal.

Habitat requirements



Diet: ants, beetles, caterpillars, crickets, grasshoppers, moths, wasps, millipedes, spiders dominate the diet; in winter, various seeds, acorns, soft mast, and grains (oats, wheat, corn) are more prevalent
Water: necessary water is obtained from the diet
Cover: shrub cover is used for loafing, foraging, nesting, and escape

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for spotted towhees
Edge Feathering: can increase usable space where woods meet fields
Forest Management: *Forest Regeneration* (*Clearcut*) will create brushy cover for 5 to 10 years; *Timber Stand Improvement* (heavy thinning) can stimulate brushy understory growth
Livestock Management: should not allow overgrazing to limit herbaceous vegetation or leaf litter that is used when foraging; livestock may be excluded from areas managed for spotted towhee
Plant Shrubs: in large areas of Stages 2 and 3 to provide Stage 4 for nesting and cover
Set-back Succession: *Prescribed Fire*, *Chaining*, and *Drum-chopping* can be used to promote dense resprouting shrubs; *Chainsawing* and *Herbicide Applications* can be used to reduce tree cover and stimulate increased shrub cover and stem density
Wildlife or Fish Survey: point counts can be used to estimate population trends

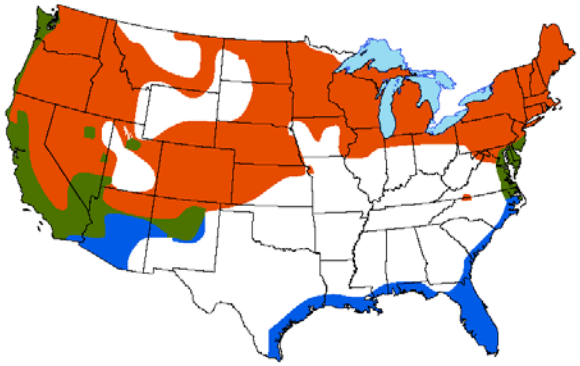
Virginia rail

General information

Dave Menke

The Virginia rail is a game bird of freshwater marshes, but occasionally occurs in saltwater marshes. It prefers to stay hidden in moderately dense emergent vegetation and is more often heard than seen. If wetland vegetation becomes too thick, Virginia rails will not be as abundant. Virginia rails may be found in wetlands of all sizes, but prefer hemi-marsh, which is represented by scattered patches of emergent vegetation with small openings of open water at about a 50:50 ratio. Periodic water level manipulation should be used to favor annual wetlands plants and avoid a monoculture of perennial wetland vegetation. Shallow water depths (generally less than 1 foot) are required. Virginia rails will flee quickly on the ground through vegetation if approached and will fly rarely. They typically inhabit shallow water areas and can swim under water if attacked. Virginia rails are migratory and can travel great distances. The Virginia rail is known to build dummy nests around the vicinity of their actual nests.

Habitat requirements



Diet: insects, aquatic invertebrates, snails, small fish, and small amphibians; some seeds and plant material in fall and winter
Water: obtained from food
Cover: moderately dense wetland vegetation, such as cattails, sedges, rushes, smartweeds, and other plants are used for cover; nests are woven into vegetation over shallow water and may have a canopy over them

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to limit open water or otherwise reduce habitat quality for Virginia rail
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* may be used in wetlands dominated by very dense perennial vegetation to encourage a hemi-marsh consisting of openings and annual plants; *Chainsawing* and *Herbicide Applications* may be used to reduce tree cover and create more open marsh
Water Control Structures: should be installed if not present in dikes to allow periodic water drawdowns to maintain a hemi-marsh structure and the appropriate shallow water required by Virginia rails
Water Developments for Wildlife: shallow impoundments can be constructed to provide habitat
Decrease Harvest: may be necessary where populations are declining, especially where hunting pressure has been excessive
Wildlife or Fish Survey: Call counts are most often used to estimate population trends; playing a tape of their call increases the chance of hearing rails; also, ropes can be dragged across vegetation between two or more observers to flush birds during observation counts

Western bluebird

General information

Dave Menke

Western bluebirds occur in portions of the western U.S. and southwestern U.S. and Mexico. They tend to use more wooded areas than eastern or mountain bluebirds. Western bluebirds are usually found in open woodlands, especially ponderosa and pinon pine-juniper. Open deciduous forest, particularly aspen that has been burned, where cavity trees are plentiful are commonly used. Wooded riparian areas in arid environments also attract western bluebirds. Like other bluebirds, insects dominate the diet during spring and summer, and various fruits are most prevalent during fall and winter. Western bluebirds nest in cavities, especially old woodpecker cavities, as well as nest boxes. Clutches consist of 2-8 eggs. Western bluebirds may have 1-3 broods per year.

Habitat requirements

Diet: invertebrates, especially grasshoppers, crickets, beetles, and spiders; various fruits, such as chokecherry, elderberry, grape, raspberry, sumac, serviceberry, and poison oak, in fall and winter
Water: necessary water obtained from diet
Cover: nest in cavities of trees and fence posts

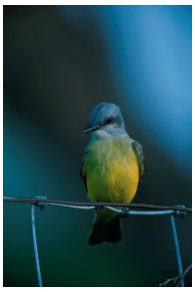
Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduces habitat quality for western bluebirds
Create Snags: where cavities are limited to provide potential nest sites and perching sites in open areas
Edge Feathering: to increase foraging opportunities, perching sites, and potential cavity trees (if trees are killed and left standing) around fields
Field Borders: to increase foraging opportunities around crop fields
Forest Management: *Forest Regeneration* (*Seed Tree*, *Shelterwood*) may be used to enhance habitat in pine forests for a few years, especially if coupled with *Prescribed Fire*; *Timber Stand Improvement* may be used to enhance habitat by reducing tree density in pine forests and woodlands
Livestock Management: livestock must be excluded from recently planted trees and shrubs
Nesting Structures: should be erected where a scarcity of natural cavities may be limiting the population; nest boxes should be approximately 5 feet high with an entrance hole 1½ inches in diameter; nest boxes should be placed no closer than 80 yards apart to limit territorial fighting among males
Plant Native Grasses and Forbs: to aid in establishing herbaceous groundcover where planting is necessary
Plant Shrubs: in large open areas where perching sites or winter foods may be limiting
Plant Trees: in large open areas where perching sites are limiting; may provide potential nest sites in distant future

Set-back Succession: *Prescribed Fire* is recommended to improve woodland structure and maintain herbaceous openings for western bluebirds; *Herbicide Applications* may be used to reduce tree density; *Chaining* and *Drum-chopping* can be used to reduce shrub cover where necessary; *Chainsawing* can be used to convert forested areas to open woodlands; *Root Plowing* may be used to reduce shrub density and promote herbaceous openings
Wildlife or Fish Survey: point counts can be used to monitor bluebird populations; nest boxes should be checked to monitor use and nest success
Mowing: can be used to maintain open areas in Urban environments

Western kingbird

General information

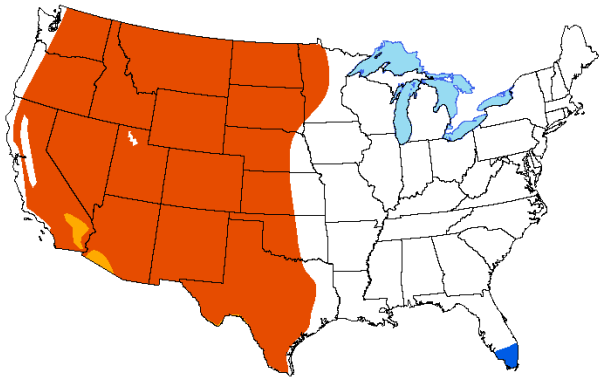


Gary Kramer

Western kingbirds are readily seen throughout the western U.S. They are found in grasslands, pastures, cultivated fields, desert shrub areas, savannas, and urban areas. Scattered trees and shrubs are used for nesting cover, and human activity often improves habitat because trees and structures provide potential nest sites. Western kingbirds winter in southern Mexico and Central America.

Habitat requirements

Diet: more than 90 percent of the diet is comprised of insects; soft mast from various plants is occasionally eaten
Water: water requirements unknown
Cover: trees and shrubs for nesting and perching; nests may also be placed on buildings, windmills, utility poles, and antennas; herbaceous openings for foraging



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation is beginning to reduce habitat quality for western kingbirds
Create Snags: to provide perching sites where open areas where trees are abundant
Edge Feathering: to increase nesting cover around fields
Field Borders: to increase prey abundance around crop fields
Plant Native Grasses and Forbs: in areas where herbaceous openings are limiting and planting is necessary
Plant Shrubs: in open areas where nesting cover is limiting
Set-back Succession: *Prescribed Fire* and *Disking* can be used to maintain herbaceous openings; *Chainsawing* and *Root Plowing* can be used to create herbaceous openings where limiting
Wildlife or Fish Survey: point counts are used to estimate population trends

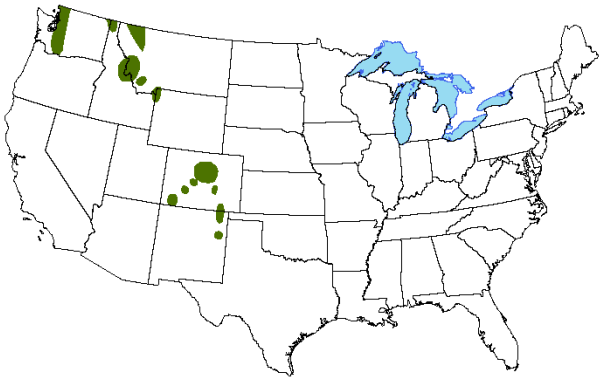
White-tailed ptarmigan

General information

Greg Lavaty

The white-tailed ptarmigan occurs in alpine regions of western North America. Their distribution and abundance is relatively consistent over time because their range is very remote and largely undisturbed. They inhabit alpine ridges and meadows approximately 2,000 feet above timberline during spring and summer. Males vigorously defend their breeding territory from other males with "scream flights" to intimidate rivals. Rock bases are preferred nesting cover because of warmer temperatures for incubation and openness for quick escape from predators. Low-growing willow and mosses are used as cover as well. In winter, white-tailed ptarmigan are found at slightly lower elevations within a few miles of summer ranges and closer to the timberline where willows are more abundant. Willows are critical for cover and food, especially during winter. Alpine ecosystems take a long time to recover when disturbed. Therefore, preventing disturbance can be critical for white-tailed ptarmigan habitat management.

Habitat requirements



Diet: buds, twigs, catkins, fruits, seeds, flowers, stems, leaves, and insects are common in spring and summer; buds and twigs of willows are most common in fall and winter
Water: largely unknown, though they have been observed drinking water and eating snow
Cover: rocks or clumps of vegetation around rocks are most often used for nesting because of increased warmth and protection from inclement weather; high, rocky, windswept ridges with interspersed herbaceous vegetation are used for brooding; in winter, areas near the treeline up to almost the summering range where there is an abundance of willow (food) and soft snow (roosting cover) for concealment with their white winter plumage

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to encroach and reduce habitat quality for white-tailed ptarmigan
Livestock Management: should prevent livestock grazing where ptarmigan occur
Plant Shrubs: willows may be planted for food and cover where they are lacking, especially near the treeline below alpine areas
Decrease Harvest: may be necessary if the local population is declining at the current harvest level
Wildlife or Fish Survey: scream call counts are the only known survey technique, but they are limited because of the remote locations and small range of effectiveness

White-winged dove

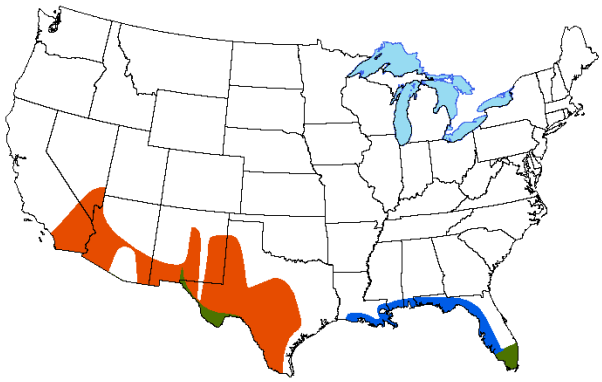
General information

White-winged doves are generally found near the southern borders of the United States. They use agriculture and open areas for feeding and dense shrubs and trees for nesting and loafing. They are also found in urban and riparian areas. White-winged doves are light brown with a black mark on the cheek and a white band on the edge of their wing, for which they are named. They build nests, comprised mainly of twigs, in trees where they will lay only 1 or 2 eggs. Both the male and female will produce crop milk to feed their young, often eating snails or bone to increase calcium content. They often roost, forage, or migrate as flocks.

Gary Kramer

Habitat requirements

Diet: a variety of grass and forb seeds (such as spurge, bristlegrass, saguaro cactus, and brasil), waste grain from cropland and livestock feedlots; small areas of bare ground are beneficial for obtaining grit (small gravel) to help digest food
Water: free-standing water is required daily
Cover: tall shrubs and trees for nesting and loafing; nests are made of twigs placed on branches of shrubs or trees; nests may also be placed on the ground



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for white-winged doves
Create Snags: where needed to create perching sites
Leave Crop Unharvested: will provide additional food from a variety of small grain crops, such as millets, grain sorghum, wheat, and oats
Livestock Management: should prevent overgrazing forbs, which will reduce food availability for white-winged doves
Plant Food Plots: where additional food, specifically grain, is needed
Plant Native Grasses and Forbs: forbs may be planted in areas where food is limiting and planting is feasible
Plant Shrubs: in large open areas where nesting sites are limited
Plant Trees: especially along riparian areas where nesting cover is limiting
Set-back Succession: *Prescribed Fire* can be used to enhance seed availability; *Disking* and Herbicide Applications can provide bare ground; *Chainsawing*, *Chaining*, *Drum-chopping*, and *Root Plowing* can be used to reduce shrub cover and provide increased bare ground and forb production
Tillage Management: eliminate tillage in the fall to allow access to waste grain
Water Developments for Wildlife: where water is limiting, small ponds, guzzlers, or windmills can provide free-standing water
Wildlife or Fish Survey: observational surveys and point counts are used to estimate population trends

Wild turkey

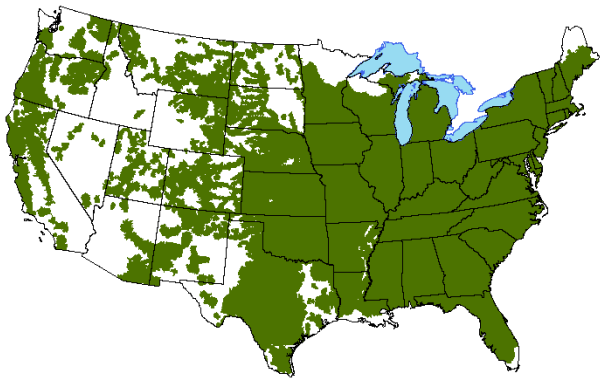
General information

Robert Burton

Wild turkeys are large game birds found across the U.S. They are adapted to use a wide variety of vegetation types, from deciduous forest to desert shrub to open grassland interspersed with tree-lined riparian areas. Their distribution is largely limited only by snow depth and persistence to the north, which limits their ability to forage on the ground, and by trees or large shrubs needed for roosting at night. Wild turkeys flock together during fall and winter. Breeding occurs in spring when males gobble to attract females. Nests are a slight depression on the ground, usually placed adjacent to a log, shrub, or some other structure to aid in concealment. Shrub cover is often used for nesting, but wild turkeys also nest in open woods and in fields. Nests are lined with leaves and other vegetation and usually contain about 12 eggs. Poults (young turkeys) are precocial, meaning they are able to walk around with the hen and forage for themselves soon after hatching. Herbaceous openings, especially those with a forb canopy and open ground structure, are preferred for brooding. Although wild turkeys spend most of their time on the ground, except when the fly up into trees in the evening to roost for the night, they can fly well and often take flight for short distances to escape possible predation.

Habitat requirements

Diet: extremely varied; hard mast, especially acorns and beechnuts in the fall and winter; soft mast, such as blackberries, mulberries, and black cherry; insects and other invertebrates, including spiders and snails, are especially important for young poults and hens prior to nesting; miscellaneous seeds; leaves from forbs and grasses; grain from a variety of agricultural crops
Water: obtain water from diet, but may use free-standing water when available
Cover: mature forest, regenerating forest, brushy areas, and old-fields for nesting; mature forest; herbaceous openings; grain fields for foraging; trees or tall shrubs for roosting



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for wild turkeys; common examples include sod-grasses, such as tall fescue, bermudagrass, and others, such as cogongrass, which limit mobility for turkey poults and food availability; kudzu and shrub honeysuckle are other species that often degrade habitat in forested areas
Edge Feathering: can enhance nesting and brooding cover around fields
Field Borders: to increase usable space for nesting and brooding around row crop fields
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*, *Seed-tree*) can enhance nesting and brooding cover and stimulate increased soft mast and miscellaneous seed for a

few years after harvest; *Timber Stand Improvement* can improve the structure of the understory for nesting and brood rearing, increase production of soft mast and miscellaneous seed, and enable crowns of desired trees to grow and produce additional mast

Leave Crop Unharvested: especially corn, soybeans, and grain sorghum, to provide supplemental food source during fall and winter

Livestock Management: should prevent livestock from degrading habitat by overgrazing and damaging planted trees and shrubs

Plant Food Plots: to provide supplemental foods where food may be limiting or increase carrying capacity where increased wild turkeys is desirable; corn, soybeans, wheat, and clovers are often used

Plant Native Grasses and Forbs: where herbaceous cover is limiting and planting is necessary

Plant Shrubs: where additional soft mast or brushy cover is needed

Plant Trees: where additional hard mast production, especially acorns, is needed and where roosting sites are limited

Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous openings, rejuvenate shrubland, and improve understory structure and composition for foraging, brooding, and nesting in forests, woodlands, and savannas; *Disking* can be used to maintain herbaceous openings and reduce thatch build-up; *Herbicide Applications*, *Chaining*, *Root Plowing*, and *Drum-chopping* can be used to reduce shrub cover and stimulate more herbaceous groundcover; *Chainsawing* can be used to remove trees and create herbaceous openings, especially where brooding cover may be limiting

Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially when adjacent to tall shrub or forest cover

Water Developments for Wildlife: can be useful when there is little or no free-standing water

Decrease Harvest: may be necessary if populations are declining in areas where hunting pressure has been excessive

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

Wildlife Damage Management: may be necessary in rare instances when wild turkeys are depredating crops

Wildlife or Fish Survey: gobble surveys, poult surveys, and hunter success rates are used to estimate population trends

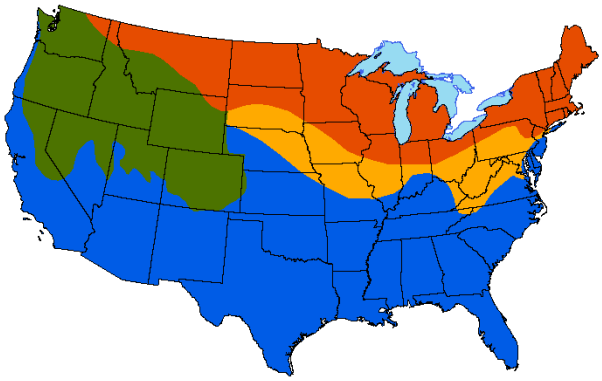
Wilson's snipe

General information

David Ward

Named after ornithologist Alexander Wilson, the Wilson's snipe is a ground-dwelling, migratory shorebird of North, Central, and South America that uses a variety of wetlands and riparian areas, especially where mudflats or sandbars are present. They breed, nest, and raise their broods during summer in their northern range and migrate to their southern range in the fall and winter. There are resident populations in the Pacific Northwestern United States. High-quality Wilson's snipe habitat will have a marshy area with low herbaceous vegetation, and sparse shrubs, with a mudflat or sandbar nearby. Nests are constructed of grass bowls placed on the ground in herbaceous vegetation near water.

Habitat requirements



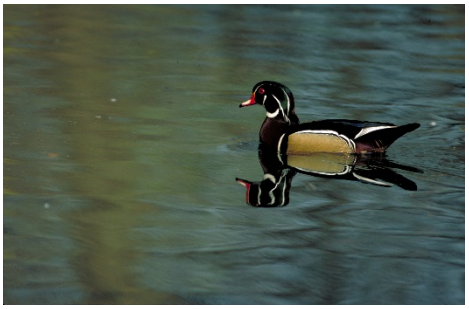
Diet: invertebrates (insects and larvae)
Water: obtained through diet
Cover: bogs, fens, swamps, and marshy, vegetated edges of ponds, rivers, and streams are used for courtship and nesting; areas with moist soil or mud for insect probing (such as wet fields, marshy edges of water bodies, and exposed muddy banks or sandbars) are used for foraging

Wildlife management practices

Control Nonnative Invasive Vegetation: may be necessary if nonnative plants are degrading habitat
Set-back Succession: *Disking* and *Herbicide Applications* can provide bare ground; *Prescribed Fire* can maintain herbaceous groundcover; *Chaining* can reduce excessive shrub cover; *Chainsawing*, *Root Plowing*, and *Herbicide Applications* may be used to remove trees and create wetland openings
Water Control Structures: to allow manipulation of water levels, expose mudflats, and encourage aquatic vegetation
Decrease Harvest: may be necessary when data suggests populations are trending downward
Wildlife or Fish Survey: flush counts, hunter harvest data, and breeding bird survey data are used to estimate population trends

Wood duck

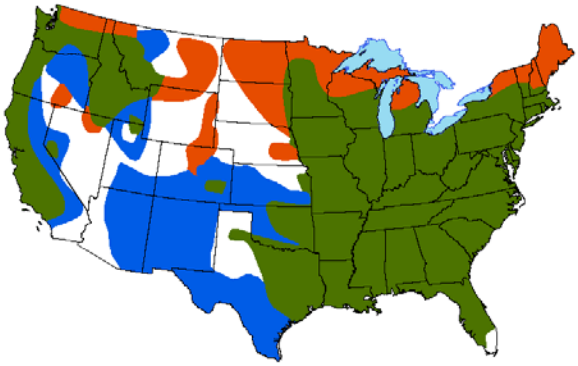
General information



Thomas G Barnes

Wood ducks are spectacularly colored ducks found throughout most of the U.S. They primarily use forested and shrub-emergent wetlands and riparian systems (rivers and creeks), but may also forage and loaf in flooded fields, especially if there is plenty of emergent vegetation. Wood ducks nest in tree cavities, usually within or adjacent to flooded timber, but possibly up to 1 mile from water. Cavity availability is critical for a sustainable population. Thus, artificial cavities (nest boxes) are readily used by wood ducks and have been, most likely, the number one reason for the increase in wood duck populations during the past 50 years.

Habitat requirements



Diet: acorns are the primary diet item in fall and winter; other hard mast, miscellaneous seeds and soft mast, as well as waste grain (especially corn) also are eaten; insects and other invertebrates are most important for wood duck chicks and hens prior to and during the nesting season
Water: obtained through diet and drink free-standing water regularly
Cover: shallowly flooded bottomland hardwoods, emergent wetlands, swamps, and marshes are commonly used for loafing and foraging cover; tree cavities in forested areas and artificial cavities used for nesting

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for wood ducks; this is applicable in wetlands as well as adjacent uplands where wood ducks may be foraging
Create Snags: where relatively large cavity nesting sites (trees >12 inches in diameter) may be limiting
Forest Management: *Forest Regeneration* (*Shelterwood*, *Group Selection*) in relatively large forested areas that can be flooded will create openings with emergent woody vegetation that will attract foraging and loafing wood ducks; *Timber Stand Improvement* in bottomland hardwoods that can be flooded can lead to larger crowns of favored trees and increased mast production; woody stem density should increase following TSI and improve cover in stands that can be flooded
Leave Crop Unharvested: especially corn, to provide high-energy food source during fall and winter; this is especially important in fields that can be flooded and those adjacent to a water source used by wood ducks
Livestock Management: should prevent overgrazing in fields that are flooded for wood ducks; livestock should be excluded from bottomland hardwoods and areas where trees and shrubs have been planted

Nesting Structures: nest boxes should be erected where a lack of natural cavities may be limiting the wood duck population; nest boxes for wood ducks should be at least 100 yards apart and should not be placed within sight of each other to prevent dump nesting (if a wood duck hen sees another hen entering a cavity or nest box, she may be stimulated to enter that cavity and "dump" her own eggs instead of laying in her own nest; thus, heat from incubation is not even over too many eggs and fewer eggs hatch overall)
Plant Food Plots: shallowly flooded grain plots, especially corn, can provide an important source of energy in fall/winter, especially during years of poor mast production
Plant Shrubs: where there is a lack of emergent woody vegetation in open areas that can be flooded
Plant Trees: mast trees planted adjacent to or within open areas suitable for flooding may provide future food and nesting cavities in areas where these trees may be limiting
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Chainsawing*, *Prescribed Fire*, and *Herbicide Applications* can be used to reduce tree and shrub cover where needed to stimulate more herbaceous cover and provide increase food availability
Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially fields that can be shallowly flooded
Water Control Structures: should be installed in existing dikes if there are none present
Water Developments for Wildlife: shallow impoundments should be created where topography allows to provide increased feeding and nesting space for wood ducks
Wildlife or Fish Survey: nest box usage rates, brood counts, and flush counts are used to estimate population trends

Yellow-rumped warbler

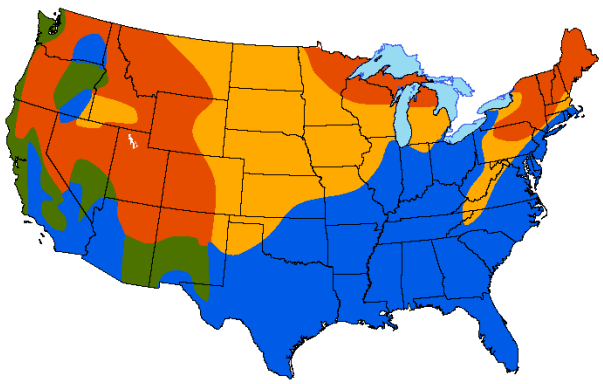
General information

Yellow-rumped warblers are relatively large warblers found throughout the U.S., Canada, and Mexico. They breed throughout southern Canada, the western U.S., the Great Lakes region, and the northeastern U.S in coniferous and mixed coniferous-deciduous woodlands. They winter throughout the southern U.S. using open areas, especially shrub cover with plentiful soft mast. Yellow-rumped warblers eat insects gleaned from the branches and bark of trees and shrubs, and may also catch insects on-the-fly.

Frank Miles

Habitat requirements

Diet: ants, caterpillars, beetles, grasshoppers, craneflies, and spiders in spring and summer; various seeds and fruit during winter, such as bayberry, wax myrtle, juniper, poison ivy, greenbrier, grapes, Virginia creeper, and dogwoods
Water: necessary water obtained from diet, but free-standing water is used when available
Cover: coniferous or mixed forest during nesting season; occasionally nest in shrubs; nest is made of twigs, bark strippings, and weed stems and placed on small branches 5 feet to 50 feet above the ground; brushy thickets are used for feeding, loafing, and escape during winter



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for yellow-rumped warblers
Forest Management: *Timber Stand Improvement* can improve forest structure for nesting and foraging
Livestock Management: should not allow overgrazing in wintering areas; livestock should be excluded from forested areas used for nesting
Plant Shrubs: where shrub cover is lacking in winter range
Plant Trees: where forest cover is limiting during the nesting season
Set-back Succession: *Prescribed Fire* and *Herbicide Applications* can be used to maintain open areas with scattered shrub cover in wintering areas
Wildlife or Fish Survey: point counts are used to estimate population trends

Mammals

American beaver

General information

Steve Hersey

Beavers occur throughout most of North America. They are found in various wetlands that have permanent water with a variety of shrubs and trees adjacent to the water. Beavers build dams from tree branches, shrubs, and mud to form ponds that stabilize water levels, slow water movement, and provide shelter beneath the ice in winter. Beavers also build lodges from sticks and mud and dig burrows in banks of streams and rivers. Beavers eat the inner bark of shrubs and trees and store cuttings in caches (piles of branches) for use during winter. The ecological benefits provided by beavers cannot be overstated. Beavers are responsible for creating habitat for many species of birds, mammals, reptiles, amphibians, fish, and invertebrates. Without beavers, the distribution and abundance of many freshwater wetland-associated species would decline dramatically. Unfortunately, beavers were once such a valuable fur resource that trapping led to their extirpation in many parts of their former range. Today, beavers have rebounded with help from wildlife agency regulations and a lack of available fur market. In some areas, beavers have become a nuisance, as they cut down trees and dam ditches and streams in undesirable places. Their dams often flood crops, destabilize road edges, and kill trees. When beavers construct dams in places that cause problems, removal of the beaver is usually the best solution. If the dam is destroyed and the beavers remain, they will build the dam again.

Habitat requirements

Diet: primarily bark from shrubs and trees; also some forbs and grasses
Water: prefer slow-moving or still water at least 5 feet deep (to allow movement under water
Cover: bottomland riparian areas that can be dammed to provide still water with sufficient depth

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for American beaver
Livestock Management: should prevent livestock access to riparian areas and other wetlands where beaver is a focal species; this may include developing livestock watering facilities in upland areas
Plant Shrubs: where beavers are desired, but not present, deciduous shrubs may be planted along riparian areas where there are few trees or shrubs to make the area more attractive to beavers
Plant Trees: where beavers are desired but not present, deciduous trees may be planted along riparian areas where there are few trees or shrubs to make the area more attractive to beavers

Water Control Structures: a Clemson Beaver Pond Leveler can be installed in beaver dams to maintain water levels

Decrease Harvest: may be necessary where an increased beaver population is desired and trapping pressure has limited growth

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

Wildlife Damage Management: should be implemented where beavers are causing problems for landowners, such as flooding timber, crops, roads, and other areas

Wildlife or Fish Survey: presence and extent of beaver activity (dams, evidence of cutting shrubs and trees) is used to estimate population trends over time

American marten

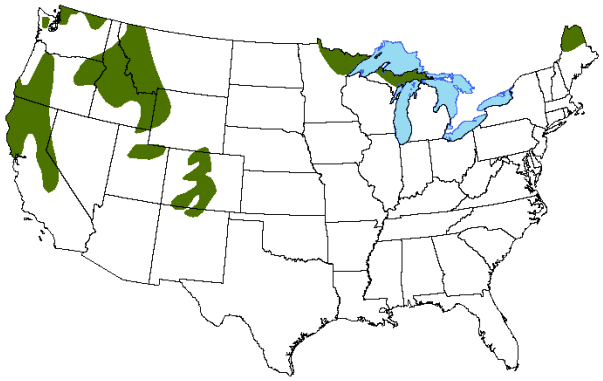
General information

USFWS

Martens are found primarily in mature coniferous or deciduous-coniferous forest of the upper Great Lakes, Rocky Mountains, and the mountains of the Pacific region and New England. Martens are carnivorous. They give birth and raise young in dens of hollow trees, stumps or rock crevices.

Habitat requirements

Diet: primarily voles, snowshoe hares, ruffed grouse, and squirrels; will also opportunistically eat eggs, amphibians, soft mast, and carrion
Water: necessary water obtained from diet
Cover: mature conifer forests, but also mixed hardwood forests; dens in hollow logs, stump holes, and rock crevices



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for American marten
Forest Management: *Forest Regeneration* (*Single-tree Selection*, *Group Selection*) and *Timber Stand Improvement* can diversify understory structure and composition and increase abundance of prey; snags should be retained for prey
Plant Trees: where additional forest cover is needed
Decrease Harvest*:* may be necessary when trapping pressure is limiting population
Increase Harvest: where populations can sustain additional trapping pressure
Wildlife or Fish Survey: track counts and trail cameras can be used to estimate population trends over time

Big brown bat

General information

Don Pfitzer

Big brown bats are one of 46 bat species in North America. They inhabit nearly all of the U.S., except south Florida and south-central Texas. They use a variety of vegetation types, from farmland to mature deciduous forest. Big brown bats are common in urban areas, including cities, parks, and suburban neighborhoods. They frequently use buildings and houses for daytime summer roosts and sometimes as winter hibernacula, but most hibernate in caves. Big brown bats are insectivores. Lactating females will eat their weight in insects daily. Males and females may roost individually or in small numbers, but males and females usually roost separately. Females may roost together in a maternal colony when pups are born and nursing. Females usually give birth to one or two pups, often in a hollow tree or attic. Big brown bats, as well as all other bat species, are nocturnal and are the only mammals capable of flying. Big brown bats will drink "on-the-wing" by dipping their lower jaw into a water source. Big brown bats hibernate in the winter in northern latitudes. Therefore, they do not actively feed during winter months, but instead rely on stored fat reserves.

Habitat requirements

Diet: night-flying insects, especially beetles
Water: free-standing water is required daily when they are active
Cover: buildings and hollow trees are often used for daytime roosts; bat houses may also be used for daytime roosting; caves, mines and buildings are used for hibernation

Wildlife management practices

Create Snags: to provide roost sites (only in areas where they pose no danger to human structures or health when they fall)
Nesting Structures: may provide additional roost sites if natural roost sites are limiting
Plant Trees: in large open areas where few trees are present to promote future old trees that may provide roost sites
Set-back Succession: *Chainsawing* and *Prescribed Fire* (in rural areas) can be used to maintain more than 50 percent open areas for foraging
Water Developments for Wildlife: where available open water is not available, small ponds and shallow impoundments may be constructed for drinking and to attract insects; water developments should be constructed with nothing above the water (such as fencing or bracing) so bats have an unobstructed flight path
Wildlife Damage Management: may be necessary when roosting or hibernating in areas occupied by humans
Wildlife or Fish Survey: observation counts are used to estimate population trends
Mowing: may be used in Urban areas to maintain openings

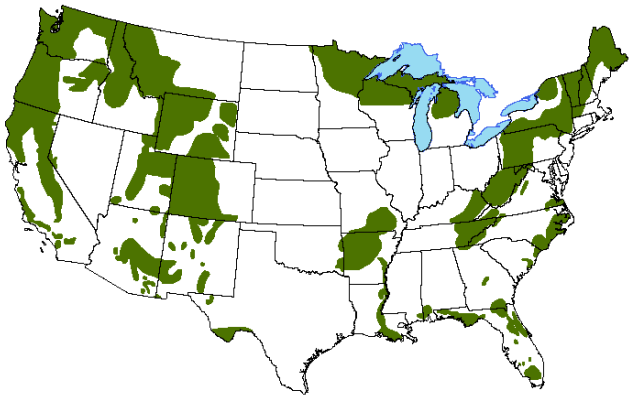
Black bear

General information

Steve Hillebrand

Black bears primarily use mature deciduous or mixed deciduous/coniferous forest interspersed with early successional openings containing soft mast. Young regenerating stands, shrub thickets with dense brushy cover, and riparian corridors are also used. Black bears are generally secretive and avoid human contact. However, black bears are highly adaptable and may occur in and around human dwellings and become problematic, especially if food is available. Black bears are primarily nocturnal, but may be seen anytime during the day. They hibernate in winter (even in warm climates such as Florida and Louisiana) and have large home ranges (several square miles) that vary based on sex, age, and/or time of year. In general, adult male home ranges (up to 50 square miles) are much larger than female home ranges (15 square miles). Black bears are omnivorous. However, more than 90 percent of their diet consists of vegetation. Liberalizing or restricting females in the harvest influences population growth. Regulation of bear population density is influenced by public tolerance toward bear-human conflicts, property damage, livestock and agricultural damage, and the desire to see bears.

Habitat requirements



Diet: in spring, skunk cabbage, squaw root, grasses, and insects; occasionally, small to medium-sized mammals, such as deer fawns and young livestock (calves and lambs) are preyed upon; during summer and early fall, a variety of soft mast, such as blackberry, blueberry, serviceberry, black cherry and pokeweed, are important; during late fall, acorns, beechnuts, and hickory nuts, as well as field corn and soybeans, help bears prepare for hibernation; when natural foods are scarce, bears may wander near human residences and feed on bird seed, dog/cat food, and other food scraps

Water: free-standing water is used for drinking; spring seeps and other shallow water sources are used to cool off and get away from biting insects; water is seldom a limiting factor because black bears have such a large home range

Cover: mature hardwood or mixed hardwood-conifer forests for foraging; brushy areas and young regenerating forest for loafing and escape; early successional openings primarily for foraging, usually for soft mast; rock crevices, excavations, hollow trees, dense mountain laurel and rhododendron thickets for hibernation

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for black bear

Edge Feathering: can stimulate increased soft mast production around row-crop fields (especially corn, soybean, and wheat)
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) creates dense escape and loafing cover for bears; an abundance of soft mast (pokeweed, blackberry, huckleberry, blueberry) is usually available in recently regenerated stands; *Timber Stand Improvement* practices can stimulate increased hard mast production and can stimulate groundcover, which usually increases soft mast production
Leave Crop Unharvested: strips of corn, wheat, grain sorghum, or soybeans should be left standing, especially where adjacent to escape cover, to provide food close to cover
Plant Food Plots: where available food may be limiting, forage and grain plots (especially corn) may be planted to provide additional nutrition
Plant Shrubs: crabapple, blueberry, hawthorn, wild plum, elderberry, and others can be planted within forest openings where soft mast is lacking
Plant Trees: apple, pear, cherry, persimmon, mulberry, and dogwood are good choices to provide additional soft mast
Set-back Succession: *Prescribed Fire* can stimulate groundcover and soft mast in early successional openings, maintain shrub cover when quality begins to decline, and stimulate understory structure and soft mast availability in forests, especially where sufficient sunlight reaches the forest floor
Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially when adjacent to dense shrub or forest cover
Decrease Harvest: may be necessary when additional bears are desired and hunting pressure may be limiting population growth
Increase Harvest: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Wildlife Damage Management Techniques: may be needed if bear-human conflicts occur in agricultural or urban settings
Wildlife or Fish Survey: scent stations, camera surveys, and hunter harvest data are used to estimate population trends

Black-tailed jackrabbit

General information

Ryan Hagerty

The black-tailed jackrabbit is a large, long-eared hare that lives in open, arid grasslands and brushland in the west. They prefer open pastures, even those that have been grazed, rather than thick brush for the increased visibility that helps them avoid predators. This jackrabbit has brownish fur peppered with black. Its hind feet are as large as its ears and used to run fast, up to 36 mph, to elude predators, such as hawks, coyotes, and bobcats. The large ears help regulate body heat by increasing or decreasing the blood flow through the ears. Black-tailed jackrabbits are mostly seen in the late evening hours and stay out at night to forage when they would be less likely to face predation. During the day, black-tailed jackrabbits rest in hollows made in the ground at the base of shrubs or tall grass for shade. They mate year-round and produce 1 to 4 litters per year with up to 8 young per litter. They do not typically make a nest. Black-tailed jackrabbits eat a wide range of vegetation depending on what is available. A concentration of these jackrabbits may overgraze parts of a property and is considered a pest in many places. Their population can be affected by a reduction in forage as a result of brush encroachment and development.

Habitat requirements

Diet: forage crops, twigs, cactus, mesquite, grasses, and forbs
Water: obtained from the foods they eat
Cover: open grasslands for foraging; shrubs and tall grasses for burrow cover

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for black-tailed jackrabbits
Livestock Management: should provide adequate forage for jackrabbits where black-tailed jackrabbit is a focal species
Plant Shrubs: can provide cover where trees and shrubs are lacking
Set-back Succession: *Prescribed Fire*, *Chaining*, *Drum-chopping*, and *Root-plowing* can be used to reduce shrub cover where necessary
Decrease Harvest: may be necessary if harvest has been excessive and an increase in the black-tailed jackrabbit population is desired
Increase Harvest: where population can withstand additional harvest for recreational hunting or when population needs to be lowered
Wildlife Damage Management: is necessary when jackrabbits reduce forage available for livestock
Wildlife or Fish Survey: observation counts are used to monitor population trends

Black-tailed prairie dog

General information

Elise Smith

The black-tailed prairie dog is the most widely distributed of the North American prairie dogs. They live in densely populated colonies (20 to 35 per acre) among subterranean burrows within grassland or sparse shrubland communities. Some areas of colonies will be bare ground where there is a high prairie dog density. They often establish colonies near intermittent streams, water impoundments, homestead sites, corrals, and windmills. They do not tolerate tall vegetation well—they avoid brush and timbered areas. In tall and mixed-grass rangelands, prairie dogs have a difficult time establishing a colony unless large grazing animals (bison or livestock) have closely grazed the vegetation. Heavily grazed or trampled areas are often selected by prairie dogs. Periodic disturbance, such as grazing, is required to maintain suitable conditions for prairie dogs, particularly in areas where rainfall is sufficient to support shrub and tree cover. Prairie dogs occupied up to 700 million acres of western grasslands in the early 1900s. In Texas, the largest prairie dog colony on record measured nearly 25,000 square miles. Since 1900, prairie dog populations have been reduced by as much as 98 percent in some areas and eliminated in others. Today, only about 2 million acres of prairie dog colonies remain in North America. Colonies must be linked to other adjacent colonies (generally less than 1 mile) as colonies periodically move or disappear only to be repopulated by nearby colonies. Therefore, multiple adjacent colonies are critical for long-term population persistence. Although prairie dogs can cause substantial damage to agriculture, prairie dogs are a keystone species on native range and part of a healthy range system. The loss of prairie dog colonies affects many other plant and animal species.

Habitat requirements

Diet: green grasses and forbs
Water: necessary water is obtained from diet
Cover: open grassland with relatively short vegetation; burrows provide escape cover

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for black-tailed prairie dogs
Livestock Management: grazing can promote suitable grassland structure for prairie dogs
Plant Native Grasses and Forbs: where planting is required to provide forage where limited
Set-back Succession: *Prescribed Fire* is used to maintain grasslands; *Chaining*, *Drum-chopping*, and *Root-plowing* can be used to reduce shrub cover and promote grass/forb community
Decrease Harvest: on native range where shooting or other population reduction methods have reduced prairie dog colonies to the point where they are approaching unsustainable levels
Increase Harvest: where populations can withstand increased hunting for recreation; can be used to limit population growth where additional prairie dogs are not desired
Wildlife Damage Management: registered control techniques, such as toxicants (toxic baits), fumigants and shooting can be used to reduce populations where damage is occurring to agricultural interests
Wildlife or Fish Survey: observation counts, aerial surveys, and extent of colonies are used to estimate population trends

Bobcat

General information

Bobcats occur throughout the U.S. Bobcats are carnivorous predators and are seldom active during the day. Bobcats may be a significant cause of mortality to pronghorn and wild turkeys, but are not considered a major source of mortality for deer. They are classified as a furbearer game species in many states.

Gary Kramer

Habitat requirements

Diet: rabbits, rodents, opossums, raccoons, skunks, pronghorns, deer, snakes, and many bird species, including wild turkeys, ruffed grouse, northern bobwhite, domestic poultry, and other livestock
Water: water requirements are not well known; free-standing water is used
Cover: dense cover, rocky outcrops and ledges, hollow logs, and other sheltered spots for denning

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for bobcat prey species
Edge Feathering: can provide increased cover and food for prey species
Field Borders: can provide increased usable space for bobcat and prey species
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) will provide increased dense cover and food resources for various prey species; *Timber Stand Improvement* can provide enhanced understory development and forage for various prey species; down woody debris (logs) can provide denning sites for bobcat
Livestock Management: should prevent overgrazing; livestock should be excluded from forests to prevent destruction of forest understory, which provides food and cover for many prey species
Plant Shrubs: in areas where additional shrub cover is needed to attract prey and provide security cover
Plant Trees*:* in areas where additional forest cover is needed to attract prey and provide security cover
Set-back Succession: *Prescribed Fire* can be used to maintain early successional communities, *Herbicide Applications*, *Chaining*, *Drum-chopping*, and *Root-plowing* can be used to reduce or maintain shrub cover
Decrease Harvest: may be necessary when additional bobcats are desired and hunting or trapping efforts may be limiting growth
Increase Harvest: where populations can sustain additional hunting or trapping pressure for recreation and where populations need to be lowered
Wildlife Damage Management: may be necessary if poultry or other livestock depredation is a problem
Wildlife or Fish Survey: track counts, scent stations, and trail cameras are used to estimate population trends

Brazilian free-tailed bat

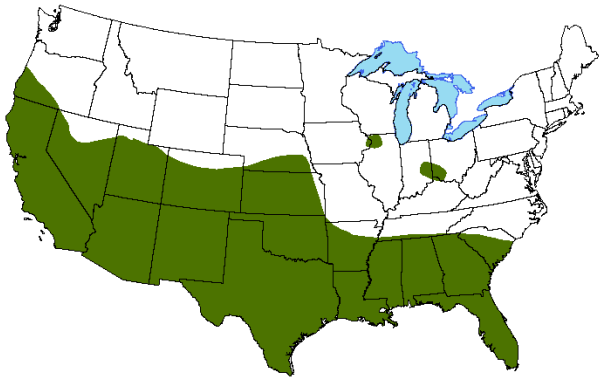
General information

J.N. Stuart

The Brazilian free-tailed bat roosts in large numbers at a relatively small number of roost sites. They have brown fur with broad ears, large climbing feet, and a characteristic "free," mouse-like tail. Anywhere from dozens to millions of bats may roost at a single site, which could be a cave, bridge, or other building structures with cracks or niches where bats can escape during the day. They are frequently found around and in buildings and have earned the nickname "house bats." At dusk, these free-tailed bats emerge from roosts to feed on insects and are estimated to eat between 6,000 and 18,000 metric tons of insects annually, in Texas alone! This insectivory is beneficial both for human comfort and the reduction of agricultural pests. The millions of bats that roost in central Texas spend their winters in Mexico, Central America, and possibly South America. In contrast, Brazilian free-tailed bats in east Texas are non-migratory and remain there during winter. Each female gives birth to one pup, who is unable to fly and without fur. Seventy percent or more of the young are born within a 10-day period in mid-summer. Young bats live in large congregations on cave ceilings. At about one month old, young bats are able to fly to find their own insects. Although a small percentage of the Brazilian free-tailed bat populations carry rabies (about 24 percent), humans occasionally use pesticides to poison the bats and vandalize key roosting sites because of fear.

Habitat requirements

Diet: insects, such as moths, beetles, flying ants, and June bugs
Water: require free-standing water; Brazilian free-tailed bats sweep over water sources and drink while flying
Cover: caves, mine tunnels, hollow trees, bridges, and other buildings for roots sites during the day; the young remain on the ceiling for about a month after birth



Wildlife management practices

Nesting Structures: providing bridges or man-made structures for bats to roost could help expand their population or decrease concentrations at existing roost locations.
Wildlife Damage Management: education on how to properly handle deceased bats to protect humans from the rabies virus could decrease fears of bats spreading the disease
Wildlife or Fish Survey: exit counts from caves are used to estimate population trends

Collared peccary

General information

C.A. Williams

The collared peccary (also called javelina [have-a-leena]) is game mammal found in the southwestern U.S. Although similar in appearance to pigs, the collared peccary is not in the same taxonomic family as pigs. They have a smaller body size than pigs with 4-toed hooves on their front feet and 3 toes on their back feet. The peccary's large head and long snout are capped off by sharp tusks pointing to the ground. Their black, bristly coats include a white collar around their neck. Javelinas have a strong-smelling musk gland on the top portion of their rump, which they use to mark their home range. They run in herds of a few to several dozen within fairly small home ranges and can usually be found cooling off near water or resting in the shade during the heat of the day. Collared peccaries are the only wild ungulate in the western hemisphere that breed all year long, and breeding may be dependent upon rain events. Females will give birth to 1 to 5 young. Peccaries may be aggressive, increasing unnecessary fear among humans, but will not attack unless they are defending themselves. Often confused with pigs, they push dirt around, but do not root-up the ground.

Habitat requirements

Diet: cacti, mesquite beans, lechuguilla and other succulent vegetation, fruit, mast, insects, and small lizards
Water: free-standing water is required unless prickly pear is abundant
Cover: thickets of brush, prickly pear, scrub oak, or rocky canyons

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative vegetation is competing with native vegetation and reducing habitat quality for collared peccary
Plant Shrubs: planting prickly pear cacti where limited may increase available food resources for collared peccary
Set-back Succession: *Prescribed Fire*, *Chaining*, *Drum-chopping* can be used to maintain low-growing shrub cover and herbaceous groundcover
***Water Developments* for Wildlife**: peccaries do not sweat; thus, free-standing water is necessary for cooling in hot environments
Decrease Harvest: when populations are declining in good habitat and additional animals are desired
Increase Harvest: when additional harvest is desired and populations can withstand additional harvest and when the population needs to be lowered
Wildlife or Fish Survey: spotlight surveys, camera surveys, and hunter harvest data can assess population trends

Columbian black-tailed deer

General information

Erin Willett

The Columbian black-tailed deer is a subspecies of mule deer that occurs in the coastal regions of northwestern North America (northern California, Oregon, Washington, and southern British Columbia). Columbian black-tailed deer use a mixture of openings (with herbaceous groundcover and scattered shrubs) and conifer forest. Black-tailed deer are ruminants (animals with a four-chambered stomach) and are adapted to eat higher-quality forages more so than some other ruminants (such as elk or cattle). Black-tailed deer are crepuscular (active at dawn and dusk) and prefer relatively flat areas at mid to low elevations (below 1,500 ft.), on south-facing slopes. These sites tend to be dominated by vine maple, huckleberry, and salal plant communities, which provide preferred forage, minimal duration of snow cover, and protection from cold winds. Where overabundant, black-tailed deer can cause damage to ornamental plantings, forest crops, and row crops, and can be hazardous for motor vehicles.

Habitat requirements

Diet: forbs, browse, soft mast, grains, and grasses
Water: obtain most of their water from diet, but will drink free-standing water when available
Cover: mixture of dense young forest, mature forest, and early successional cover

Wildlife management practices

Control Nonnative Invasive Vegetation: may be necessary if the native plant community is being outcompeted and food and cover resources are being reduced
Edge Feathering: will create a soft edge ecotone between openings and the forest that will encourage shrub and young tree growth to enhance travel corridors, fawning cover, and forage availability
Field Borders: to increase fawning cover and forage availability around fields
Forest Management: *Forest Regeneration*, especially *Clearcut*, can stimulate herbaceous cover and provide additional brushy cover for a few years; timber stand improvement can stimulate additional herbaceous cover and browse in the understory, if the understory is limited
Leave Crop Unharvested: to provide additional food resource, especially near cover
Livestock Management: should prevent overgrazing in early successional areas to maintain forage and browse for black-tailed deer; livestock should be excluded from forested areas where black-tailed deer is a focal species to maintain the forest understory
***Plant Food Plots*:** to provide additional nutrition, particularly during late summer and winter in some areas where naturally occurring food resources are limited
Plant Native Grasses and Forbs: where early successional cover is limited and additional grasses and forbs are needed for forage

Plant Shrubs: where additional shrub cover, browse, or soft mast is needed
Plant Trees: in large open areas where additional forest cover is needed
Set-back Succession: *Prescribed Fire* can be used to maintain early successional openings and to improve forest understory structure and composition for increased forage and soft mast; *Disking* can be used to maintain early successional openings; *Chainsawing* and *Root-plowing* can be used to create forest openings and maintain shrub-dominated communities
Tillage Management: eliminate fall tillage of grain-crop residue adjacent to cover to make waste grain available as an additional food source
Water Developments for Wildlife: where water is limiting (within one-half mile), ponds and shallow impoundments can provide an external water source for drinking
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Increase Harvest: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Wildlife Damage Management Techniques: fencing, repellents, and scare tactics may be helpful to keep deer from ornamental plantings, gardens, and some crops; reducing the population through shooting is recommended when local overabundance is causing crop depredation and increasing vehicle collisions
Wildlife or Fish Survey: spotlight surveys, camera surveys, and hunter harvest data can assess population trends

Common muskrat

General information

Bo Zaremba

Muskrats are found throughout the U.S., especially in shallow marshes with abundant cattails. They are mainly nocturnal and need water at least 4 feet deep or flowing water that allows free movement under ice during winter. Muskrats prefer water 1 to 2 feet deep during summer, with about 20 percent of the wetland open water, free of emergent aquatic vegetation. Muskrats build lodges of cattails or other herbaceous vegetation, but do not use sticks or limbs. They sometimes nest in a bank burrow along a waterway. Burrowing and denning activities can cause problems in flooded agricultural areas, such as rice fields and waterfowl management areas.

Habitat requirements

Diet: roots, tubers, and green shoots of emergent aquatic vegetation, such as cattails and bulrushes
Water: necessary water obtained from diet
Cover: primarily shallow-water wetlands with a mixture of open water and emergent aquatic vegetation; den in lodges built from cattails and bulrushes; loaf on floating logs or tops of lodges

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive aquatic vegetation is competing with the native aquatic plant community and reduce habitat quality for common muskrat
Livestock Management: livestock should be restricted from riparian areas and other wetlands; this may require development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate old, decadent wetland vegetation
Water Control Structures: are necessary to control water levels and allow cattails and bulrushes to grow
Water Developments for Wildlife: small impoundments can be built in low-lying areas to provide habitat
Decrease Harvest: when trapping efforts have reduced population below desirable levels
Increase Harvest: when populations can sustain additional trapping or where populations need to be lowered
Wildlife Damage Management: may be necessary when muskrats damage dikes in agricultural areas and waterfowl management areas; populations are typically reduced by trapping
Wildlife or Fish Survey: observation surveys, track counts, and presence of lodges are used to estimate population trends

Coyote

General information

Craig Harper

Coyotes are found throughout the continental U.S. and have even been observed in large cities and urban areas. Grasslands, shrubland, and farmland provide optimal habitat for coyotes, but they also use forested areas as well. Coyotes den in a variety of places, including brush-covered slopes, steep banks, rock ledges, thickets, and hollow logs. Coyotes are most active at night, during early morning, and around sunset, but they may be active throughout the day. Coyotes live in packs, alone, or in mated pairs, depending on the time of year. Coyotes have an extremely varied diet that fluctuates with the seasons.

Habitat requirements

Diet: rodents, rabbits, and other small mammals, insects, birds, eggs, deer, carrion, and soft mast; livestock and wild ungulates (deer, elk, pronghorn) are usually represented in coyote stomachs as carrion; however, in some cases, coyotes prey heavily on deer and pronghorn fawns, and can limit reproductive success in some situations
Water: requirements are not well documented; necessary water is probably obtained in diet
Cover: grasslands, shrublands, regenerating forest, mature forest; crevices and burrows along river banks, rock ledges, brushpiles, and holes under stumps or abandoned buildings are used as den sites for raising pups

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation reduces habitat quality for coyotes or prey species
Edge Feathering: to increase cover and food availability for prey species around fields
Field Borders: to increase usable space for prey species around fields
Forest Management: *Forest Regeneration* (*Clearcutting*, *Shelterwood*, *Seed-tree*, *Group Selection*) and *Timber Stand Improvement* can improve habitat for prey and lead to more abundant prey
Livestock Management: should maintain adequate cover for prey species
Plant Native Grasses and Forbs: where additional early successional cover is needed for prey and planting is necessary
Plant Shrubs: in areas where additional shrub cover is needed to attract prey and provide security cover for coyotes
Set-back Succession: *Prescribed Fire*, *Disking*, *Chaining*, and *Herbicide Applications* are recommended to maintain herbaceous openings; *Prescribed Fire* can be used to enhance forest understory structure and composition; *Chainsawing* can be used to create additional forest openings where necessary
Decrease Harvest: where hunting or trapping has limited population and additional coyotes are desired
Increase Harvest: through hunting or trapping where populations need to be lowered
Wildlife Damage Management: may be necessary where livestock or pet depredation is a problem
Wildlife or Fish Survey: track counts and camera surveys are used to estimate population trends

Desert cottontail

General information

Craig Harper

Desert cottontails can be found in woodlands, grasslands, creosote brush, and desert areas from California to Texas and from northern Montana to Mexico. In the Hot Desert ecoregion, desert cottontails use thick shrub cover interspersed with open areas. Riparian and urban areas also are used. Because cottontails do not travel far, shelter and food must be close together.

Habitat requirements

Diet: a variety of forbs and grasses spring through fall; in winter, bark and twigs of shrubs are important; buds, grain, seeds, and soft mast are also eaten when available
Water: necessary water obtained from diet
Cover: grassland, shrub vegetation, and ground burrows for hiding and nesting cover

Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and limiting habitat for cottontails
Field Borders: to increase usable space around row crop fields
Forest Management: (Mediterranean Ecoregion only) *Forest Regeneration* (*Clearcut*) provides optimal brushy cover for a few years
Leave Crop Unharvested: to provide additional food
Livestock Management: should exclude livestock from food plots and prevent overgrazing to allow ample amounts of herbaceous vegetation for nesting, cover, and forage
Plant Food Plots: where rainfall is sufficient, forage plots may be planted adjacent to shrub cover
Plant Native Grasses and Forbs: where early successional cover is limited and planting is necessary to provide additional grasses and forbs
Plant Shrubs: in areas where shrub cover is lacking
Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous openings; *Prescribed Fire* and *Chaining* can rejuvenate decadent shrublands and encourage additional herbaceous groundcover (burning is not recommended in the Hot Desert ecoregion unless sufficient precipitation is available)
Tillage Management: cropland tillage may be delayed in spring to allow use of standing stubble for cover; tillage may be eliminated in the fall to allow access to waste grain
Decrease Harvest: may be necessary when additional rabbits are desired and hunting or trapping is limiting growth
Increase Harvest: where populations can sustain additional hunting and trapping pressure for recreation and where populations need to be lowered
Wildlife Damage Management: shooting, trapping, and exclusion techniques can be used where there is damage to ornamental and garden plants
Wildlife or Fish Survey: observation counts, track counts, and transect flush counts can be used to estimate population trends
Mowing: can be used to maintain herbaceous openings in Urban areas

Eastern cottontail

General information

Aubrey Deck

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

Habitat requirements

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

Wildlife management practices

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

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

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

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

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

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

Eastern fox squirrel

General information

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

Joe Fischer

Habitat requirements

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

Wildlife management practices

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

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

Eastern gray squirrel

General information

Laura Perlick

The eastern gray squirrel lives primarily in mature deciduous forests and woodlands. They also forage along the edge of crop fields, especially mature cornfields. Eastern gray squirrels have adapted to parks and other urban areas where mature trees are available. Eastern gray squirrels forage both in trees and on the ground. They den in cavities of mature trees and also build nests, generally 30 feet or more aboveground. Eastern gray squirrels will use nest boxes, but nesting structures are not necessary because squirrels build nests when cavities are not available. Thus, cavities are not a limiting factor for eastern gray squirrel populations.

Habitat requirements

Diet: a variety of hard and soft mast, miscellaneous seeds, grains, bark, buds, and mushrooms; they may also eat eggs
Water: necessary water is generally obtained through diet, but free-standing water is also used
Cover: mature forest and woodlands; suburban and urban areas with mature trees; den in tree cavities and also build nests of leaves and twigs

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native species and reduce habitat quality for eastern gray squirrel; several nonnative trees, such as tree-of-heaven and royal paulownia, and nonnative groundcover and vines, such as Japanese stiltgrass, kudzu, and English ivy, can displace more valuable native species and make finding food difficult
Edge Feathering: can enhance forest structure and increase food availability in forested areas surrounding fields
Forest Management: *Forest Regeneration* (*Group Selection*, *Single-tree Selection*) can increase soft mast and availability of various seed-producing plants used by eastern gray squirrels; *Timber Stand Improvement* can encourage larger crowns of mast-producing trees and enable oaks, hickories, beech, and others to produce more mast; can also increase soft mast availability and provide snags for potential den sites
Livestock Management: should not allow overgrazing in woodlands; livestock should be excluded from forests to prevent overgrazing of the forest understory; livestock should be excluded from riparian areas in open landscapes where tree cover is largely limited to riparian areas; livestock should be excluded from areas where trees have been planted to enhance habitat for eastern gray squirrels
Plant Food Plots: grain food plots, especially corn, can provide an important food source, during winters with poor mast availability
Plant Trees: plant mast trees (especially oaks and hickories) where they are limiting; most appropriate for large open areas that do not represent habitat for gray squirrels; may also be appropriate where composition of wooded areas is lacking mast and limiting gray squirrel population

Decrease Harvest: may be necessary when additional gray squirrels are desired and hunting pressure is limiting population growth
Increase Harvest: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Wildlife Damage Management: may be required if squirrels become a nuisance around houses
Wildlife or Fish Survey: observation counts are most often used to estimate population trends
Artificial Feeders: may be used in Urban areas

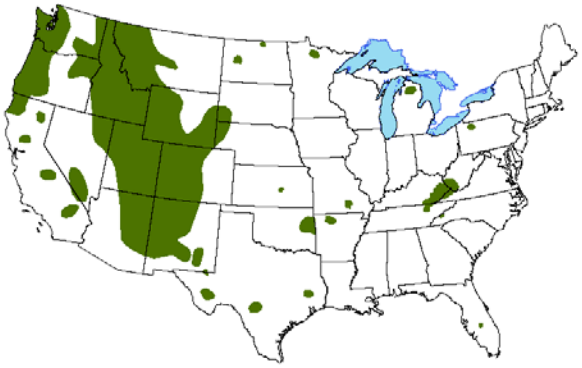
Elk

General information

Erwin and Peggy Bauer

Elk primarily occur in mountainous regions of western North America (from New Mexico to Oregon and Canada). They also have been reintroduced in multiple states of the eastern United States. Elk are ruminants (animals with a four-chambered stomach), as are the other ungulate species common to North America, such as white-tailed deer and mule deer. Elk stomachs are much larger than those of deer, which allows elk to eat more and bed down to chew their cud for an extended period. For this reason, elk may only feed twice a day during some portions of the year to avoid risk of predation. Elk use mature forest with interspersed openings. This type of cover supplies food and provides protection from predation and weather. Male elk (bulls) rigorously defend a harem (breeding groups of up to 30 cows) during breeding season (September – October). Nutritional requirements and diet change seasonally. Elk rely on grasses and forbs in spring and summer, and eat less-preferred browse, such as aspen, maples, and poplar, during winter when food availability is limited. Cows that occupy ranges with high elevations will migrate to lower elevations and south-facing slopes in winter to find food and avoid deep snow and cold winds. Elk can cause significant damage to ornamental plantings, forest crops, and row crops when overabundant, and can be hazardous for motor vehicles.

Habitat requirements



Diet: predominantly grasses and forbs, but also browse, especially when palatable grass and forbs are not available
Water: free-standing water used regularly in summer; water should be within one-half mile
Cover: mature woods for loafing and calving; early successional openings and young forest for foraging

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for elk
Edge Feathering: may increase forage availability in woods around fields
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) will provide additional forage for a few years; Timber Stand Improvement can improve forage availability and stimulate understory/midstory cover
Livestock Management: livestock should be excluded from forested areas managed for elk; where elk is a focal species, livestock grazing in open lands and woodlands should be managed to prevent overgrazing and provide sufficient forage for elk
Plant Food Plots: where naturally occurring food sources are limited, forage food plots may provide additional nutrition, particularly during late summer and winter in some areas
Plant Native Grasses and Forbs: elk are grazers and eat native grasses; planting may be necessary where forage is lacking or where forage quality is insufficient

Plant Trees: where additional forest cover is needed
Set-back Succession: *Prescribed Fire* is recommended to maintain early successional openings and stimulate additional herbaceous forage in forested areas with adequate sunlight; *Chainsawing* and *Root-plowing* may be used to convert forest to early succession and increase forage availability
Water Developments for Wildlife: small ponds may be constructed if water is not available within one-half mile
Decrease Harvest: may be necessary when hunting pressure is limiting growth of elk population where an increase is desired
Increase Harvest: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered; when populations need to be lowered because of habitat considerations, increased harvest should concentrate on females
Wildlife Damage Management: necessary when elk begin to damage hay and crop fields, or when they become a nuisance in suburban areas; both lethal and nonlethal practices can be effective
Wildlife or Fish Survey: aerial surveys, observational counts, and trail cameras can be used to estimate population trends

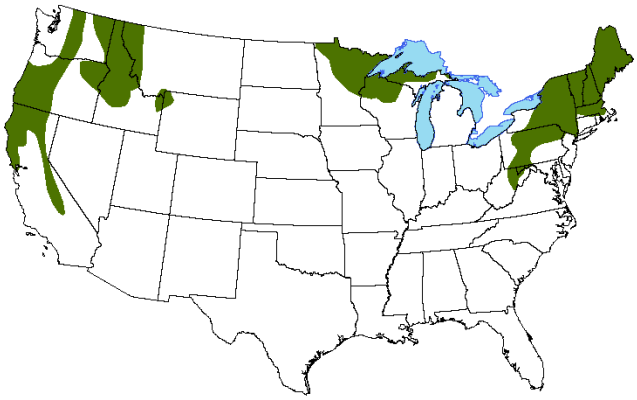
Fisher

General information

USFWS

Fishers are furbearers are found in forests within the upper Great Lakes area and the mountains of the Pacific and northeastern U.S. Fishers were once a valuable fur resource that led to over-trapping and population decline in many areas. Fishers are one of the few natural predators of porcupines. A desire to control porcupines in some areas because of the damage they cause to trees has led to large-scale reintroduction of fishers throughout many portions of their former range. Fishers are now re-established as far south as West Virginia and Pennsylvania along the Appalachian Mountain range.

Habitat requirements



Diet: primarily porcupines and snowshoe hare; will readily consume other rodents, rabbits, insects, reptiles, soft mast, and carrion; small domestic pets
Water: necessary water obtained from diet
Cover: mature conifer or mixed hardwood forests with abundant down woody debris; den in hollow logs, snags, or live trees

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation is competing with native vegetation and reducing habitat quality
Create Snags: in forested areas where denning cavities are suspected to be limiting the population
Forest Management: *Forest Regeneration* (*Single-tree Selection*, *Group Selection*) can improve forest structure for several prey species; *Timber Stand Improvement* can increase understory development that can lead to increased prey populations; forest management can also increase down woody debris
Plant Trees: in large open areas where additional forest cover is needed (should maintain >50 percent canopy cover)
Decrease Harvest*:* may be necessary when trapping pressure is limiting population growth and additional fishers are desired
Increase Harvest: where populations can sustain additional trapping pressure and a reduction in the population is desired
Wildlife Damage Management: may be necessary if small domestic pet depredation is a problem
Wildlife or Fish Survey: scent stations, track counts, and trail cameras may be used to estimate population trends

Gray fox

General information

USFWS

Gray foxes are common and widespread in North America. They are typically associated with deciduous forest landscapes, and generally avoid areas with large expanses of agriculture. They are most active at night or near dawn and dusk. Dens are used primarily during the breeding season. Gray foxes are unique among Canids (species in the family that includes dogs) because of their ability to climb trees.

Habitat requirements

Diet: primarily small mammals, birds, insects, hard and soft mast, and occasionally carrion
Water: requirements largely unknown; gray foxes likely drink free-standing water and get some water from the foods they consume
Cover: mostly deciduous forest; breeding dens are located in brushy or wooded areas and found in hollow trees or logs, under large rocks, or in underground burrows; daytime resting sites are generally aboveground in trees, thickets, and brushy areas, or rocky crevices

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative species begin to compete with native plant species and reduce habitat quality for gray fox
Create Snags: when large (>12 inches) down woody debris is needed for breeding dens or resting sites
Edge Feathering: to enhance cover for prey and provide additional soft mast around fields
Forest Management: *Forest Regeneration* (*Clearcut, Shelterwood, Seed-tree, Group Selection, Single-tree Selection*) in large areas of mature forest and *Timber Stand Improvement* practices may increase prey abundance, soft mast, hollow logs for breeding dens, and daytime resting sites
Livestock Management: livestock should be excluded from forested areas because they consume plants in the understory that provide cover and food for gray fox and associated prey
Plant Shrubs: in relatively large openings devoid of brushy cover or thickets to create resting sites, provide cover for den locations, and provide soft mast
Plant Trees: in large open areas to increase deciduous forest conditions
Set-back Succession: low-intensity *Prescribed Fire* can be used in forests and woodlands to enhance cover for prey and soft mast production
Decrease Harvest: to promote an increase in population where current harvest levels are limiting population
Increase Harvest: when the population can sustain additional harvest and increased harvest is desired for recreational trapping or hunting; to promote increase abundance of prey species, such as eastern cottontails or tree squirrels, if gray fox has been identified as limiting those populations; when population reduction is desired
Wildlife Damage Management: exclusion practices can discourage gray foxes from denning under human structures; exclusion practices and trapping can prevent gray foxes from preying on small livestock, such as chickens
Wildlife or Fish Survey: scent stations, track counts, and trail cameras may be used to estimate population trends

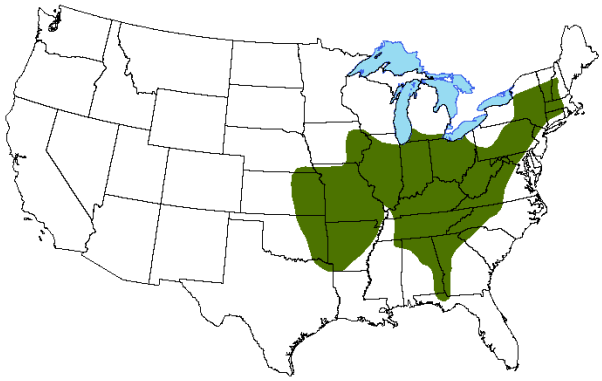
Indiana bat

General information

Susi von Oettingen

The Indiana bat is an endangered species that occurs over most of the eastern United States. The Indiana bat population is in decline because of susceptibility to disturbance during hibernation and a disease known as white nose syndrome. Bats must store fat reserves and then hibernate (from October – April) to survive through winter when food is limiting. If they are disturbed by human activity or if cave temperatures increase, they may starve from using critical energy reserves. Male Indiana bats roost alone or in small groups during spring and summer, whereas females roost in larger maternal colonies (100+ individuals). Females give birth to one pup in June, and then young are nursed under loose tree bark, usually in wooded areas near water. Inserting gates in front of cave openings that allow passage of bats but prevent human intrusion can prevent disturbing Indiana bats during hibernation.

Habitat requirements



Diet: insects (up to half their body weight per night)
Water: although they get some from their food, they require considerable free-standing water
Cover: winter hibernation occurs in caves, also known as hibernacula, or other areas that are cool, humid, with stable temperatures of 33-50 F (nearly half of all Indiana bats use caves); trees with flaky bark (like shagbark hickory or mature white oak) or snags along forest edges and water bodies are used for roosting; mature mixed deciduous forest with canopy gaps and riparian zones are used for foraging

Wildlife management practices

Conservation Easement: can protect property with caves that this declining species is using for hibernacula
Control Nonnative Invasive Vegetation: may be required if desirable trees for roosting are being outcompeted by nonnative invasive species
Create Snags: can provide temporary foraging and roosting sites if an adequate number of trees are not already available
Forest Management: *Forest Regeneration (Group Selection)* provides small openings used for foraging; *Timber Stand Improvement* can favor tree species with flaky bark used for roosting
Plant Trees: in large open areas where forest cover is limiting
Wildlife or Fish Survey: roost counts during hibernation and acoustic sampling surveys are used to survey Indiana bat populations

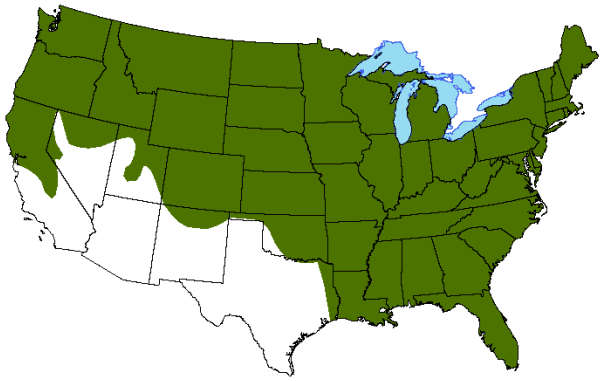
Mink

General information

Bo Zaremba

Mink occur in Alaska, Canada, and across most of the U.S. They are mainly nocturnal and are found along stream banks, river banks, and edges of a variety of wetlands. Mink are strictly carnivorous. Most prey is found in close association with dense vegetation along wetland edges and other riparian areas. Availability of den sites is considered a key factor in how mink use an area. Areas with lots of trees and shrubs and limited livestock grazing near riparian areas usually have more den sites. Mink can eat significant numbers of upland nesting waterfowl or game birds, especially in areas where nesting habitat is limited.

Habitat requirements



Diet: rabbits, mice, muskrats, crayfish, snakes, and birds
Water: necessary water probably obtained through diet
Cover: closely associated with water; riparian areas, wetland edges, dens often located under log jams and tree roots, old muskrat burrows and rock piles

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for mink and their prey
Livestock Management: livestock should be excluded from wetlands and riparian areas where mink is a focal species; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* is recommended to rejuvenate old decadent wetland vegetation that can improve habitat for prey
Water Control Structures: are necessary to regulate water level and manipulate growth of emergent aquatic vegetation adjacent to an impoundment
Water Developments for Wildlife: shallow impoundments can be developed to increase habitat where needed
Decrease Harvest: may be necessary when trapping pressure is limiting population and an increase in population is desired
Increase Harvest: where populations can sustain additional trapping pressure, and when mink have been identified limiting upland nesting waterfowl or game birds
Wildlife or Fish Survey: track counts are often used to estimate population trends

Moose

General information

Karen Laubenstein

The moose is the largest member of the deer family. Adult males can reach 1,800 pounds and females may weigh 1,000 pounds. Males exhibit palmated (flattened or palm-like) antlers, whereas most other members of the deer family have a dendritic (twig-like) antler configuration. Moose are herbivores and inhabit both boreal and mixed deciduous forests in temperate and subartic climates. Moose are typically solitary and do not group into herds. Predators include wolves, bears, and humans. Moose are typically found around wetlands (such as swamps, streams, lakes) because of the abundance of browse and aquatic plants moose prefer. The moose is the only deer species that can dive underwater to reach plants on stream, marsh, and lake bottoms. An adult moose can consume as much as 70 pounds of vegetation per day. In winter, moose are often drawn to roadways to satisfy their sodium requirements where they lick salt applied to road surfaces to melt snow and ice. This habit leads to moose-vehicle collisions wherever roads are salted during winter. Moose populations have rebounded over the past 30-40 years as pollution in waterways has been reduced and abandoned farms have succeeded into shrub-dominated and young forest cover.

Habitat requirements

Diet: leaves and twigs of willow, maple, aspen, mountain ash, and birch trees, as well as aquatic vegetation, including submerged aquatic vegetation, which may represent as much as half of the diet
Water: water requirements are met through consumption of aquatic vegetation and standing water where they are typically found
Cover: riparian areas along streams and rivers, edges of marshes adjacent to thick upland cover, mature softwood stands during extreme cold and/or deep snowfall

Wildlife management practices

Control Nonnative Invasive Vegetation: may be necessary when native plant communities, both upland and aquatic, are being threatened by nonnative invasive vegetation and habitat quality for moose is declining
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) will provide increased browse; *Timber Stand Improvement* may also enhance cover and increase browse availability
Plant Shrubs: may be necessary in large open areas where additional shrub cover is needed
Plant Trees: may be necessary in large open areas where additional forest cover is needed
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* and *Chainsawing* can be used to rejuvenate and enhance low-growing woody cover and increase browse

Water Control Structures: can be used to manipulate water levels and maintain aquatic vegetation surrounding wetlands
Water Developments for Wildlife: can be provided if a lack of wetlands are limiting the presence or abundance of moose
Decrease Harvest: may be necessary if hunter harvest has limited the population and a population increase is desired
Increase Harvest: may be implemented if the moose population needs to be lowered
Wildlife or Fish Survey: camera surveys may be used to monitor moose populations

Mountain cottontail

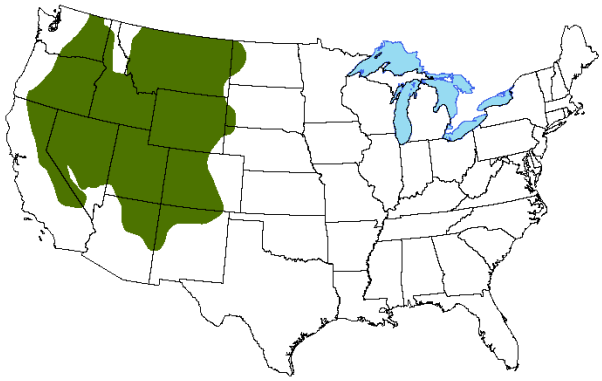
General information

Lewis Scharphf

Mountain cottontails occur in the mountainous regions of the western U.S. They use thick shrubs and burrows for nesting and cover, and eat a variety of forbs, grasses, and browse. They have relatively small home ranges and daily movements, so food and cover should be close together.

Habitat requirements

Diet: a variety of forbs, grasses, seeds and soft mast in spring through fall; in winter, bark and browse is most important; grains and alfalfa are eaten when available
Water: necessary water is obtained from diet
Cover: thick shrubs and burrows for nesting and cover



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for mountain cottontail
Forest Management: *Forest Regeneration* (*Clearcut*) will enhance cover and stimulate additional forage for a few years
Livestock Management: should prevent overgrazing and maintain sufficient groundcover for rabbits
Plant Food Plots: where additional forage is needed and can be planted adjacent to good cover
Plant Native Grasses and Forbs: where desirable groundcover is lacking and planting is necessary for establishment
Plant Shrubs: where shrub cover is lacking
Set-back Succession: *Prescribed Fire* and *Chaining* can be used to rejuvenate and maintain shrubby cover and stimulate forbs and grass interspersed with shrub cover
Decease Harvest: may be necessary when additional rabbits are desired and hunting or trapping efforts are limiting growth
Increase Harvest: where populations can sustain additional hunting or trapping pressure for recreation or where populations need to be lowered
Wildlife Damage Management: may be necessary to control damage to ornamental and landscaping plants and vegetable gardens
Wildlife or Fish Survey: track counts, observation counts, and hunter observation data can be used to estimate population trends

Mountain lion

General information

NPS

The mountain lion (also called cougar or puma) are predatory cats once common across North America. Adult mountain lions weigh 80 to 200 pounds. Males are larger than females. Mountain lions are typically buff, cinnamon, tawny, or reddish color. Contrary to local belief, there is no such thing as a black mountain lion. Mountain lions are primarily nocturnal, but may be active during daylight hours. The mountain lion is a stalk-and-ambush predator and pursues a wide variety of prey. Populations in the eastern U.S. were drastically reduced as the country was settled. Populations may fluctuate with prey abundance. Mountain lions are a game species in several western states, but have historically been removed because of livestock depredation. The mountain lion is listed as an endangered species in Florida.

Habitat requirements

Diet: primary food source is deer and rabbits, but beaver, porcupine, mice, skunks, marten, coyote, javelina, bighorn sheep, pronghorn, moose, elk, ruffed grouse, wild turkey, fish, and occasionally domestic livestock, dogs, and house cats also may be eaten

Water: free-standing water is required for drinking; water sources are also used as ambush sites for prey

Cover: coniferous and tropical forests, grasslands, swamps, brushland, and desert edges; mountain lions can survive in most any environment that supports an abundance of deer

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for mountain lion

Forest Management: (in some ecoregions) *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) and *Timber Stand Improvement* can enhance cover and food resources for a variety of prey species if prey abundance is limiting mountain lion populations

Plant Shrubs: in large open areas where shrub cover is limiting prey for mountain lions

Plant Trees: (in some ecoregions) in large open areas where additional forest cover is needed

Set-back Succession: *Prescribed Fire* may be used to enhance cover and food availability for several prey species

Water Developments for Wildlife: may be implemented where free-standing water is limited for prey and mountain lions, which may also increase prey opportunities

Decrease Harvest: may be necessary where mountain lion populations have declined and hunting pressure may be limiting population increase

Increase Harvest: may be implemented when mountain lion populations are limiting other wildlife species, such as white-tailed or mule deer

Wildlife Damage Management: may be needed if livestock depredation is problematic and in the rare instance of attacks on humans (approximately 90 attacks on humans have been documented in the last 125 years)

Wildlife or Fish Survey: track counts, scent stations, hunter observation data, and camera surveys can be used to estimate population trends

New England cottontail

General information

USFWS

The New England cottontail (NE cottontail) is found in isolated areas of Maine, New Hampshire, New York, Connecticut, Massachusetts, and Rhode Island. The USDA-NRCS included them in its Working Lands For Wildlife Initiative. NE cottontail is often confused with the eastern cottontail, which looks very similar, and because the eastern cottontail is more of a habitat generalist, it has been displacing the NE cottontail since the eastern cottontail was introduced to the New England states in the early 1900s. Because this region has dense human populations, habitat distribution for NE cottontail has declined by 86 percent since 1960. In addition to direct reduction of habitat distribution, urban sprawl also indirectly reduces habitat quality and quantity because of land-use changes (fire suppression, aesthetic mowing, afforestation, and the reduction of timber harvest). The remaining habitat is largely fragmented and isolates local populations, making them more vulnerable to overall population decline. Early successional cover in at least 25-acre blocks is desirable. Habitat may be provided in old-fields, cleared areas (such as utility and railroad right-of-ways), young regenerating forest, shrubby fringes around swamps and beaver ponds, managed early succession openings, and coastal shrublands. Nests are constructed of fur, grass, and leaves on the ground in a 4-inch depression.

Habitat requirements

Diet: grass, forbs, and soft mast in late spring and summer; grass, leaves, soft mast, and buds in fall; bark, twigs, buds, and grasses in winter
Water: obtained through diet
Cover: early successional cover consisting of perennial native grasses, forbs, and shrubs; evergreen shrubs and trees are critical for escape and thermal cover in winter

Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species
Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for NE cottontail
Edge Feathering: to enhance cover and forage availability between fields and forest
Field Borders: to increase usable space around crop fields
Forest Management: *Forest Regeneration (Clearcut, Shelterwood, Seed-tree)* will enhance habitat for a few years
Livestock Management: should exclude livestock from food plots and prevent overgrazing to allow sufficient herbaceous vegetation for nesting, cover and forage
Plant Native Grasses and Forbs: where herbaceous vegetation is limiting and planting is necessary to establish desirable cover
Plant Shrubs: where there is a lack of shrub cover and none is regenerating naturally
Plant Trees: evergreen species may be planted in areas lacking thermal cover in winter

Set-back Succession: *Prescribed Fire* and *Disking* can be used to maintain perennial grass and forb cover; *Prescribed Fire* can be used to rejuvenate and maintain shrub cover; *Chainsawing* and *Root-plowing* can be used to convert forest to early successional cover
Decrease Harvest: may be necessary if the local population is declining or cannot withstand harvest.
Wildlife or Fish Survey: because differentiating New England cottontails from Eastern cottontails is very difficult and only reliable under genetic testing or morphological skull identification, wildlife agencies request hunters submit heads of harvested rabbits for identification and analysis of population trends

Pronghorn

General information

James C. Leupold

Pronghorns are hoofed ungulates found in open prairie grassland and sagebrush desert of the western U.S. Although somewhat similar in appearance, the pronghorn is not an antelope, goat, or deer. The pronghorn is the second-fastest land mammals in the world, reaching a top speed of about 55 mph (cheetahs can run short distances up to 75 mph). Both the male and female pronghorn have horns that are covered in a black keratin sheath, which is shed annually. The sheath curves backwards and has a prong that points forward (hence the name, pronghorn). Pronghorns of females are much smaller than those of males. According to location, some pronghorn populations migrate long distances between their summer and winter ranges. Corridors that allow safe passage are a management concern for migrating pronghorn. Pronghorns are generally tan with white markings on the face, neck, stomach, and rump. When alarmed, pronghorn often raise the white hairs on their rump to signal danger to other pronghorn. Pronghorns have fantastic vision, which helps them identify predators in the open country they inhabit.

Habitat requirements

Diet: varies with season; grasses, forbs, and cacti in spring and summer; primarily browse in winter
Water: free-standing water is required
Cover: native grassland and desert sagebrush with flat to rolling terrain that allows long-range visibility

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for pronghorn
Livestock Management: should maintain appropriate stocking rate to prevent overgrazing and maintain adequate herbaceous groundcover; fencing should be kept to a minimum with at least 16 inches between the ground and the bottom wire, which should be smooth, not barbed; the top wire should not be more than 42 inches aboveground; large blocks of rangeland should be maintained within cropland; no more than 30 percent of a management area should be cropland
Plant Food Plots: in areas where there is adequate rainfall, food plots can provide high-quality forage, such as alfalfa, for increased nutrition
Plant Native Grasses and Forbs: where herbaceous vegetation is lacking and planting is required to establish desirable groundcover
Set-back Succession: *Prescribed Fire* and *Chaining* are recommended to stimulate additional herbaceous groundcover in large expanses of shrubland
Water Developments for Wildlife: where water is limited or absent within two miles, development of dugouts, windmills, and spring developments is warranted
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Wildlife Damage Management: may be necessary in areas where crop damage is occurring
Increase Harvest: when populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Wildlife or Fish Survey: observation counts are used to estimate population trends

Raccoon

General information

David Menke

Raccoons are very common throughout most of the U.S., except in certain parts of the Rocky Mountains, Nevada, Utah, and Arizona. Raccoons are found in a variety of vegetation types, but are usually most abundant near riparian areas and wetlands. They also are found in urban areas. Raccoons den in hollow trees, in burrows under stumps or brush piles, or in chimneys, attics, and crawl spaces of houses and buildings. They are omnivorous and eat a wide variety of foods. Raccoons can become pests in urban areas and in wetlands (depredating waterfowl nests). Raccoons also have been identified as major predators on game bird nests and young game birds.

Habitat requirements

Diet: crayfish, birds, eggs, small mammals, insects, lizards, snakes, worms, fish, carrion, grains, seeds, hard and soft mast, and foods prepared for human and pet consumption
Water: require water frequently during warm seasons
Cover: riparian areas, bottomland hardwoods, and along other wetlands; natural tree cavities are used for denning and daytime loafing; raccoons also den in ground burrows under stumps, brush piles, junk piles, old abandoned buildings, and rocky cliffs and ledges

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for raccoon
Create Snags: where denning sites are limited
Edge Feathering: to increase usable space for prey around fields
Field Borders: to increase usable space for prey around fields
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*, *Single-tree Selection*) and *Timber Stand Improvement* can stimulate soft mast production and cover for prey
Leave Crop Unharvested: especially cornfields adjacent to bottomland hardwoods and riparian areas
Livestock Management: livestock should be excluded from riparian areas and other wetlands; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
Plant Food Plots: annual grain food plots, especially corn, may be planted where food is limiting and where an increase in raccoon population is desired (this situation is exceptionally rare)
Plant Shrubs: where soft mast is lacking and to provide corridors across large open areas
Plant Trees: in riparian areas and adjacent to wetlands where few trees are present to maintain riparian corridors; maintain approximately 50 percent deciduous forest cover; also in large open areas where there are few trees
Repair Spillway/Levee: if not functioning properly

Set-back Succession: *Prescribed Fire* is recommended to rejuvenate old decadent wetland vegetation; *Prescribed Fire* and *Disking* can maintain herbaceous openings; *Prescribed Fire*, *Herbicide Applications*, *Chaining*, and *Root-plowing* are recommended to rejuvenate decadent shrub cover
Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source
Water Control Structures: to control water levels and provide water less than 2 feet deep and stimulate emergent vegetation and enhance habitat for prey
Water Developments for Wildlife: shallow impoundments can provide a water source and additional habitat for various prey species
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired (this situation is rare)
Increase Harvest: where populations can sustain additional hunting or trapping pressure for recreation and where populations need to be lowered for various reasons
Wildlife Damage Management: is often necessary when raccoons get into garbage cans, occupy residences or buildings, or prey upon poultry; exclusion is cost-effective; cultural modification, such as using wildlife-proof trash cans, is effective; trap and euthanize is most effective for problem raccoons
Wildlife or Fish Survey: track counts and camera surveys may be used to monitor population trends

Red fox

General information

Ronald Laubenstein

Red foxes are the most widely distributed carnivore in the world and occupy a wide range of ecoregions and vegetation types, including grasslands, shrublands, woodlands, farmlands, and cities. They prefer brushy areas in winter and may avoid mature forests. Red foxes are solitary animals and are mostly nocturnal. They can sometimes be seen during the early morning and early evening. Red foxes use dens for shelter and raising young. Red foxes have a characteristic manner of hunting small mammals by standing motionless, listening, and watching intently. When a red fox locates prey, it often leaps high and brings the forelimbs straight down, pinning the prey to the ground.

Habitat requirements

Diet: primarily small mammals, birds, insects, hard and soft mast, and occasionally carrion; red foxes will store food and are very good at relocating these caches
Water: requirements largely unknown; they likely drink free-standing water and get some water from the foods they consume
Cover: prefer a mixture of herbaceous openings with brushy cover, shrubland, and woodland; dens are located in brushy areas and in hollow logs, under large brush piles, under large rocks, or in underground burrows; daytime resting sites are generally thickets and brushy areas

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative vegetation begins to compete with native vegetation and decrease habitat quality for red fox and associated prey
Edge Feathering: will enhance cover in woods around fields for red fox and their prey
Field Borders: will enhance cover around crop fields for red fox and their prey
Forest Management: *Forest Regeneration* (especially *Clearcutting*) in relatively large areas of mature forest will temporarily enhance cover for prey and may provide increased denning sites (down logs and debris), and daytime resting sites
Livestock Management: grazing should be managed to maintain suitable cover for prey
Plant Native Grasses and Forbs: where planting is necessary to provide herbaceous cover for prey
Plant Shrubs: in relatively large open areas where brushy cover or thickets for denning and resting sites is limiting
Set-back Succession: *Prescribed Fire* is recommended to maintain grasslands and prevent young trees from dominating early successional openings in some areas; *Prescribed Fire* can also be used to enhance understory structure in savannas and woodlands; *Chainsawing* and *Root-plowing* may be used to convert forest cover to herbaceous openings and shrublands; *Drum-chopping* may be used to enhance shrublands when shade limits herbaceous growth

Decrease Harvest: when the population is declining in response to trapping or hunting pressure and an increase in population is desired

Increase Harvest: when the population can sustain additional harvest for additional recreational trapping or hunting; to promote increased abundance of prey species, such as waterfowl (nests) or cottontails, if red fox has been identified as limiting those populations; increasing harvest may also reduce damage issues associated with human structures and small livestock

Wildlife Damage Management: exclusion practices can discourage red foxes from denning under human structures; exclusion practices and trapping can limit predation on small livestock, such as chickens

Wildlife or Fish Survey: track counts and scent stations are used to estimate population trends

Red squirrel

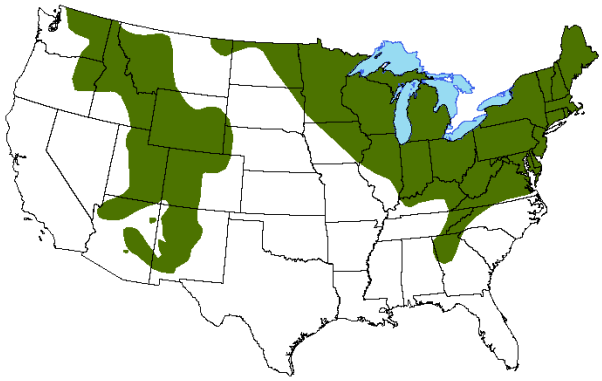
General information

Gilles Gonthier

Red squirrels occur in the Rocky Mountains, Great Lakes, and New England regions, and down the Appalachians. They are found primarily in boreal coniferous forest and mixed deciduous-coniferous forest. Red squirrels den in tree cavities, but will make ball nests on large tree limbs close to the trunk or in underground burrows if cavities are not available.

Habitat requirements

Diet: pine seeds, hard and soft mast, eggs, and mushrooms
Water: free-standing water required regularly
Cover: coniferous and mixed deciduous-coniferous forest; nest in tree cavities and build nests of shredded bark, grass, leaves, twigs



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for red squirrels
Forest Management: *Timber Stand Improvement* can improve species composition and help increase mast production; snags should be retained for possible cavities
Livestock Management: livestock should be excluded from forest managed for red squirrel
Plant Trees: in large open areas to provide future habitat for red squirrels
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Increase Harvest: where populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Wildlife or Fish Survey: observation surveys can be used to estimate population trends

River otter

General information

Jim Leopold

The river otter is a brownish black semi-aquatic mammal that is a member of the weasel family. River otters are highly social and the group is called a family, which consists of an adult female and her offspring. Adult males form social groups separate from the families except during the breeding season. Adults typically weigh 15 to 25 pounds and are well-equipped for aquatic life with short fur, short, powerful legs, webbed toes, and long tapered tails. River otters are superb swimmers and divers and can remain underwater for several minutes. They are active year-round, but are mostly nocturnal during spring, summer, and fall. River otters live in a holt, which is a den constructed of burrows of other mammals. They also den along undercut riverbanks, hollow logs near or in the water, rock formations, and flooded debris that provide protection and seclusion with easy access to water. Urbanization and pollution have decreased the range of river otters.

Habitat requirements

Diet: primarily fish, but they will also feed extensively on aquatic insects and crayfish; small mammals and amphibians are eaten occasionally
Water: largely obtained from their diet; clean water is essential for fish populations
Cover: riparian areas along creeks and rivers, as well as freshwater lakes, inland wetlands, coastal shorelines, marshes, and estuaries

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive aquatic vegetation begins to reduce habitat quality for prey
Repair Spillway/Levee: if not functioning properly
Water Control Structures: are required to manage water levels in impoundments and influence habitat for river otters and prey
Water Developments for Wildlife: impoundments may be created adjacent to riparian areas where additional habitat for river otters is desired
Decreased Harvest: may be necessary if trapping has been excessive and an increase in population is desired
Increase Harvest: may be required if predation is limiting populations of various prey species or when a reduction in population is desired
Wildlife Damage Management: is necessary when recreational or commercial fisheries are being threatened by river otters
Wildlife or Fish Survey: camera and track surveys can be used to monitor populations

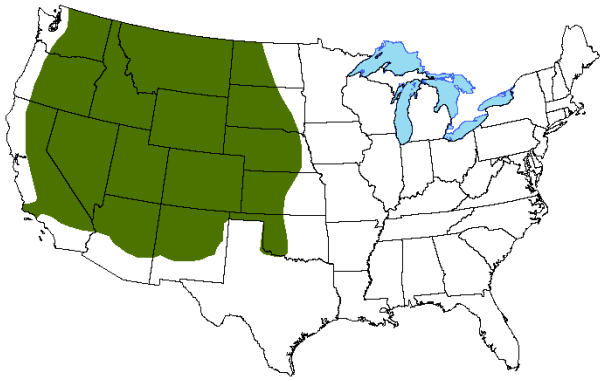
Rocky Mountain mule deer

General information

Tupper Ansel Blake

Rocky Mountain mule deer, a subspecies of mule deer, occur in western North America (from Oklahoma to California and Northward to Northern Canada), just north of the range of the desert mule deer. They are adapted to a wide range of western plant communities from prairie to alpine to semi-desert, but prefer a mixture of early successional areas with scattered shrubs and mature forest. Mule deer are ruminants (animals with a four-chambered stomach) and are adapted to eat higher-quality forages, more often than other ruminants (such as elk or cattle). Rocky Mountain mule deer that occupy ranges with high elevations migrate to lower elevations in winter for access to preferred forage, avoidance of deep snow cover, and protection from cold winds. Mule deer can cause significant damage (ornamental plantings, forest crops, and row crops) when overabundant and can be hazardous for motor vehicles.

Habitat requirements



Diet: forbs, browse, soft mast, grains, and grasses
Water: free-standing water is required nearly daily in dry ecoregions and during summer; water should be available within one mile
Cover: dense woody vegetation and relatively tall early successional cover, including native grasses, forbs, and shrubs; rock outcrops and ravines for loafing cover; in the Intermountain ecoregion, 50 percent young and mature forest well interspersed with herbaceous and shrubby cover is optimal

Wildlife management practices

Control Nonnative Invasive Vegetation: if nonnative invasive plants are competing with native vegetation and reducing habitat quality for Rocky Mountain mule deer
Edge Feathering: to create an ecotone between openings and forest that will provide increased browse and enhance fawning cover
Field Borders: to increase fawning cover and forage availability around row-crop fields
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) can stimulate herbaceous cover and provide additional brushy cover for a few years; *Timber Stand Improvement* can stimulate additional herbaceous cover and browse in the understory where needed
Leave Crop Unharvested: to provide additional food resource, especially near cover
Livestock Management: grazing intensity should be managed to maintain forbs for forage, adequate cover for fawning, and shrubs and young trees for browse and cover; livestock should be excluded from forests to prevent destruction of the understory where mule deer is a focal species; livestock watering facilities may be necessary in uplands to discourage congregation in and overuse of riparian areas

Plant Food Plots: where naturally occurring food resources are limited; food plots may provide additional nutrition, particularly during late summer and winter in some areas
Plant Native Grasses and Forbs: where planting is necessary to increase grasses and forbs for forage and cover
Plant Shrubs: where additional shrub cover and browse is needed
Plant Trees: (in some ecoregions) where additional forest cover is needed
Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous cover and revert shrubby areas and young forest back to herbaceous vegetation; also to stimulate the understory for increased forage and soft mast in young and mature forests; *Mowing* and *Chaining* also can maintain herbaceous vegetation and shrubs; *Chainsawing* and *Root-plowing* may be used to create additional open areas
Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source
Water Developments for Wildlife: where water is limited or absent (within one mile), ponds and shallow impoundments can provide an external water source for drinking
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Increase Harvest: when populations can sustain additional hunting pressure for recreation and when populations need to be lowered
Wildlife Damage Management Techniques: fencing, repellents, and scare tactics may be helpful to keep deer from ornamental plantings, vegetable gardens, and crops; reducing the population through shooting is recommended when local overabundance is causing crop depredation and increasing vehicle collisions
Wildlife or Fish Survey: spotlight surveys, camera surveys, and hunter harvest data help assess population trends

Snowshoe hare

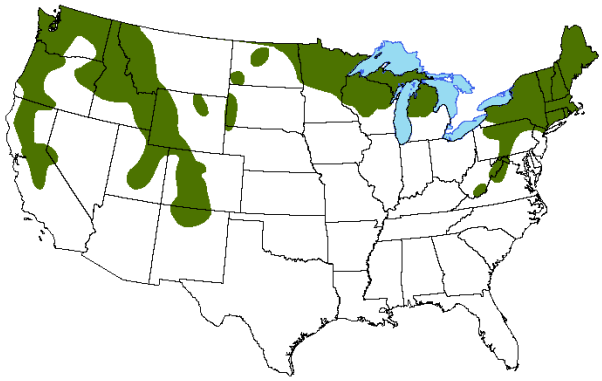
General information

Snowshoe hares are found in the northern U.S., the Rocky Mountains, the Sierra Nevada, and the Appalachians. They are commonly found in both young and mature coniferous and deciduous forest, but prefer dense cover, especially near low wet areas. They forage in recently regenerated forest and forest openings. Snowshoe hares do not use dens.

USFWS

Habitat requirements

Diet: forbs, grasses, soft mast in spring and summer; browse and bark in winter
Water: probably obtain necessary water through diet
Cover: dense thickets and young forest cover; mature forest with dense understory; seldom far from dense cover; forest openings and riparian areas; give birth under a shrub or fallen log



Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for snowshoe hares
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*) will provide dense cover and increased soft mast for several years after harvest; *Timber Stand Improvement* can enhance understory development and soft mast production
Livestock Management: livestock should be excluded for forests managed for snowwhoe hare; should prevent overgrazing in forest openings to maintain sufficient cover and forage for snowshoe hares
Plant Shrubs: where dense shrub cover is lacking and planting is necessary
Plant Trees: in relatively large open areas to maintain at least 80 percent forest cover
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Increase Harvest: when populations can sustain additional hunting pressure for recreation and when population reduction is desired
Wildlife Damage Management: when snowshoe hare populations eat the bark of commercially valuable trees during winter
Wildlife or Fish Survey: track counts, observation counts, and hunter observation data can be used to estimate population trends

White-tailed deer

General information

Craig Harper

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

Habitat requirements

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

Wildlife management practices

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

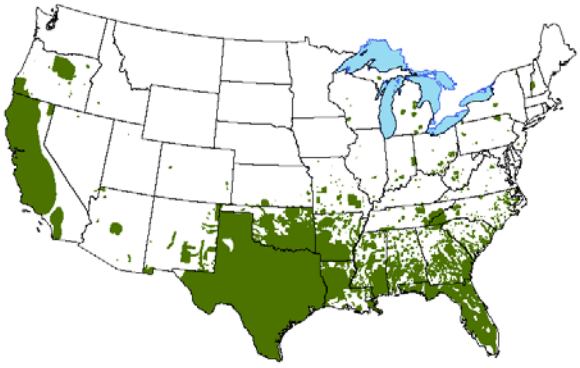
Plant Food Plots: when naturally occurring food sources are limited, food plots may provide additional nutrition, particularly in late summer and winter of most ecoregions
Plant Native Grasses and Forbs: where early successional cover is limiting and planting is necessary for establishment
Plant Shrubs: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

Wild pig

General information

Craig Harper

Wild pigs (also called feral hogs) were first introduced into what is now the United States at Tampa Bay, Florida by the explorer Hernando de Soto in 1539. In addition, early settlers throughout the southeastern United States also raised domesticated swine, some of which escaped and became feral, leading to their establishment throughout the South and California. Today, 36 states have wild pig populations estimated between 5 and 8 million nationwide. Many of these populations became established because of indiscriminant and illegal stockings for hunting purposes.
As an invasive nonnative species, wild pigs cause ecological damage via their rooting behavior and competition for food and space with a number of native wildlife species and predate upon many small amphibian and reptile species. Wild pigs also cause considerable agricultural damage to crops, pastures, livestock, and environmental damage to riparian areas, often resulting in water quality degradation as a result of their rooting and wallowing behavior.



Habitat requirements

Diet: Wild pigs are perhaps the perfect example of an omnivore; approximately 85 percent of their diet is vegetation, but they also prey upon small animals and often scavenge animal carcasses; they especially prefer crops, such as corn and peanuts, and aggressively out-compete native wildlife species for hard and soft mast whenever those food items are available
Water: wild pigs must have access to free-standing water for drinking and thermoregulation
Cover: wild pigs seek dense cover, such as heavy understory or thick shrubs and grasslands, near or in riparian areas that reduce opportunity for human contact; pig family groups (called sounders) often use streams, rivers, creeks, and associated wetlands as travel corridors to move as they seek food sources

Wildlife management practices

Increase Harvest: the wild pig is an invasive nonnative species that competes with native wildlife for food and in some instances preys directly upon many small vertebrate species, including birds, mammals, reptiles, and amphibians; whenever wild pigs are observed or their sign is documented, control methods, such as trapping, snaring, shooting, and dogging, should be used with an ultimate goal of eradication
Wildlife Damage Management: may be necessary if wild pigs negatively impact crops, forages, or livestock; fencing high-value crops and other areas may be used as a non-lethal method for reducing wild pig damage, but it does not decrease the population
Wildlife or Fish Survey: camera surveys, track counts, and evidence of rooting are used to estimate population trends

Reptiles

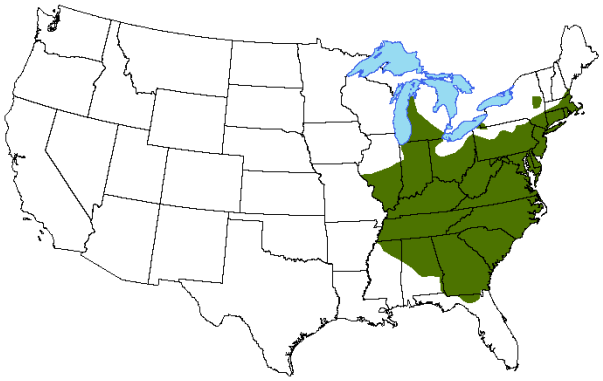
Eastern box turtle

General information

Chelsi Hornbaker

The eastern box turtle occurs throughout much of the eastern United States. It prefers deciduous or mixed woodlands, but will also inhabit thickets, old-fields, pastures, and wetlands. The species is named for its high, domed-shaped shell that closes tightly into a "box" when the turtle is alarmed. The eastern box turtle is active throughout spring, summer, and fall. During the hot, dry summer months it is often found soaking around the edges of ponds, streams, or wetlands. When temperatures begin to drop in late fall, it burrows into the leaf litter and loose soil to overwinter (for up to six months of the year). It burrows deeper into the ground as the soil temperature drops. The same overwintering location may be used year after year. Eastern box turtles are long-lived reptiles. They have been recorded to live more than 100 years in the wild.

Habitat requirements



Diet: omnivorous; earthworms, snails, slugs, insects, mushrooms, numerous leafy greens, and soft mast (fruit)
Water: requires water to soak during the hot, dry months of the active season
Cover: moist, forested areas with a diverse understory and abundant leaf litter; nesting cover found in moist soil within small openings with an open structure at ground level

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality
Field Borders: to increase usable space around row crop fields
Forest Management: *Forest Regeneration* (*Group Selection*) and *Timber Stand Improvement* can increase understory vegetation for food
Livestock Management: should prevent overgrazing in open areas; livestock should be removed from forested areas to maintain understory
Plant Native Grasses and Forbs: to provide cover in open areas where there is little to no vegetation
Plant Shrubs: where adequate cover is lacking in large open areas
Plant Trees: where additional forest cover is needed
Set-back Succession: *Prescribed Fire* and *Disking* are recommended to maintain herbaceous openings and provide open structure at ground level; it is important these practices occur during the inactive season to minimize negative effects on the turtles
Water Development for Wildlife: small ponds should be provided when water is absent
Wildlife or Fish Survey: transect counts and dogs are used to estimate population trends

Eastern indigo snake

General information

Daniel Dye

Eastern indigo snakes are found primarily in Florida and southern Georgia and have been listed as federally endangered since 1971. They are the largest snakes in the United States, reaching lengths of 60-84 inches. Although they prefer wetland areas, they also may be found in pine and shrubby flatwoods, grasslands, tropical hammocks, agricultural fields, and coastal dunes. They use abandoned gopher tortoise burrows, and other burrows, for reproduction and cover. Eastern indigo snakes have a docile, nonaggressive nature and can live near humans without negative interactions. They are important predators of rodents and venomous snakes.

Habitat requirements

Diet: small mammals, frogs, lizards, fish, eggs, birds, and other snakes
Water: requirements largely unknown; likely obtain water needs from the foods they consume
Cover: sandy soils with an abundance of animal burrows and stump holes in areas dominated by pine and hardwood forests, woodlands, and savanna; they also use hammocks, palmetto flats, and brushy areas near riparian areas and wetlands

Wildlife management practices

Conservation Easement: can protect longleaf pine systems for this declining species
Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to decrease habitat quality for eastern indigo snakes
Forest Management: *Forest Regeneration*, especially *Seedtree* and *Single-tree Selection*, in pine forests and woodlands can enhance cover for prey and provide stump holes and down woody debris; *Group Selection* and *Timber Stand Improvement* can enhance cover in hardwood stands
Plant Native Grasses and Forbs: may be necessary in open areas with insufficient groundcover
Plant Trees: in large open areas where additional forest cover is needed
Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous groundcover in longleaf pine savanna and woodland, and limit encroachment of woody cover in old-fields and grasslands
Water Developments for Wildlife: where lacking, small wetlands can increase habitat suitability
Wildlife or Fish Survey: transect surveys and drift fences with snake traps may be used to estimate population trends

Eastern snapping turtle

General information

Chelsi Hornbaker

The eastern snapping turtle is found across much of the U.S. east of the Rocky Mountains. It occurs in most permanent bodies of water, but prefers soft mud-bottomed ponds, lakes, and slow streams with dense vegetation. It is one of the more aquatic freshwater turtles and spends most of its time lying on the bottom of deep pools or buried in the mud in shallow water with only its eyes and nostrils breaking the surface of the water. The primary nesting season is May-June with the female digging a hole and laying about 30 eggs. Eastern snapping turtles are omnivorous and will consume relatively large invertebrate and small vertebrate prey. If approached, snapping turtles will turn to face the potential predator, lunge forward, and strike quickly with powerful beaked jaws. Eastern snapping turtles grow slowly, but can attain very large sizes (>50 lbs). They have heavy muscular legs and are often harvested for human consumption.

Habitat requirements

Diet: insects, crayfish, clams, earthworms, fish, frogs, toads, salamanders, snakes, small turtles, birds, and small mammals; also consumes various aquatic plant species
Water: requires permanent bodies of water
Cover: permanent water bodies with muddy bottoms and thick vegetation; hides underwater beneath submerged stumps, roots, brush, and buried in the mud

Wildlife management practices

Repair Spillway/Levee: if not functioning properly
Water Control Structure: should be installed if one is not present to manipulate water levels as needed
Water Development for Wildlife: small ponds may be built when permanent bodies of water are not available
Decrease Harvest*:* may be necessary when harvest pressure limits population growth
Increase Harvest: where populations can sustain additional harvest pressure and if the turtles are limiting other desirable species
Wildlife Damage Management: may be necessary if turtles are found in fish hatcheries
Wildlife or Fish Survey: hoop net traps are used to estimate population trends

Gila monster

General information

Gary M Stolz

The Gila monster is the largest lizard native to the U.S., and one of only a few venomous lizard species in the world. Most of the Gila monster's teeth have two grooves that allow its venom, a nerve toxin, to flow into the wound as the lizard holds its prey. Gila monster venom is not fatal to humans. Furthermore, the Gila monster is not aggressive and prefers to avoid people. It is restricted to the arid regions of the desert southwest. It is most active during the spring and summer months, but spends more than 95 percent of the active season in burrows or under rocks emerging mainly to bask and feed. The Gila monster is a carnivore that feeds on nestling mammals and birds, eggs of birds and reptiles, lizards, and carrion. They are able to go months between meals and store fat reserves in their stout tails.

Habitat requirements

Diet: young of small mammals and birds, eggs of lizards and ground nesting birds, carrion
Water: receives necessary water from diet
Cover: typically found in desert grasslands, Mohave and Sonoran desert scrub, and thorn scrub (Sonora); less often oak or pine-oak woodland; sub-surface shelters are important components of its habitat

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for Gila monsters
Plant Shrubs*:* where cover is lacking for prey species
Water Developments for Wildlife: in certain areas, it may be possible to create standing water to attract prey species
Wildlife or Fish Survey: transect surveys are used to estimate population trends

Gopher tortoise

General information

Dwayne Elmore

The gopher tortoise occurs in the southeastern Coastal Plain from southeastern South Carolina to extreme southeastern Louisiana. It inhabits open uplands, especially those with relatively well-drained, sandy soils. The gopher tortoise prefers longleaf pine and oak sandhills with open canopies, but also occurs in dry prairie, coastal grasslands and dunes, and mixed hardwood-pine stands. Gopher tortoises dig burrows up to 20 feet long and 6 feet deep. These burrows, from which the species was named, provide it protection from high and low temperatures extremes, moisture loss, and predators. These burrows also serve as a refuge for nearly 400 other species (including the federally endangered indigo snake). Gopher tortoises require a diverse understory of plants close by as most feeding occurs within 150 feet of their burrow entrance.

Habitat requirements

Diet: grasses, legumes, and fruits
Water: necessary water obtained from diet
Cover: burrows provide necessary cover

Wildlife management practices

Conservation Easement: can protect longleaf pine systems for this declining species
Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for gopher tortoises, especially by limiting herbaceous diversity
Forest Management: *Forest Regeneration* (*Single-tree Selection*) is recommended to regenerate and maintain mature stands of longleaf pine; *Timber Stand Improvement* can remove undesirable species
Plant Native Grasses and Forbs: may be necessary in open areas with insufficient groundcover
Plant Trees*:* where additional forest cover is needed (maintain 20-60 percent canopy cover)
Set-back Succession: *Prescribed Fire* is recommended to maintain a diverse herbaceous understory; *Chainsawing* is recommended to maintain <60 percent canopy cover and to maintain a diverse herbaceous understory; *Herbicide Applications* may be used with fire and TSI when needed to control undesirable species
Wildlife or Fish Survey: observations and use of gopher tortoise burrows are used to estimate population trends

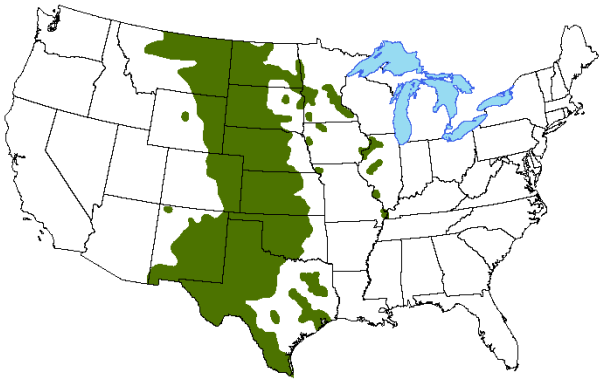
Plains hog-nosed snake

General information

Gary M Stolz

Plains hog-nosed snakes are characterized with dark blotches down a pale brown or yellowish back with a strongly upturned, pointed snout. They are relatively thick, heavy-bodied snakes, reaching 2-3 feet in length. Plains hog-nosed snakes prefer shrubby flat or gently rolling prairies with loose, sandy soil. They use their snouts to burrow into loose soil to find food and spend the winter. Often these sandy sites are characterized by sparse vegetation in most years. Plains hog-nosed snakes have slightly toxic saliva that is not dangerous to humans, but it helps hog-nosed snakes subdue prey. Hog-nosed snakes are masters at bluff behavior. When threatened, they will flatten their heads, giving a hood appearance, similar to a cobra. Then, they often inflate themselves with air and slowly release the air with a hissing noise, similar to a rattlesnake. They may strike, but usually with a closed mouth! It is actually difficult to get a plains hog-nosed snakes to bite in self-defense. It will turn over on its back, thrash back and forth, open its mouth and stick its tongue out, and feign death, while upside down.

Habitat requirements



Diet: mostly toads, but also other reptiles, birds, mice, and eggs
Cover: grasslands and shrubland
Water: necessary water obtained from diet

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for plains hog-nosed snakes
Livestock Management: should prevent overgrazing and leave adequate cover for prey
Plant Native Grasses and Forbs: in open areas where groundcover is lacking and planting is necessary
Set-back Succession: *Prescribed Fire* and *Chaining* are recommended to reduce woody vegetation where needed and maintain native shortgrass prairie; it is important these practices occur during the inactive season to minimize negative effects on snakes
Wildlife or Fish Survey: transect surveys are used to estimate population trends

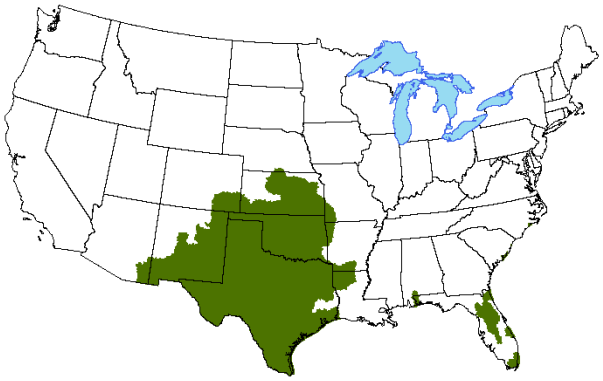
Texas horned lizard

General information

Robert Burton

Texas horned lizards are spiny lizards with a wide body. They are found in deserts, grasslands, and shrublands of the southwestern United States. They regulate their body temperature by basking and burrowing. When a predator approaches, Texas horned lizards will inflate themselves. If the lizard is further frightened, it is capable of squirting nearly one third of its blood volume through a pore near the eye. They also "rain harvest." During heavy rain, they stand high on their feet, flatten the body, and lower the head. This behavior funnels rain to the mouth through specialized scales. Daily activities often are timed around highest ant activities.

Habitat requirements



Diet: mostly ants, but also other invertebrates
Water: known to drink using specialized scales to harvest rain water during heavy rains
Cover: sandy to rocky soils with sparse vegetation of grass, cactus, or scattered shrubs

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative vegetation reduces habitat quality; in particular, dense sod grasses planted as livestock forage should be eradicated where possible when the Texas horned lizard is a focal species.
Plant Shrubs: where shrub cover is lacking
Set-back Succession: *Prescribed Fire* is recommended to maintain diverse grasslands and shrublands; *Drum-chopping* can rejuvenate shrublands; it is important that these practices occur during the inactive season to minimize negative effects on the lizards
Wildlife or Fish Survey: transect surveys are used to estimate population trends

Timber rattlesnake

General information

Dwayne Elmore

Timber rattlesnakes are found throughout much of the eastern U.S. They are most often found in forests, particularly those with rock outcrops, ledges, and steep slopes. Timber rattlesnakes are long-lived reptiles, capable of reaching 25 years of age or older. They are pit vipers, having a heat-sensing organ behind the nostrils that can detect temperature differences, which the snake uses to determine if another animal is a predator or prey. Timber rattlesnakes spend approximately six months of the year hibernating underground (fall-spring) and will re-use a den for many years. They emerge in spring and are primarily active during the daylight hours. Timber rattlesnakes are sit-and-wait predators. They rely on their camouflage patterns as they ambush prey along runways, at the base of tree trunks, and adjacent woody debris. Timber rattlesnakes are generally shy and unaggressive. When approached, they will normally "freeze" or retreat to thick cover, but if cornered they will form a loose coil, raise their heads, rattle their tails, and may strike. The rattle is made of the protein keratin and a new segment is added each time the snake sheds. To rattle, rattlesnakes move the rattle back and forth as much as 40-60 times per second. A rattlesnake cannot be aged by counting the rattle segments because snakes shed at varying rates, often multiple times in one year, and rattle segments commonly break-off. Timber rattlesnakes are venomous and should not be handled.

Habitat requirements

Diet: small to moderate-sized mammals; chipmunks, mice, voles, and squirrels; occasionally small birds
Water: receives necessary water from diet, but will drink free-standing water if available
Cover: upland forests with deep leaf litter and large amounts of downed woody debris; winter cover is necessary for hibernation in the form of rock crevices, rodent burrows, and root systems

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for timber rattlesnakes; in particular, nonnative sod grasses should be eradicated
Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*) and *Timber Stand Improvement* will provide dense groundcover that may support increased prey for several years and increased large woody debris for ambush sites and loafing cover; timing of *Forest Management* should ideally happen during the inactive season, especially around denning sites
Livestock Management: should prevent overgrazing and leave adequate cover for prey; livestock should be excluded from forests where timber rattlesnakes are a focal species to avoid eliminating understory cover
Plant Trees: in relatively large open areas where additional forest cover is needed
Wildlife Damage Management Techniques: may be necessary to relocate timber rattlesnakes if found within or close to human dwellings
Wildlife or Fish Survey: transect surveys and searches near known hibernacula sites during spring and fall when snakes are entering or leaving hibernacula are used to estimate population trends

Western diamond-backed rattlesnake

General information

Gary M. Stolz

Western diamond-backed rattlesnakes are found in deserts, grasslands, shrublands, and woodlands of the southwestern United States. They are pit vipers, having a heat-sensing organ beneath the nostrils that can detect temperature differences, which the snake uses to determine if another animal is a predator or prey. Western diamond-backed rattlesnakes usually spend daylight hours in the shade of low-growing shrubs, debris piles, or rocks. They are most active around sunrise and sunset, and at night during summer. The rattle is made of the protein keratin and a new segment is added each time the snake sheds. A rattlesnake cannot be aged by counting the rattle segments because snakes shed at varying rates, often multiple times in one year, and rattle segments commonly break-off. To rattle, rattlesnakes move the rattle back and forth as much as 40-60 times per second. Western diamond-backed rattlesnakes are venomous and should not be handled.

Habitat requirements

Diet: mostly mammals (rabbits, squirrels, mice, and rats), but also lizards and birds
Water: will consume their body weight in free-standing water annually; they also get water from their food and some is absorbed during shedding.
Cover: areas with grass, forbs, cactus, or scattered shrubs; areas with sandy to rocky soils may provide animal burrows and rocky crevices used for cover

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for western diamond-backed rattlesnakes; in particular, nonnative sod grasses should be eradicated
Plant Native Grasses and Forbs: when grass/forb cover is limiting and planting is necessary
Plant Shrubs: in large open areas where additional shrub cover is needed to provide daytime loafing areas and attract prey
Set-back Succession: *Prescribed Fire* is recommended to maintain diverse grasslands and rejuvenate shrublands that have become too dense to allow sufficient herbaceous groundcover; *Drum-chopping* also can be used to rejuvenate shrublands; it is important these practices occur during the inactive season to minimize negative effects on snakes
Wildlife Damage Management: it may be necessary to remove western diamond-backed rattlesnakes from around human dwellings; debris piles attract prey, and thus snakes, making it desirable to keep such debris away from houses and buildings
Wildlife or Fish Survey: transect surveys are used to estimate population trends

Amphibians

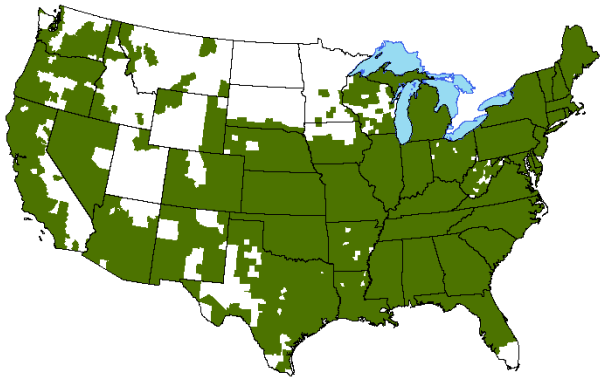
American bullfrog

General information

Bill Buchanan

The American bullfrog's native range extends from the Atlantic Coast to eastern Colorado and eastern Mexico, and from southern Colorado to northeastern Mexico. Bullfrogs are not native west of the Rocky Mountains, but have been successfully introduced in many areas. Bullfrogs inhabit permanent bodies of standing or slow-moving water. Bullfrog tadpoles require two years to metamorphose. They prefer shorelines with dense vegetation adjacent to shallow open water dominated by floating and submerged aquatic vegetation. All habitat requirements are usually found in and around a single pond.

Habitat requirements



Diet: insects, crayfish, other frogs, reptiles, snails, fish, and occasionally small mammals and birds
Water: stable water levels are necessary for hibernation and egg development; water levels should be maintained at a constant level
Cover: dense, emergent aquatic and upland herbaceous vegetation adjacent to water for hiding and foraging

Wildlife management practices

Livestock Management: livestock should be excluded from ponds managed for bullfrog; livestock watering facilities should be developed away from pond
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be installed if none are present so water depth can be managed as appropriate
Water Developments for Wildlife: where insufficient water source is present, ponds and shallow impoundments can be provided
Decrease Harvest: if current hunting pressure is causing population to decline and population growth is desired
Increase Harvest: where populations can sustain additional harvest pressure for hunting recreation
Wildlife or Fish Survey: call counts are used to estimate population trends

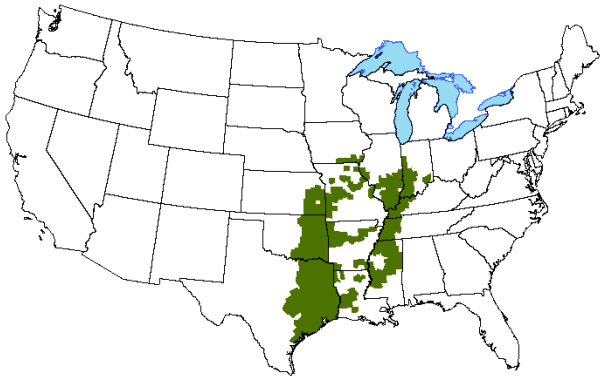
Crawfish frog

General information

Rick Fridell

Crawfish frogs are found from Indiana south to Louisiana, and from eastern Kansas south to the Texas coast. Crawfish frogs are found in a variety of vegetation types ranging from damp wooded valleys, open brushy fields, to tallgrass prairies. Populations are often associated with major river floodplains. Areas with shallow soils and intensive agriculture are avoided. Crawfish frogs are largely fossorial and spend the non-breeding season in crayfish burrows. Adults make annual migrations to temporary, fishless ponds to breed. Eggs hatch within 3-4 days, but tadpoles may take 2 months to transform.

Habitat requirements



Diet: adults eat beetles, spiders, crickets, ants, millipedes, and small crayfish; tadpoles filter feed on phytoplankton
Water: breed in ephemeral, fishless ponds with grassy margins
Cover: adults require low, wet areas, including moist meadows, prairies, woodlands, and brushy fields; burrows are required; crayfish burrows are preferred, but any burrow may be used as long as it reaches the water table; tadpoles require ponds that contain some algae, pondweed, and other vegetation to provide food and shelter

Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species
Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for crawfish frogs
Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for crawfish frogs; livestock watering facilities should be developed away from pond
Plant Native Grasses and Forbs*:* may be necessary to convert fields currently in row-crop agriculture to crawfish frog habitat
Plant Shrubs: in fields that are currently in row-crop agriculture to convert them to crawfish frog habitat, or in large open areas that need additional cover
Water Control Structures: should be installed if not present in ponds with levees that are managed for crawfish frogs to enable the pond to be drained, especially if fish are introduced
Water Developments for Wildlife: small, fishless ponds may be created if additional breeding ponds are needed
Wildlife or Fish Survey: call counts are used to estimate population trends

Monterey salamander

General information

Stuart Wilson

The Monterey salamander occurs along the Pacific coast from Washington to southern California. This species is treated as a "ring" species whose subspecies form a ring-shaped distribution around the Central Valley of California and do not interbreed where the ends of the ring overlap in southern California. It inhabits a wide variety of vegetation types in hilly or mountainous terrain from near sea level to approximately 10,000 feet in elevation. Monterey salamanders occur in chaparral, wet coastal forests, coastal sagebrush, pine-oak woodlands, and mixed conifer-hardwood forests. Moist soil conditions are necessary for Monterey salamanders to occur because they lack lungs and respire through their moist skin.

Habitat requirements

Diet: invertebrates, such as sow bugs, mites, spiders, centipedes, and beetles
Water: moist soil required for respiration
Cover: large amounts of downed woody debris; they also hide beneath moss mats, rocks, leaf litter, and within rodent burrows

Wildlife management practices

Forest Management: *Forest Regeneration* (*Group Selection, Single-tree Selection*) or *Timber Stand Improvement* may be beneficial in areas where additional down woody debris is needed; when regenerating a forest, it is important to use either *Group Selection* or *Single-tree Selection* to minimize area exposed to sunlight and soil-drying conditions
Plant Shrubs: where cover is limiting
Plant Trees*:* where cover is limiting
Wildlife or Fish Survey: drift fences with pitfall traps are used to estimate population trends

Northern red-legged frog

General information

Northern red-legged frogs are found in low, moist forests of the Pacific Northwest. They typically occur near permanent, quiet water, such as stream pools, marshes, and ponds. During wet weather, they can be found in damp woods and meadows, as well as ephemeral pools. They are active mostly at night, especially during wet periods. Northern red-legged frogs usually remain motionless when approached before bounding away with long, evasive jumps. The breeding call is relatively weak and consists of 4-7 notes that sound like "uh-uh-uh-uh." When captured by a predator, they often emit a loud scream.

Nirvan Hope

Habitat requirements

Diet: tadpoles are herbivores, consuming algae and organic debris; adults consume small invertebrates, including beetles, caterpillars, and isopods
Water: non-flowing water is required for reproduction
Cover: breeding ponds require limbs or stems at the surface to attach egg masses, and must not contain fish; adults use damp woods and meadows with permanent water; forests must contain fallen logs and other coarse woody debris.

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for northern red-legged frogs
Forest Management: *Forest Regeneration* (*Group Selection* and *Single-tree Selection*) can create small canopy gaps in the forest and increase the amount of coarse woody debris; *Timber Stand Improvement* can also increase understory structure and coarse woody debris; it is important to retain considerable overstory cover
Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for northern red-legged frogs; livestock watering facilities should be developed away from pond
Plant Trees: where forest cover is limiting
Water Developments for Wildlife: small ponds can be created in forested areas to provide breeding areas; woody debris in the pond should include small stems at the water surface for egg mass attachment.
Wildlife or Fish Survey: call counts are used to estimate population trends

Rough-skinned newt

General information

Dwayne Elmore

Adult rough-skinned newts prefer moist coniferous and hardwood forests, but also are found in open valleys. Newts require permanent water, such as ponds or slow-moving streams, for courtship, breeding, egg-laying, and larvae development. Eggs are laid singly on aquatic vegetation or submerged twigs. Aquatic larvae transform in late summer or over winter and transform the following summer. Adult rough-skinned newts are generally terrestrial, often seen crawling over land in the daytime and becoming aquatic when breeding. However, some populations hide in daylight and are active at night. Some adults are primarily aquatic. Newts are often seen moving in large numbers to breeding sites during the breeding season. Some newts spend the dry summer in moist areas under woody debris, rocks, or animal burrows. Adults emerge to feed after fall rains. In some populations, adults remain in ponds throughout summer and migrate back onto land in fall following rain events. Often, they will form large aggregates of thousands of newts in the water. Adult newts have rough or granular skin, which produces toxins that repel most predators. Rough-skinned newts may assume a swaybacked defense pose with a coiled tail, exposing the bright ventral surface to warn potential predators. Toxin-resistant garter snakes are the only known animals that prey on rough-skinned newts.

Habitat requirements

Diet: larvae feed on aquatic invertebrates; adults eat amphibian eggs and larvae, aquatic and terrestrial invertebrates, worms, and slugs
Water: permanent water, such as ponds and slow-moving streams, are required for breeding and larval development
Cover: shallow water with aquatic vegetation or submerged woody debris is needed for attachment of eggs; soft logs, rocks, and bark are necessary for adult escape cover

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for rough-skinned newts
Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for rough-skinned newts; livestock watering facilities should be developed away from pond
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be installed in pond dams or impoundment levees if none are present so water depth can be controlled
Water Developments for Wildlife: small ponds can be constructed when breeding ponds are limiting
Wildlife or Fish Survey: seine surveys and minnow traps could be used to estimate population trends

Tiger salamander

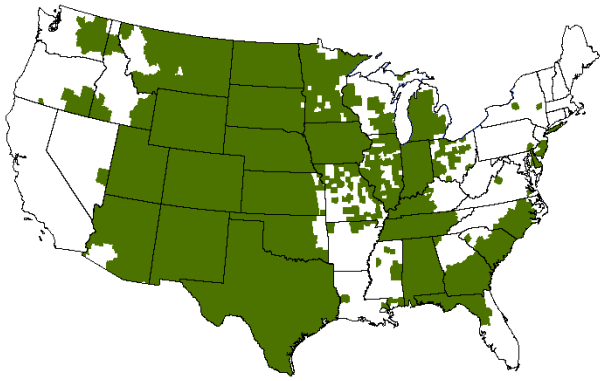
General information

Gary M Stolz

The tiger salamander is a wide-ranging species occurring throughout the Great Plains and much of the eastern U.S. (it is absent from the Appalachian mountain regions). It is one of the largest terrestrial salamanders in North America with adults attaining more than one foot in length. Adults inhabit a wide array of vegetation types including bottomland deciduous forests, conifer forests, woodlands, fallow fields, grasslands, meadows, brushy areas, semideserts, and deserts. Free-standing water must be present for breeding. Adults are terrestrial, but make annual, spring migrations to ephemeral (temporary) ponds to breed. Ephemeral ponds contain water during only a portion of the year. The breeding season is short and eggs develop rapidly. Larvae are top predators in fishless ponds. They often grow quickly and can reach 4-6 inches in length before transforming in late summer.

Habitat requirements

Diet: adults eat worms, snails, insects, and slugs; larvae eat a wide variety of aquatic organisms, including invertebrates and other amphibian eggs and larvae
Water: ephemeral or semi-permanent ponds are necessary for reproduction; ponds should be fishless if successful reproduction is to occur
Cover: adult tiger salamanders live underground in burrows for most of the year; deep leaf litter and large amounts of downed woody debris are most desirable



Wildlife management practices

Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for tiger salamanders; livestock watering facilities should be developed away from pond
Plant Native Grasses and Forbs*:* when converting fields that are currently in row-crop agriculture to tiger salamander habitat
Plant Shrubs: when converting fields that are currently in row-crop agriculture to tiger salamander habitat, or in relatively large open areas that need additional cover
Plant Trees: where additional forest cover is needed
Water Control Structures: should be installed if not present in ponds with levees that are managed for tiger salamanders to enable the pond to be drained, especially if fish are introduced
Water Developments for Wildlife: small, fishless ponds may be created if additional breeding ponds are needed
Wildlife or Fish Survey: cover boards and pitfall traps along drift fences are used to estimate population trends

Wood frog

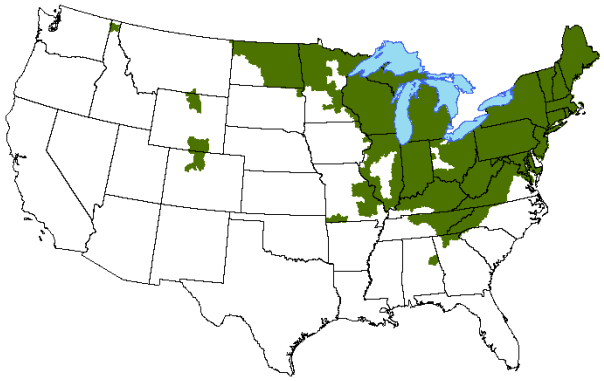
General information

Bo Zaremba

Wood frogs have the most extensive range of any North American frog or toad. They occur from the southern Appalachian mountains of Georgia to northern Canada, and westward throughout the Great Lakes region, Canada, and Alaska. In the northern climates, wood frogs bury themselves in the leaf litter to escape freezing temperatures. They also are able to withstand extended periods of sub-freezing temperatures by increasing blood-glucose levels, which serve as cryoprotectants (antifreeze). Individuals can survive whole-body freezing for more than a week. Wood frogs are closely associated with closed-canopy deciduous and boreal forests. Adults are largely terrestrial, but make annual migrations to ephemeral ponds to breed. The breeding seasons are short (6-14 days) and eggs develop rapidly (4-30 days) in the shallow ponds. Tadpoles grow quickly and generally transform in 6 to 15 weeks.

Habitat requirements

Diet: adults eat terrestrial invertebrates, such as beetles, crickets, spiders, and earthworms; tadpoles filter phytoplankton from the water
Water: breed in shallow water within closed-canopy forests; breeding ponds are usually fishless and are dry at some time of the year
Cover: optimum habitat consists of >70 percent canopy cover in deciduous or boreal forests; prefer areas with moist soils, abundant leaf litter, and downed woody debris



Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation creates undesirable conditions for wood frogs, limiting movement to breeding ponds
Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for wood frogs; livestock watering facilities should be developed away from pond
Plant Trees: in large open areas where additional forest cover is needed (should maintain >70 percent canopy cover)
Water Developments for Wildlife: maintain ephemeral pools; create small, fishless ponds if additional breeding ponds are needed
Wildlife or Fish Survey: call counts are used to estimate population trends

Fish

Bluegill

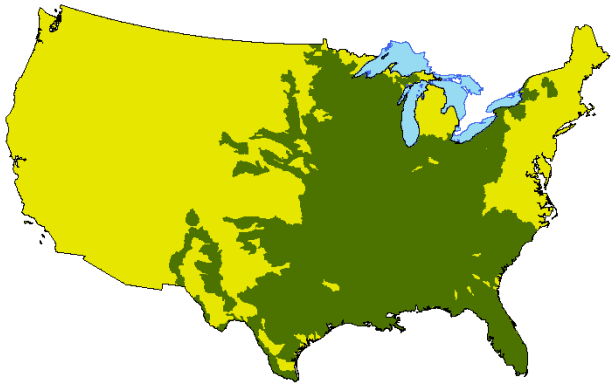
General information

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

Eric Engbretson

Habitat requirements

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



Wildlife management practices

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

Coho salmon

General information

Timothy Knepp

The Coho salmon is an anadromous fish species, which means they live part of their lives in saltwater before migrating to freshwater to spawn. They can attain weights of about 35 pounds, but 10 pounds is the average. The range of the Coho salmon in the U.S. is from Alaska southward to northern California. While in the ocean, Coho salmon have dark bluish backs and silver sides and are therefore often called silver salmon. When mature (3 years old), Coho salmon migrate to freshwater to spawn (November to January) and their coloration darkens with reddish sides. Males develop a pronounced hooked jaw/nose during the spawning season. Adults return to their stream of origin to spawn and die after spawning. The eggs are laid in nests called *redds* and hatch 6 to 7 weeks later in the spring. Young Coho salmon remain in streams and freshwater tributaries for more than a year before migrating (they are called *smolts* in this life stage) to the ocean. The life cycle is complete when they return to their freshwater stream of origin to spawn. The Coho, like many other salmon species found on the west coast, have experienced severe population declines in the past several decades. Reasons for these declines are complex but may include siltation of spawning areas, blockage of migratory routes by dams, and inadequate water flows in spawning areas as a result of water diversion for other purposes. Estuarine and marine ecosystems are often negatively impacted by shoreline development, residential drainage, and filling marine wetlands. Several Coho salmon populations occurring from California to Oregon have been listed as federally endangered or as species of concern. However, this species is also an important recreational and commercial species where populations remain strong, especially in Alaska.

Habitat requirements

Diet: in the freshwater juvenile or fingerling stage, Coho salmon feed on plankton, insects, and small fish; smolts switch to a diet comprised solely of fish upon entering the ocean

Water: obtained from aquatic environment and food

Cover: Coho salmon need pollution-free freshwater and marine ecosystems; spawning streams must have a stable gravel substrate for construction of redds

Wildlife management practices

Wildlife or Fish Survey: fishing records, seining, electro-shocking, and fish condition are used to survey Coho salmon populations

Streams: Remove Fish Barriers: such as culverts or dams that may prevent Coho salmon from migrating upstream to spawn

Cutthroat trout

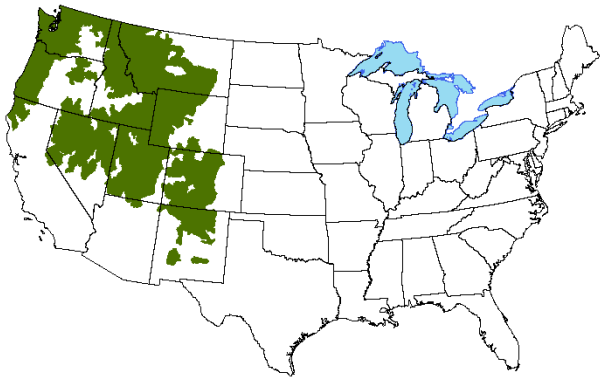
General information

Cutthroat trout are native to the western U.S. They are found in diverse areas, such as the Rocky Mountains, the valleys of the Great Basin, and the Pacific Ocean. They prefer rivers and streams with a gravel bottom, but several subspecies mate in lakes and ponds. Cutthroat trout are carnivores, eating a variety of organisms found in streams and lakes.

NPS

Habitat requirements

Diet: young cutthroat trout eat algae and small crustaceans; adults eat crustaceans, eggs, aquatic insects, mollusks, amphibians (tadpoles), and other fish; adults also eat terrestrial organisms if they fall into stream, but they are not a major part of their diet
Water: streams, lakes, and ponds where water does not rise above 70 F in summer; ideally streams should have a variety of riffles, runs, and pools; basic requirements include dissolved oxygen (minimum 6 parts per million); pH range between 6.5 and 9.0
Cover: prefer streams with overhanging vegetation along the shore that provides shade and reduces water temperature, providing terrestrial organisms for food; rocks, as well as debris on the bottom of the river or lake, provide cover that will hide them from prey



Wildlife management practices

Livestock Management: livestock should be excluded from areas managed for cutthroat trout or only allowed access to a small portion; fencing along the riparian area or lakeside may be necessary; livestock watering facilities should be developed away from streams, rivers, lakes, or ponds;
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest
Wildlife or Fish Survey: fishing records, seining, electro-shocking, and fish condition are used to survey cutthroat trout populations
Streams: Create Pools: gravel and cobble should be placed in streams to provide structure for insects and locations for spawning; structures should not change currents, which could increase bank erosion; boulders and logs may be placed in the stream or lake to provide cover for trout while hunting, as well as cover for prey species; this practice is likely not needed if there are overhanging stream banks that provide cover
Streams: Remove Fish Barriers: because most cutthroat trout populations are migratory, dams can impede their ability to return to spawning grounds; installing fish ladders or removing dams will improve the ability of cutthroat trout to migrate

Largemouth bass

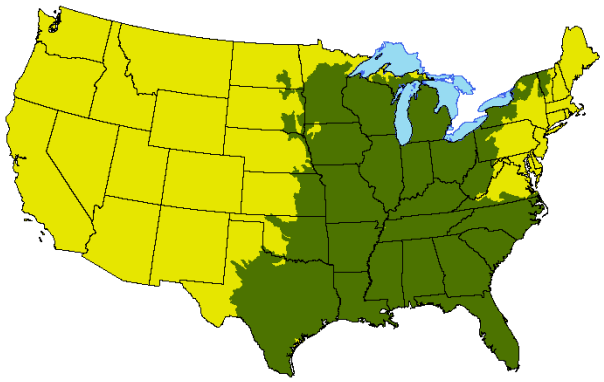
General information

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

Robert H Pos

Habitat requirements

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



Wildlife management practices

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

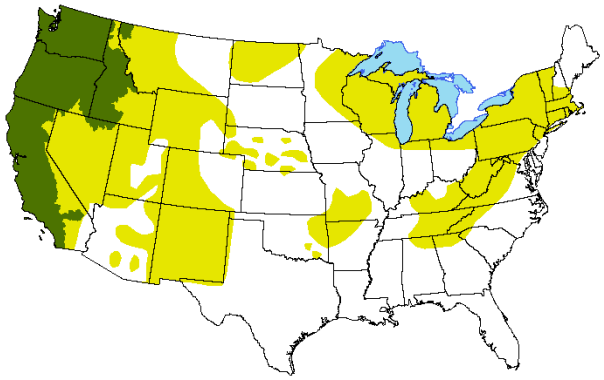
Rainbow trout

General information

Robert H Pos

Rainbow trout are native to the U.S. west of the Rocky Mountains. However, they have been introduced throughout the U.S. as a sport fish. Rainbow trout are cool- to cold-water fish that do best in freshwater systems below 70 F. They can thrive in both rivers and lakes. Rainbow trout are carnivorous and spawn in areas with a rocky bottom. A water flow that reduces sedimentation of the river floor will increase spawning. A healthy riparian system provides rainbow trout with shade. They are responsible for driving many native species into extinction or endangerment in places where they have been introduced. Thus, increased harvest may be required in some streams to control their abundance in river systems and protect native species.

Habitat requirements



Diet: fish, aquatic insects, crustaceans, and mollusks; also eat terrestrial organisms that fall into the water
Water: streams, lakes, and ponds where the water does not get above 70 F in summer; ideally, stream should have 50 percent riffles and 50 percent pools; basic requirements include dissolved oxygen (minimum of six parts per million); pH should range between 6.5 and 9.0
Cover: rocks, as well as debris on the bottom of the river or lake, provide cover for hiding from prey or fishermen

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be installed if none are present so water depth can be controlled
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest; managers have begun reducing rainbow trout populations to minimize predation on or competition for resources with native fish species; increasing harvest can reduce the rainbow trout population
Wildlife or Fish Survey: fishing records, seining, electro-shocking, and fish condition are used to survey rainbow trout populations
Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam
Control Aquatic Vegetation: where pond edges are not at least two feet deep to discourage rooted aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if too few are present

Streams: Create Pools: gravel and cobble should be placed in stream to provide structure for insects and locations for spawning; structures should not change currents, which could increase bank erosion; boulders and logs may be placed in the stream or lake to provide cover for trout while hunting, as well as cover for prey species

Streams: Remove Fish Barriers: because most native rainbow trout populations are migratory, dams can impede their ability to return to spawning grounds; installing fish ladders or removing dams will improve the ability of rainbow trout to migrate

Wildlife Management Practices (WMPs)

Various Wildlife Management Practices (WMPs) are used to manage wildlife and their habitat. This section describes WMPs and the potential effect they can have on wildlife habitat and populations. The WMPs are grouped according to type of practice (Habitat management, Population management, Pond/Stream Management, Additional WMPs for Urban areas) and listed in alphabetical order within each grouping. Contestants should be familiar with the WMPs and able to identify which WMPs might be recommended to improve habitat or adjust populations in the ecoregion used for the Invitational (or state or local contest). Several practices are commonly used in certain ecoregions, but not in others. It is beneficial to learn as much as possible about any WMP before recommending it.

Some WMPs may seem contradictory. **Landowner objectives, as well as specific information given by contest organizers, must be considered to determine the appropriate WMPs.** Some WMPs are not applicable in all ecoregions, even though some of the species may be the same. **Current conditions should be considered when deciding if a WMP needs to be applied within the next year. However, the benefits of a WMP may not be realized for years.** For example, planting trees in a field to provide habitat for eastern gray squirrels or acorns for wood ducks is a sound practice, but the benefit will not be realized for many years. In this manual, costs and budgets are not considered when recommending practices. However, in actual situations, wildlife managers must consider economics when planning and recommending WMPs.

Index to Wildlife Management Practices (WMPs)

Habitat management practices

Population management practices

Decrease Harvest
Increase Harvest
Wildlife Damage Management
Wildlife or Fish Survey

Fish Pond and Stream Management practices

Construct Fish Pond
Control Aquatic Vegetation
Fertilize/Lime Fish Pond
Reduce Turbidity in Fish Pond
Restock Fish Pond
Streams: Create Pools
Streams: Remove Fish Barriers

Additional management practices specific to Urban areas

Artificial Feeders
Mowing
Plant Flowers
Rooftop/Balcony Gardens

Habitat Management Practices

Conservation Easement

General description

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

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

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

Effect on habitat

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

Control Nonnative Invasive Vegetation

General description

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

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

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

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

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

Effect on habitat

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

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

John Gruchy

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

Create Snags

General description

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

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

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

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

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

Effect on habitat

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

Craig Harper

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

Delay Crop Harvest

General description

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

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

Effect of practice

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

Blake Brown

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

Edge feathering

General description

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

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

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

Effect on habitat

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

Field Borders

General description

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

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

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

Effect on habitat

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

Craig Harper

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

Forest Management

General description

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

Forest Regeneration

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

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

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

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

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

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

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

Craig Harper

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

Craig Harper

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

Craig Harper

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

Dwayne Elmore

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

Craig Harper

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


Craig Harper

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

Effect on Habitat

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

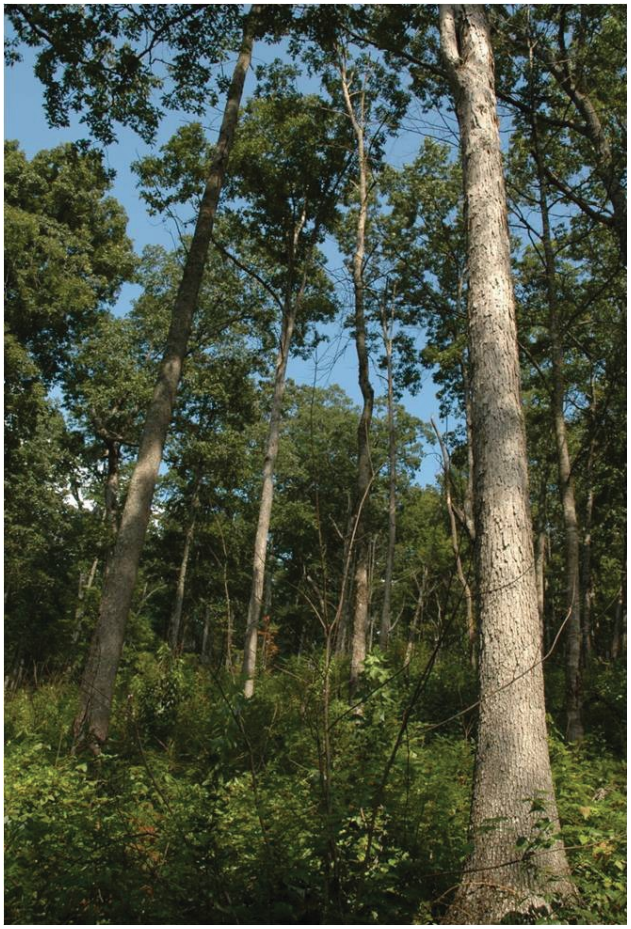
Timber Stand Improvement (TSI)

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

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

Effect on habitat

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



Craig Harper

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

Forest Road Maintenance

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

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

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

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

Craig Harper

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

Craig Harper

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

Craig Harper

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

Leave Crop Unharvested

General description

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

Effect on habitat

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

Craig Harper

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

Livestock Management

General description

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

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

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

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

Effect on habitat

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

Dwayne Elmore

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

Nesting Structures

General description

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

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

Effect on habitat

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

Craig Harper

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

Plant Food Plots

General description

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

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

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

Craig Harper

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

Craig Harper

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

Craig Harper

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

Effect on habitat

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

Plant Native Grasses and Forbs

General description

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

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

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

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

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

Examples of desirable native warm-season grasses

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

Examples of desirable native cool-season grasses

- Virginia wildrye, Canada wildrye, povertygrass, low panicgrasses

Examples of invasive nonnative warm-season grasses

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

Examples of undesirable nonnative cool-season grasses

- tall fescue, orchardgrass, bromegrasses, timothy

Examples of desirable native forbs and brambles

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

Examples of invasive nonnative forbs

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

Craig Harper

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

Effect on habitat

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

Plant Shrubs

General description

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

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

Effect on habitat

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

Craig Harper

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

Plant Trees

General description

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

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

Effect on habitat

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


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

Repair Spillway/Levee

General description

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

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

Effect on habitat

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

Craig Harper

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

Billy Higginbotham

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

Set-back Succession

General description

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

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

Prescribed Fire

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

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

Effect on Habitat

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

Craig Harper

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

Mechanical applications

Disking

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

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

Effect on habitat

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

Craig Harper

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

Chainsawing

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

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

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

Effect on habitat

- Reduces tree density and encourages earlier successional plant communities.

Craig Harper

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

Drum-chopping/Chaining/Root-plowing

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

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

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

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

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

Effect on habitat

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

Craig Harper

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

Mark Bartoskewitz

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

Mowing/Mulching

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

Effect on habitat

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

Craig Harper

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

Herbicide Applications

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

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

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

Effect on habitat

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

Craig Harper

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

Tillage Management

General description

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

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

Effect of practice

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

Craig Harper

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

Water Control Structures

General description

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

Craig Harper

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

Effect on habitat

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

Water Developments for Wildlife

General description

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

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

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

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

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

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

Craig Harper

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

Craig Harper

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

Effect on habitat

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

Craig Harper

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

Population Management Practices

Decrease Harvest

General description

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

Game birds and mammals

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

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

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

Largemouth bass/bluegill

Balanced Bass/Bluegill Populations

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

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

Decrease Bass Harvest When:

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

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

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

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

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

Increase Harvest

General description

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

Game birds and mammals

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

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

Craig Harper

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

Largemouth bass/bluegill

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

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

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

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

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

Wildlife or Fish Survey

General description

Wildlife surveys

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

Wildlife Survey Techniques

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

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

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

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

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

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

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

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

Fish surveys

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

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

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

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


Craig Harper

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

Wildlife Damage Management Techniques

General description

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

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

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

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

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

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

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

Craig Harper

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

Dwayne Elmore

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

Jim Phillips

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

Fish Pond and Stream Management Practices

Construct Fish Pond

General description

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

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

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

Effect on Habitat

- Ponds provide habitat for some fish and wildlife species.

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

Control Aquatic Vegetation

General description

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

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

Effect on habitat

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

Billy Higginbotham

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

Fertilize/Lime Fish Pond

General description

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

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

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

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

Effect on habitat

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

Reduce Turbidity in Fish Pond

General description

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

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

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

Effect on habitat

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

Restock Fish Pond

General description

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

Effect on habitat

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

Streams: Create pools

General description

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

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

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

Effect on habitat

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

Streams: Remove Fish Barriers

General description

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

Effect on habitat

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

Urban Wildlife Management Practices

Artificial Feeders

General description

Artificial feeders are used primarily to feed songbirds and butterflies for viewing purposes. A wide variety of feeder designs, methods, and foods are available. Most bird species prefer black-oil sunflower seeds and white proso millet. Species such as hairy woodpecker prefer suet (fat) rather than seeds. Some species, such as mourning dove and song sparrow, prefer to eat on the ground than on an elevated feeder.

It is important to realize artificial feeders can be hazardous to birds. Disease transmission is often problematic because feeders draw birds close together. Salmonellosis, aspergillosis, and mycoplasmal conjunctivitis are fatal diseases among songbirds and are readily transmitted at heavily used bird feeders. It is imperative to clean feeders regularly with hot soapy water and a mild bleach solution. In addition, feeders pose danger via nonnative predators, specifically house cats. Although house cats may be fed, they still hunt and kill millions of birds and small mammals each year. It is irresponsible to own a cat and leave it outside because of the unnatural pressure they put on native wildlife. Feral cats should be reported to local animal control officials, removed from the area, and euthanized.

Effect of practice

- Provides supplemental food source, primarily for viewing purposes.

Mowing

General description

Mowing with a lawnmower can maintain lawns and park-like settings in urban areas. Mowing is usually the only possible practice for maintaining openings in urban areas. Mowing is well-suited to maintain low-growing grasses and forbs. Many wildlife species inhabiting urban areas are attracted to yard-like settings, especially when interspersed with shrub and forest for cover and travel corridors.

Effect on Habitat

- Mowing maintains yards and grassy openings.
- Wide expanses of mowed areas do not provide adequate cover for some wildlife species; therefore, it is important to leave some areas unmowed or provide cover using islands of shrubs and flowers.

Craig Harper

Backyards can be arranged in various shapes and with various plantings and nest boxes so that they are more attractive and useful for wildlife.

Plant Flowers

General description

Annual and perennial forbs can be planted to attract a number of wildlife species. A variety of species will flower over a longer period. Species and varieties should be selected to provide food and cover throughout the year where possible. Forbs should be planted in proximity to other cover sources to make them readily available.

Effect on habitat

- Provides a supplemental source of food and cover.

Rooftop/Balcony Gardens

General description

In urban areas, residential green space may be limited. Urbanites can create rooftop or balcony gardens to provide additional food, water, and viewing opportunities. Although limited in space, the goal of rooftop or balcony gardens is to create habitat; thus, rooftop or balcony gardens should provide food, water, and cover for species that are adapted to the space restrictions. Moving water, such as a small waterfall, will attract more wildlife than stationary water.

Effect on Habitat

- Provides food, cover, and water, though in small amounts, for wildlife in urban areas.

WHEP Activities and Scoring

The National WHEP Invitational comprises 3 activities:

Activity I: On-site Recommendation of Wildlife Management Practices
Activity II-A: Written Wildlife Management Plan
Activity II-B: Oral Reasons for Wildlife Management Plan
Activity III: Wildlife Challenge

These activities may be used as presented, or they may be modified as deemed appropriate for local, regional, or state contests.

Individual Activities

Activities I, II-B, and III will be scored on an individual basis. However, awards for top individuals will be based on the sum of scores from Activity I and Activity III only. Individual scores for Activity II-B do not contribute to the top individual score because each participant gives oral reasons to a different judge.

The top three individual scores within a team for Activities I, II-B, and III will count toward the total overall team score. For teams of four members, the lowest score for each activity will be dropped. For teams of three members, all scores will count.

Activity I: On-Site Recommendation of Wildlife Management Practices (50 points)

Activity III: Wildlife Challenge (50 points)

In case of ties for top individuals (summation of Activities I and III), scores for Activity I, then Activity III (if necessary), will be used to break ties.

Team Activity

Activity II will be scored as a team effort and will include scores for Activity II-A and II-B. The written wildlife management plan (Activity II-A) is worth 125 points. Activity II also includes up to 75 points for oral defense of the written plan (Activity II-B). The maximum score in Activity II-B for each individual is 25 points. Only the top three scores within each team will be counted into the total score for Activity II. Thus, Activity II is worth a maximum of 200 points.

Activity II-A and II-B: Written Wildlife Management Plan and Oral Defense (200 points)

In the case of ties for the top teams (summation of Activities I, II, and III), the Activity II score will be used to break the tie. If this does not break the tie, then scores (top 3 individuals) for Activity I will be used to break the tie.

Activity I: On-Site Recommendation of Wildlife Management Practices (WMPs)

Activity I involves the recommendation of WMPs necessary to manage wildlife and habitat on a given site. Management recommendations in Activity I should consider each species listed **separately** and WMPs should be recommended as if each species was the only species (focal species) considered on the site. Refer to the WMP charts in the ***Ecoregions*** section.

Prior to starting Activity I, information will be given about the site (a scenario), either verbally or written (describing field conditions). Based on this information, an "X" should be marked in the box for each WMP recommended. Contestants will have one hour to complete Activity I. This is an individual activity, so no talking or collaboration among team members is allowed.

Scoring Activity I: Wildlife Management Practices (50 points)

Total Score = [(number of correct answers marked minus number of incorrect answers marked) divided by total number of possible correct answers] multiplied by 50.

The total number of possible correct answers is the number of Xs marked on the card by the specialist(s) in charge.

For example, a WMP score sheet key includes 20 correct answers. The contestant marks 15 correct answers, but also marks 5 incorrect answers. The contestant's score is calculated as

[(15 – 5 = 10) / 20 = 0.50] X 50 = 25 points

No negative scores will be assigned. The minimum individual score on Activity I is zero. Blank WMP worksheets for each ecoregion are provided in Appendix A for practice use.

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

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

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

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

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

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

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

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

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

Part I: Plan Background (10 Points)

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

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

Part II: Plan Development (40 Points)

Species Habitat requirements (20 Points)

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

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

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

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

Habitat Assessment (20 points)

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

Part III: Plan Implementation (40 Points)

Control Nonnative Invasive Species to reduce coverage of tall fescue and allow the seedbank to germinate, which will provide more food and better cover for all 4 species.

Field Borders should be established around portions of the soybean fields where there are none. This will increase usable space for northern bobwhite and eastern cottontail.

Leave Crop Unharvested will provide soybeans for northern bobwhite, mourning dove, and eastern cottontail into winter.

Plant Shrubs between sections of soybean fields that will be retained to provide a corridor connecting the two woodlots. This will increase usable space for northern bobwhite, eastern cottontail, and brown thrasher, and increase loafing and nesting cover for mourning dove.

Set-back Succession: Prescribed Fire will set-back and rejuvenate the understory in the woodlots and provide more forage for eastern cottontail and northern bobwhite.

Water Development for Wildlife (small pond) should be established to provide free-standing water for mourning doves.

Wildlife Survey should be conducted to monitor populations of all 4 species. Point counts may be used for mourning dove and brown thrasher, covey counts may be used for northern bobwhite, and observation counts and hunter harvest data can be used for eastern cottontail.

Part IV: Plan Evaluation (15 Points)

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

Wildlife Habitat Education Program

Judges' Scoring Sheet – Activity II-A Written Wildlife Management Plan

Scale for scoring: 0 = very poor, no points; 10 = outstanding, maximum points

Part I: Plan background (10 points maximum) **_____ points**

- Accurately identified the wildlife species to be managed and accurately identified the management objectives

Part II: Plan development (40 points maximum) **_____ points**

- Demonstrated understanding of the habitat needs of each species (20 points)
- Accurately evaluated the area as habitat for each species (what is present and what is lacking) and the management objectives (20 points)

Part III: Plan implementation (40 points maximum) **_____ points**

- Included the appropriate management practices and where they should be implemented (10 points)
- Demonstrated knowledge of the effect of various management practices on the habitat and/or the species (10 points)
- Used the appropriate native plant species or recognized nonnative invasive species (10 points)
- Recognized the management compromises necessary to meet the needs of each species and showed understanding of the mutual benefits of implementing certain practices (10 points)

Part IV: Plan evaluation (15 points maximum) **_____ points**

- Presented realistic methods for monitoring success of the recommendations (15 points)

Part V: Format and drawing (20 points maximum) **_____ points**

- Presented in the appropriate narrative format (10 points)
- Included a drawing or sketch of the area, reflecting the recommended management practices (10 points)

Activity II-A total (125 points maximum) **_____ points**

Activity II-B:
Oral Defense of Written Plan (75 points total per team)

After completing the written plan, each team member will be expected to demonstrate their understanding of the plan. Thus, it is important that each team member actively participates in preparing the written plan. Comprehensive knowledge of the written plan is necessary to successfully respond to judges questions about the team's plan. Team members are called individually into a room with two judges where they are asked a series of questions to test the individual's knowledge of the team's plan. For example, team members may be asked to explain a certain part of the plan, such as the background or the implementation; or they may be asked to further explain certain management practices recommended within the plan. They may be asked to explain the habitat needs of the focal species. Questions can cover anything related to the plan, the focal species, or management practices recommended. Each team member will be scored individually. The top three scores within each team will be added and combined with the written plan score for the total score for Activity II.

Note: Oral reason scores are not included in determining high individual scores.

Sample questions and requests:

- Explain the WMPs your team implemented for brown thrasher.
- Two of the four species in your plan had very different habitat requirements. Identify those species and explain the compromises you made to accommodate those species.
- The eastern cottontail requires early successional vegetation. Explain the practices your team chose to increase usable space and why they were recommended.
- In assessing habitat on this site, what do you consider the most limiting factor for northern bobwhite?
- Explain two methods you would use to determine the effectiveness of your team's plan.

Wildlife Habitat Education Program

Judges' Scoring Sheet – Activity II-B Oral Defense for Wildlife Management Plan

Part 1: Subject matter (80 points maximum)
Scale for scoring: 0 = very poor, no points; 20 = outstanding, maximum points

- Understanding of species biology and management (0 – 20) _____
- Understanding of species habitat requirements (0 – 20) _____
- Understanding of wildlife management practices and implementation (0 – 20) _____
- Knowledge of concepts and terms (0 – 20) _____

Part 2: Contestant (20 points maximum)
Scale for scoring: 0 = very poor, no points; 10 = outstanding, maximum points

- Logic, reasoning, and organization (0 – 10) _____
- Poise, voice, and body language (0 – 10) _____

Total points _____ X 0.25 = _____Oral score

Activity III: Wildlife Challenge (50 Points)

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

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

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

Example questions for Wildlife Challenge:

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

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

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

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

Appendix A

WMP score sheets for each ecoregion are provided in the following pages.

Eastern Deciduous Forest	American woodcock	brown thrasher	eastern meadowlark	golden-winged warbler	great horned owl	mourning dove	northern bobwhite	ovenbird	wild turkey	wood duck	bobcat	eastern cottontail	eastern gray squirrel	gray fox	Indiana bat	white-tailed deer	eastern box turtle	timber rattlesnake	bluegill	largemouth bass
Habitat Management Practices																				
Conservation Easement																				
Control Nonnative Invasive Vegetation																				
Create Snags																				
Delay Crop Harvest																				
Edge Feathering																				
Field Borders																				
Forest Management																				
Leave Crop Unharvested																				
Livestock Management																				
Nesting Structures																				
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Plant Native Grasses and Forbs																				
Plant Shrubs																				
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Wildlife Damage Management																				
Wildlife or Fish Survey																				
Fish Pond / Stream Management Practices																				
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Control Aquatic Vegetation																				
Fertilize/Lime Fish Pond																				
Reduce Turbidity in Fish Pond																				
Restock Fish Pond																				
Streams: Create Pools																				
Streams: Remove Fish Barriers																				

Great Plains Grassland: Shortgrass Prairie	American kestrel	lark bunting	mallard	mourning dove	northern harrier	scaled quail	sharp-tailed grouse	black-tailed prairie dog	coyote	pronghorn	Rocky Mountain mule deer	plains hog-nosed snake	bluegill	largemouth bass
Habitat Management Practices														
Conservation Easement														
Control Nonnative Invasive Vegetation														
Create Snags														
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Reduce Turbidity in Fish Pond														
Restock Fish Pond														
Streams: Create Pools														
Streams: Remove Fish Barriers														

Great Plains Grassland: Tallgrass/Mixed Prairie	**blue-winged teal**	**dickcissel**	**grasshopper sparrow**	**greater prairie-chicken**	**mourning dove**	**northern bobwhite**	**northern harrier**	**ring-necked pheasant**	**wild turkey**	**coyote**	**eastern cottontail**	**red fox**	**white-tailed deer**	**plains hog-nosed snake**	**bluegill**	**largemouth bass**
Habitat Management Practices																
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Fertilize/Lime Fish Pond																
Reduce Turbidity in Fish Pond																
Restock Fish Pond																
Streams: Create Pools																
Streams: Remove Fish Barriers																

Hot Desert	American kestrel	black-throated sparrow	blue-winged teal	crissal thrasher	Gambel's quail	golden eagle	ladder-backed woodpecker	southwest willow flycatcher	white-winged dove	black-tailed prairie dog	coyote	desert cottontail	mountain lion	pronghorn	Rocky Mountain mule deer	Gila monster	bluegill	largemouth bass
Habitat Management Practices																		
Conservation Easement																		
Control Nonnative Invasive Vegetation																		
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Restock Fish Pond																		
Streams: Create Pools																		
Streams: Remove Fish Barriers																		

Intermountain Foothills	American kestrel	dusky grouse	mallard	mourning dove	northern flicker	red-tailed hawk	spotted towhee	wild turkey	coyote	elk	mountain cottontail	Rocky mountain mule deer	rainbow trout
Habitat Management Practices													
Conservation Easement													
Control Nonnative Invasive Vegetation													
Create Snags													
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Restock Fish Pond													
Streams: Create Pools													
Streams: Remove Fish Barriers													

Intermountain Montane	dusky grouse	hairy woodpecker	northern goshawk	ruffed grouse	spotted towhee	yellow-rumped warbler	American beaver	American marten	black bear	elk	Rocky Mountain mule deer	snowshoe hare	cutthroat trout	rainbow trout
Habitat Management Practices														
Conservation Easement														
Control Nonnative Invasive Vegetation														
Create Snags														
Delay Crop Harvest														
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Streams: Create Pools														
Streams: Remove Fish Barriers														

Intermountain Sagebrush	American kestrel	Brewer's sparrow	ferruginous hawk	greater sage-grouse	mallard	mourning dove	northern flicker	sage thrasher	coyote	desert cottontail	pronghorn	Rocky Mountain mule deer	rainbow trout
Habitat Management Practices													
Conservation Easement													
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Intermountain Subalpine	black-capped chickadee	dusky grouse	hairy woodpecker	northern goshawk	white-tailed ptarmigan	yellow-rumped warbler	American marten	elk	red squirrel	Rocky Mountain mule deer	snowshoe hare	cutthroat trout	rainbow trout
Habitat Management Practices													
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Mediterranean	American kestrel	California quail	California thrasher	Lawrence's goldfinch	mallard	mourning dove	Nuttall's woodpecker	western kingbird	desert cottontail	raccoon	Rocky Mountain mule deer	wild pig	Monterey salamander	bluegill	largemouth bass
Habitat Management Practices															
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Streams: Remove Fish Barriers															

Northeast Mixed Forest	American black duck	American woodcock	black-backed woodpecker	brown thrasher	northern goshawk	ovenbird	ruffed grouse	wild turkey	fisher	moose	New England cottontail	red squirrel	snowshoe hare	white-tailed deer	wood frog	bluegill	largemouth bass
Habitat Management Practices																	
Conservation Easement																	
Control Nonnative Invasive Vegetation																	
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Delay Crop Harvest																	
Edge Feathering																	
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Fertilize/Lime Fish Pond																	
Reduce Turbidity in Fish Pond																	
Restock Fish Pond																	
Streams: Create Pools																	
Streams: Remove Fish Barriers																	

Pacific Coastal Forest	great horned owl	hairy woodpecker	marbled murrelet	red-tailed hawk	ruffed grouse	sooty grouse	spotted towhee	wood duck	American beaver	bobcat	Columbian black-tailed deer	coyote	elk	red squirrel	northern red-legged frog	rough-skinned newt	Coho salmon
Habitat Management Practices																	
Conservation Easement																	
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Restock Fish Pond																	
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Streams: Remove Fish Barriers																	

Prairie Brushland	black-bellied whistling duck	crested caracara	golden-fronted woodpecker	northern bobwhite	pyrrhuloxia	western kingbird	white-winged dove	wild turkey	collared peccary	coyote	white-tailed deer	wild pig	Texas horned lizard	bluegill	largemouth bass
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Conservation Easement															
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Restock Fish Pond															
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Streams: Remove Fish Barriers															

Southeast Mixed and Outer Coastal Plain Forest	barred owl	loggerhead shrike	mourning dove	northern bobwhite	prothonotary warbler	red-cockaded woodpecker	red-eyed vireo	wild turkey	wood duck	coyote	eastern cottontail	eastern fox squirrel	raccoon	white-tailed deer	wild pig	eastern indigo snake	gopher tortoise	bluegill	largemouth bass
Habitat Management Practices																			
Conservation Easement																			
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Restock Fish Pond																			
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Streams: Remove Fish Barriers																			

Urban	American robin	bluebird	common nighthawk	European starling	house finch	house sparrow	house wren	northern flicker	peregrine falcon	rock pigeon	ruby-throated hummingbird	song sparrow	big brown bat	cottontail	coyote	eastern gray squirrel	raccoon	white-tailed deer
Habitat Management Practices																		
Conservation Easement																		
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Restock Fish Pond																		
Streams: Create Pools																		
Streams: Remove Fish Barriers																		
Additional Urban Practices																		
Artificial Feeders																		
Mowing																		
Plant Flowers																		
Rooftop/Balcony Gardens																		

Wetlands	American bittern	Canada goose	mallard	northern pintail	redhead	spotted sandpiper	Virginia rail	Wilson's snipe	American beaver	common muskrat	mink	raccoon	river otter	eastern snapping turtle	American bullfrog	crawfish frog	tiger salamander	bluegill	largemouth bass
Habitat Management Practices																			
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Woodland	American wigeon	golden-cheeked warbler	greater roadrunner	ladder-backed woodpecker	mourning dove	northern bobwhite	prairie falcon	red-tailed hawk	western bluebird	wild turkey	black-tailed jackrabbit	Brazilian free-tailed bat	coyote	white-tailed deer	wild pig	western diamond-backed rattlesnake	bluegill	largemouth bass
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Appendix B. Definitions of Food Groups

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

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

Glossary

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

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

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