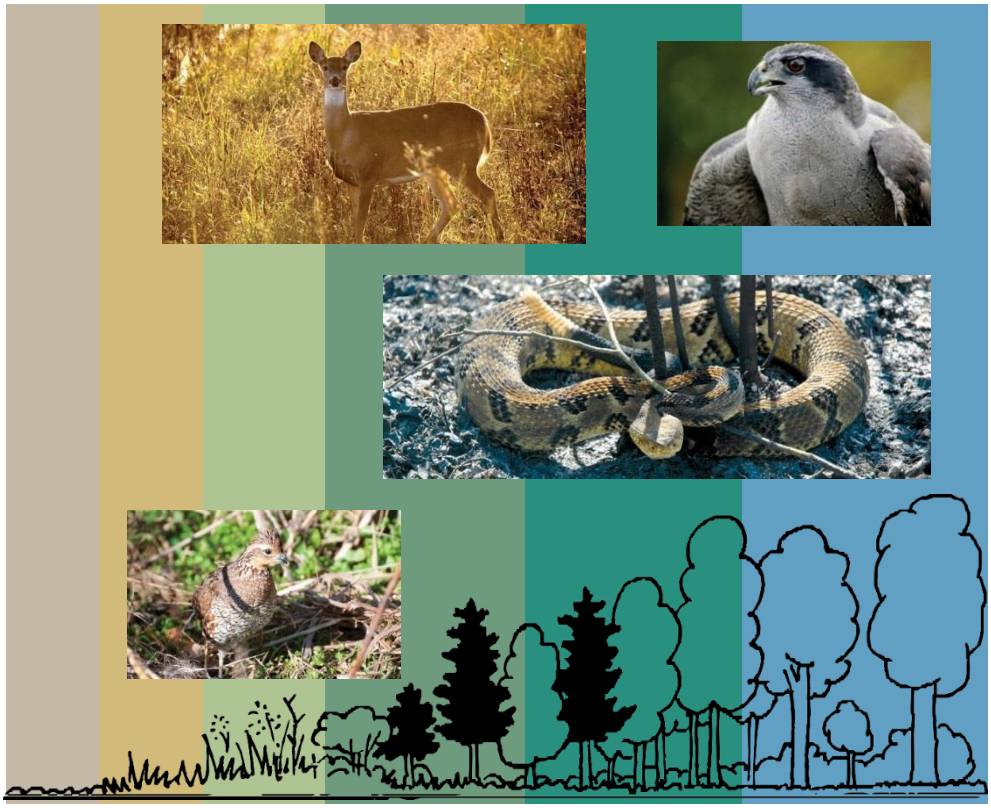
Texas 4-H

Wildlife Habitat Education Project

Manual

Texas Version (2023)

WHEP



The Texas 4-H

Wildlife Habitat Education Project

(WHEP)

Texas Version

This manual has been adapted from the National WHEP Manual to be used in Texas 4-H programming only. This version is designed to better fit the Texas 4-H program and the habitats and wildlife of the state. Many portions of the National manual have been changed; others have remained the same. Pay close attention to contest rules as they are specific to Texas 4-H only. This entire manual should be used in the Texas 4-H project only.

The National WHEP manual which is posted on the National WHEP website (whep.org) should be used to prepare for the annual National WHEP Invitational.

TEXAS A&M AGRILIFE EXTENSION

WHEP

National WHEP Manual and History of the National 4-H WHEP

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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 4th major revision. Editors of previous editions included:

First and Second Editions

Ron Masters, former Professor/Extension Wildlife Specialist, Oklahoma State University, Jim Armstrong, Professor/ Extension Wildlife Specialist, Auburn University, Champe Green, former Extension Specialist, Oklahoma State University, and Charles Lee, Professor/Extension Wildlife Specialist, Kansas State University

Third Edition

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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. 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 Invitational. In 1989, the program was expanded nationally and the first National Invitational was held with the support of the U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies.

The first edition of this manual was produced in 1990-91 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 three major revisions, 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. This Fourth Edition incorporates a complete revision, with new species, new wildlife management practices, additional wildlife management concepts and terms, and a new activity for the contest.

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.

The National manual should be used 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. The National manual is designed to provide uniformity for the program and provide wildlife management information using representative species occupying less specific, major ecoregions across the U.S.

Table of Contents

Introduction

WHEP is designed to teach youth the fundamentals of wildlife and fisheries science and management.

In this program, youth learn how management for wildlife involves managing land, water, and populations of wildlife species. 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 youth and professionals 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 habitat management. The **ID and Knowledge Quiz (**Activity III) allows participants to showcase their knowledge from these sections and others.

Wildlife managers must be able to inventory and evaluate land as habitat for various wildlife species. They must be able to recognize and explain the condition of the land and identify the wildlife present to landowners and others interested in managing for wildlife. Once the inventory and evaluation are completed, managers recommend the appropriate wildlife management practices to enhance habitat for certain wildlife species. The **Written Wildlife Management Plan** (Activity I) and **Oral Presentation of the Wildlife Management Plan** (Activity II) should explain management recommendations so others can understand and consider them.

All 4-H age divisions (Junior, Intermediate, and Senior) are eligible to compete at the State Contest as individuals or teams.

The National Invitational is open to only one Senior division 4-H team from a state each year. The Texas 4-H Office allows the 1st place Senior team from the Texas 4-H WHEP Contest the option to register and attend. Expenses of participating in the National Invitational are the responsibility of that team.

About the Manual

This manual is divided into the following major sections.

WHEP Activities and Scoring provides information on each activity, how the activities are administered, and how the state contest is scored.

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 Texas 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 contest and summarizes wildlife management practices that can be used in each ecoregion.

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

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

Appendix A is the **Glossary**, which defines technical words used in the manual.

How to Use the Manual & Prepare for Contests or Project Study

This manual is the study resource for the Texas 4-H WHEP Contest. This manual should also be considered a good basis for guidance and study in a 4-H Wildlife and Fisheries project whether dealing with various wildlife species or habitat management or both. Other curricula and resources can and should be added to a general project study. Actual wildlife habitat management by a 4-H member on personal property can serve as an excellent 4-H project. Other educational resources for study should include properties (public and private) that are being managed for wildlife habitat and the managers of those properties.

Adult leaders and youth should first learn the **Wildlife Management Concepts and Terms**. These are the foundations of wildlife ecology and habitat management. Leaders should explain the concepts and terms and provide local examples to clarify any misunderstanding. Successful completion of the contest activities requires understanding of these concepts and terms. Contestants should use these terms and concepts in their plans and presentations during the contest.

Determine which ecoregion will be used for a particular contest or study session within the project group. Maps and ecoregion descriptions are in the Ecoregions section. The **Wetlands** and **Urban** descriptions are applicable to all ecoregions and could be studied in any ecoregion. These may also be used in conjunction with an ecoregion in a contest. Leaders and youth should review plant succession, common plants, wildlife species, and wildlife management practices within the target ecoregion.

Determine which wildlife species will be studied or used in a contest. A list of species accompanies each ecoregion. There are many field guides and websites that provide photos and additional information for these wildlife species. Be sure to use reputable sites online and do not always depend on general word searches.

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. Identification in a contest may involve photos or specimen (live or mounted). Identification may be required using only tracks, skins, wings, feet, tails, or other body parts or using wildlife calls. Visual ID may also involve the use of binoculars. Practice and be prepared for any situation whether in the field or at a contest. Learning life history information about a species is critical to make appropriate management decisions. Specific information about habitat requirements and recommended wildlife management practices are found in the **Wildlife Species** section. Many participants find it helpful to mark those species included in a particular ecoregion, so the information is more easily found when studying.

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 **ID and Knowledge Activity** may incorporate information from various portions of the manual, including **Wildlife Species**, **Wildlife Management Practices**, **Concepts and Terms**, **Glossary Terms,** and the ecoregion information of the contest.

Leaders can introduce participants to the activities through various exercises. Some make note cards or flash cards to help when studying. Conducting practice sessions at outdoor sites is helpful and recommended. Participants should get outside and find examples of the concepts 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. The Texas Parks and Wildlife Department website (https://tpwd.texas.gov/), AgriLife Extension Wildlife & Fisheries websites (https://agrilifeextension.tamu.edu/browse/featured-solutions/wildlife/), Texas A&M Natural Resources Institute (https://nri.tamu.edu/), National WHEP website (www.whep.org), and local county Extension offices have additional information to enhance study and locate habitat and management facilities. Collecting pictures or specimens of the wildlife species from several different sources will help with the identification portion of the test.

4-H Wildlife Habitat Education Project
Contest Rules and Procedures

General Information:

- The 4-H Wildlife Habitat Education Project (WHEP) Contest covers information from within the Texas 4-H WHEP Manual, Texas Version 2023. View and download this manual from the Texas 4-H Program website (http://texas4-h.tamu.edu/projects/wildlife-fisheries/). Scroll down to 'Contests' then 'Wildlife Habitat Education Project State Contest' and 'Texas 4-H WHEP Manual'.
- The contest is based on information found in the Texas 4-H WHEP Manual only. This Manual should be used for a study guide to prepare for the contest. The wildlife, habitat component, and habitat management practices identification activity are based on only the species listed in the manual. Wildlife species, habitat components, and habitat management practices photos and characteristics should be studied using various identification resources available on the internet or in hard copy form along with the written information in the Wildlife Species section in the WHEP Manual. Be sure to use reliable sources on the internet for study photos.
- Only one ecoregion from the Manual is covered in a contest. The ecoregion will match the location of the contest. This current year's contest ecoregion will be posted on the 4-H Wildlife & Fisheries webpage and sent to all County Extension Offices as soon as logistics have been confirmed. Youth interested in competing should focus their study within the Manual on this single region for wildlife species and wildlife management practices.
- The contest rules and procedures listed in this document and in the Texas 4-H WHEP Manual supersede those found in the National WHEP Manual which is designed for the National Invitational only.
- The Texas contest is open to any current enrolled Texas 4-H member and includes all age divisions.
- Any contestant who previously participated in the National WHEP Invitational is not eligible to participate at the State Contest as a Team Member but may participate as an Individual.
- Contest registration must be made through 4-H Online (https://v2.4honline.com/) on specific dates.
- Coaches, parents, and other family members are welcome to attend the contest but will not be allowed in the contest activity areas during the competition.
- Parts of this contest are held outdoors regardless of the weather and field conditions. Contestants should dress appropriately for the weather and for being in the habitat such as tall grass, brush, woods, mud, etc. Contestants should be prepared with drinking water, insect repellent, sunscreen, and other necessary outdoor items.
- Each contestant should take a clipboard, two or more sharpened or mechanical #2 pencils and a good eraser. A contestant may carry a backpack to hold these and other necessary items to be outdoors such as drinking water, snacks, sunscreen, raincoat, binoculars, etc. No electronic devices will be allowed during the contest.
- Contest activities will be conducted by each contestant as follows: *NEW LIST OF ACTIVIITIES

  Activity I, Written Wildlife Management Plan – as a team unless registered in the contest as an Individual, then independently
  Activity II, Oral Presentation of the Wildlife Management Plan – as a team unless registered in the contest as an Individual, then independently
  Activity III, Identification and Knowledge – independently

Age Divisions:

As of September 1st, of the current 4-H year (Sept. 1 – Aug. 31):

- Junior (3rd – 5th grades)
- Intermediate (6th – 8th grades)
- Senior (9th – 12th grades)

Contestants may compete in an older age division than their actual grade level but may not compete in a younger age division than their actual grade level.

Contest Participation:

- **Teams**
  Contestants participate as part of a 3 or 4 member, age division specific team from their 4-H county. All contestants on a team must be enrolled in 4-H in the same county.
- **Individual Contestants**

Individuals will participate in all contest activities. A score will be given for each activity and used to formulate the individual score. Individuals are eligible for High Point Individual awards but not team awards.

Contest Activities:

- This contest consists of the following activities: *NEW LIST OF ACTIVIITIES
  - Activity I – Written Wildlife Management Plan - *REDESIGNED ACTIVITY-SEE DESCRIPTION
  - Activity II – Oral Presentation of the Wildlife Management Plan
  - Activity III –Identification and Knowledge
- Activities I, II, and III are further described below under each age division.
- Typically, all age divisions will participate in each activity at the same time. This may vary per contest location.
- Activity III is completed individually by each contestant. No communication between team members is allowed during this time.
- Activities I and II are team efforts except when a contestant is entered as an Individual in the contest. Individual contestants will develop the plan and orally present on their own. Team members work together to develop and orally present the management plan.
- *Landowner Objectives and Habitat Conditions* describe the habitat, the use of the habitat, and the wildlife species found within a habitat at the contest site. These are observations and outcomes desired by the 'Landowners' that must be considered when evaluating a habitat and prescribing habitat management practices. *Landowner Objectives and Habitat Conditions* are typically written but may also be given verbally to the contestants by contest officials.
- Activity I is always held outdoors in the habitat regardless of the weather. Contestants must dress appropriately for the weather and appropriately to be in tall grass, brush, woods, etc. Close toed shoes are mandatory at all times. In addition, contestants should be prepared with sunscreen, insect repellant, drinking water, and any other necessary item when outdoors. A contestant may carry a backpack with necessary items to be outdoors such as drinking water, snacks, sunscreen, raincoat, binoculars, etc. No electronics will be allowed during the contest. Contestants may carry and use ground cloths (tarps) or folding stools or chairs to use while in the field for two hours.
- Note time allowances given for each activity in the descriptions below. These may change on contest day due to weather, facility restrictions, or other extenuating circumstances.

Contestant Requirements:

Beyond the age and eligibility requirements, the following apply to all contestants:

- Contestants must dress appropriately for the weather and appropriately to be in tall grass, brush, woods, etc. Close toed shoes are mandatory at all times. In addition, contestants should be prepared with sunscreen, insect repellant, drinking water, and any other necessary item when outdoors. A contestant may carry a backpack with necessary items to be outdoors such as drinking water, snacks, sunscreen, raincoat, binoculars, etc.
- No electronics will be allowed during the contest.
- Contestants must carry a clipboard and two or more sharpened or mechanical #2 pencils. **No extra paper is allowed.**
- Coaches or contestants should email the State 4-H Natural Resources Program Office (lhysmith@tamu.edu) in advance to request any individual special needs or accommodations necessary to participate on contest day. Coaches or contestants should also inform this office in advance of any individual contestant medical needs, conditions, or pharmaceuticals necessary to be used or carried on contest day. **A reasonable amount of advance notice must be given on accommodation requests, so ample time is allowed to plan and set up the accommodation. Space for this request is available on the registration. Requests made on the day of the contest will be considered but accommodations may not be possible given the short notice.**

Junior Division Activities –

I: Written Wildlife Management Plan (3 hours, in the field plus 1 hour after lunch to prepare presentation)
Contestants will use an actual habitat presented to them at the contest to evaluate with their teammates unless competing as an Individual. The focal wildlife species (2) will be typed on the answer sheet. Contestants will develop a wildlife management plan in outline format for the wildlife species to be managed as directed in the *Landowner Objectives and Habitat Conditions* provided at the contest and for the habitat in its current condition on the contest site. The plan must be written using short answers and bullet points not complete sentences. The entire habitat should be evaluated within the parameters given at the contest site. The management plan should cover a year or more of management practices. Some management practices may not be put into action immediately but several months after initial evaluation when conditions and climate may best fit its implementation and need. Contestants will answer the following questions in their plan for each recommended Habitat Management Practice for each of the focal species: 'What will your practice do for the habitat?' and 'How will your practice help or control the wildlife species?'. Management practices must be made for each focal species independently. Answer sheets containing the plan outline will be provided (*see Appendix A for example*). No extra paper will be allowed. Refer to Judges Score Sheet to determine the criteria by which each contestant will be judged (*see Appendix A of this document*). Contestants will use this Manual to research species and wildlife management practices during this entire activity.

II: Oral Presentation of the Wildlife Management Plan (approximately 10 minutes per presentation)
Contestants will sit down with a judge and present their Written Wildlife Management Plan as a Team or as an Individual if competing as an Individual. Using their plan, contestants will informally discuss and explain their plan as the judge asks questions. Each contestant will receive points for verbally participating in the presentation and none if they do not participate. The plan will be judged during this presentation (*see Appendix A in this document for Junior Division Judges' Score Sheet*). The judge will ask questions to guide the contestants through their plans and to ensure all contestants speak.

III: Identification and Knowledge (1 hour; indoors or outdoors or combination)
This activity includes identification of wildlife species, habitat management practices and habitat components. Contestants will rotate through **25** stations, each with a two part challenge; part one, identification of a wildlife species, a habitat management practice or concept, or a habitat feature (ex: 'edge') and part two answering a question related to part one. Answers to the questions will be in multiple choice (A-D), 'true or false', or 'yes or no' format (*see Appendix E for example Answer Sheet*). ID pieces may be represented as photos, physical representations of habitat, management practices, full or partial wildlife mounts, various external body parts (wing, pelt, feet, antler, etc.), tracks, scat, or calls/sounds. Wildlife species may be shown as male or female, juvenile or adult. Some wildlife species may be set up to be viewed through binoculars for identification. The objective of the activity is to demonstrate knowledge of wildlife and habitat component identification, ecoregion specifics, biology and ecology of specific wildlife species, concepts of wildlife management, wildlife management terminology, and wildlife management practices.

Information for this activity will be taken from the following sections in the Manual:
Wildlife Management Concepts and Terms (pg. 18-28), the specific ecoregion designated for the contest, Wildlife Species information of those listed in the designated ecoregion, Wildlife Management Practices information of those listed in the designated ecoregion, and *Glossary*.

Intermediate Division Activities –

I: Written Wildlife Management Plan (3 hours, in the field plus 1 hour after lunch to prepare presentation)

Contestants will use an actual habitat presented to them at the contest to evaluate with their teammates unless competing as an Individual. The focal wildlife species (4) will be typed on the answer sheet. Contestants will develop a wildlife management plan in outline format for the wildlife species to be managed as directed in the *Landowner Objectives and Habitat Conditions* provided at the contest and for the habitat in its current condition on the contest site. The plan must be written using bullet points not complete sentences. The entire habitat should be evaluated within the parameters given at the contest site. The management plan should cover a year or more of management practices. Some management practices may not be put into action immediately but several months after initial evaluation when conditions and climate may best fit implementation and need. Each management practice should be described with how, when, where, and why it will be used on the answer sheet. If more than one wildlife species is to be managed, management practices must be made with each species in consideration to avoid or minimize conflict of wildlife needs. Some management practices may benefit one species and have negative effects on another. Some management practices may be recommended that will take months or years to become beneficial. Management practices may be recommended to be repeated as needed. Answer sheets containing the plan outline will be provided (*see Appendix B of this document*). No extra paper will be allowed. Refer to Judges' Score Sheet to determine the criteria by which the Plan will be scored (*see Appendix C of this document*). Contestants will use this Manual to research species and wildlife management practices during this entire activity.

II: Oral Presentation of the Wildlife Management Plan (10 minute maximum per total presentation)

Oral presentations are often necessary to convey information about a management plan to landowners. A plan must be properly written and then properly presented to understand and receive the full effect of the management to be applied. Contestants will demonstrate their plan by presenting it orally.

Teammates will present as a team. Individual contestants will present individually. Contestants will have their plan during presentation for reference. Judges will score the plan only on what is presented to them by each contestant. It is the responsibility of the contestants to present all the information. Plans will not be read by the judges.

Contestants will present using their own Written Wildlife Management Plan to a panel of judges who will score the plan as presented based on the criteria shown in the Judges' Score Sheet *(Appendix C of this document)*. Judges will also score each individual team member on their presentation technique based on the criteria shown in the Judges' Score Sheet *(Appendix D of this document)*. Contestants will be able to use their Plan when presenting. All four wildlife species from the plan must be presented. On a team of four contestants, each contestant will present one of the four wildlife species from the plan to include Plan Development, Plan Implementation, and Plan Evaluation of that species. It is up to the team to decide which member presents which wildlife species. On a team of three contestants, each contestant will present one of the four wildlife species from the plan to include Plan Development, Plan Implementation, and Plan Evaluation of that species and it will be up to the discretion of the team as to how the fourth species will be presented; by one team member or divided among the three. Contestants competing as an Individual must present all four wildlife species from the plan by themselves to include Plan Development, Plan Implementation, and Plan Evaluation. Only questions seeking clarification of a statement will be asked by judges.

III: Identification and Knowledge (1 hour; indoors or outdoors or combination)

This activity includes identification of wildlife species, habitat management practices and habitat components. Contestants will rotate through **25** stations, each with a two part challenge; part one, identification of a wildlife species, a habitat management practice or concept, or a habitat feature (ex: 'edge') and part two answering a question related to part one. Answers to the questions will be in multiple choice (A-D), 'true or false', or 'yes or no' format (*see Appendix E for example Answer Sheet*). ID pieces may be represented as photos, physical representations of habitat, management practices, full or partial wildlife mounts, various external body parts (wing, pelt, feet, antler, etc.), tracks, scat, or calls/sounds. Wildlife species may be shown as male or female, juvenile or adult. Some wildlife species may be set up to be viewed through binoculars for identification. The objective of the activity is to demonstrate knowledge of wildlife and habitat component identification, ecoregion specifics, biology and ecology of specific wildlife species, concepts of wildlife management, wildlife management terminology, and wildlife management practices.

Information for this activity will be taken from the following sections in the Manual: Wildlife Management Concepts and Terms (pg. 18-28), the specific ecoregion designated for the contest, Wildlife Species information of those listed in the designated ecoregion, Wildlife Management Practices information of those listed in the designated ecoregion, and *Glossary.*

Senior Division Activities –

I: Written Wildlife Management Plan (3 hours, in the field plus 1 hour after lunch to prepare presentation)

Contestants will use an actual habitat presented to them at the contest to evaluate with their teammates unless competing as an Individual. The focal wildlife species (4) will be typed on the answer sheet. Contestants will develop a wildlife management plan in outline format for the wildlife species to be managed as directed in the *Landowner Objectives and Habitat Conditions* provided at the contest and for the habitat in its current condition on the contest site. The plan must be written using bullet points not complete sentences. The entire habitat should be evaluated within the parameters given at the contest site. The management plan should cover a year or more of management practices. Some management practices may not be put into action immediately but several months after initial evaluation when conditions and climate may best fit implementation and need. Each management practice should be described with how, when, where, and why it will be used on the answer sheet. If more than one wildlife species is to be managed, management practices must be made with each species in consideration to avoid or minimize conflict of wildlife needs. Some management practices may benefit one species and have negative effects on another. Some management practices may be recommended that will take months or years to become beneficial. Management practices may be recommended to be repeated as needed. Answer sheets containing the plan outline will be provided (*see Appendix B of this document*). No extra paper will be allowed. Refer to Judges' Score Sheet to determine the criteria by which the Plan will be scored (*see Appendix C of this document*). Contestants will use this Manual to research species and wildlife management practices during this entire activity.

II: Oral Presentation of the Wildlife Management Plan (10 minute maximum per total presentation)

Oral presentations are often necessary to convey information about a management plan to landowners. A plan must be properly written and then properly presented to understand and receive the full effect of the management to be applied. Contestants will demonstrate their plan by presenting it orally.

Teammates will present as a team. Individual contestants will present individually. Contestants will have their plan during presentation for reference. Judges will score the plan only on what is presented to them by each contestant. It is the responsibility of the contestants to present all the information. Plans will not be read by the judges.

Contestants will present using their own Written Wildlife Management Plan to a panel of judges who will score the plan as presented based on the criteria shown in the Judges' Score Sheet *(Appendix C of this document)*. Judges will also score each individual team member on their presentation technique based on the criteria shown in the Judges' Score Sheet *(Appendix D of this document)*. Contestants will be able to use their Plan when presenting. All four wildlife species from the plan must be presented. On a team of four contestants, each contestant will present one of the four wildlife species from the plan to include Plan Development, Plan Implementation, and Plan Evaluation of that species. It is up to the team to decide which member presents which wildlife species. On a team of three contestants, each contestant will present one of the four wildlife species from the plan to include Plan Development, Plan Implementation, and Plan Evaluation of that species and it will be up to the discretion of the team as to how the fourth species will be presented; by one team member or divided among the three. Contestants competing as an Individual must present all four wildlife species from the plan by themselves to include Plan Development, Plan Implementation, and Plan Evaluation. Only questions seeking clarification of a statement will be asked by judges.

III: Identification and Knowledge (1 hour; indoors or outdoors or combination)

This activity includes identification of wildlife species, habitat management practices and habitat components. Contestants will rotate through **25** stations, each with a two part challenge; part one, identification of a wildlife species, a habitat management practice or concept, or a habitat feature (ex: 'edge') and part two answering a question related to part one. Answers to the questions will be in multiple choice (A-D), 'true or false', or 'yes or no' format (*see*

Appendix E for example Answer Sheet). ID pieces may be represented as photos, physical representations of habitat, management practices, full or partial wildlife mounts, various external body parts (wing, pelt, feet, antler, etc.), tracks, scat, or calls/sounds. Wildlife species may be shown as male or female, juvenile or adult. Some wildlife species may be set up to be viewed through binoculars for identification. The objective of the activity is to demonstrate knowledge of wildlife and habitat component identification, ecoregion specifics, biology and ecology of specific wildlife species, concepts of wildlife management, wildlife management terminology, and wildlife management practices.

Information for this activity will be taken from the following sections in the Manual: Wildlife Management Concepts and Terms (pg. 18-28), the specific ecoregion designated for the contest, Wildlife Species information of those listed in the designated ecoregion, Wildlife Management Practices information of those listed in the designated ecoregion, and *Glossary.*

Scoring and Tie Breakers:

All contestants will be scored for an overall individual placing and eligible for high point individual awards. All activities will be used for the individual score and the team score.

Ties will be broken for individuals and teams by using the highest score on Activity I: Written Wildlife Management Plan for those contestants or teams in question. In the case of a tie score on Activity I, ties will be further broken using highest team/individual score from Activity II, then Activity III, in that order. Further ties will be broken at the discretion of the contest officials.

National WHEP Invitational:

The First Place Senior Team from the annual State Contest will be eligible to represent Texas 4-H by participating in the National WHEP Invitational to be held in late summer at the location named by the National committee (contest held in a different state each year). Participation in the National WHEP Invitational is not mandatory by the First Place Senior Team.

Contestants who have previously participated in a National WHEP Invitational are not eligible to participate a second time. However, those contestants are eligible to participate in the State Contest but as Individuals only and not as members of a team.

Note: The State 4-H Office does not fund any team attending the National WHEP Invitational. All expenses incurred in registering, outfitting, and attending the event will be the responsibility of the eligible team.

APPENDICES

A: Junior Division Formats, Answer Sheets, and Judges' Score Sheets – Activities I and II
B: Intermediate and Senior Age Divisions Answer Sheets – Activity I
C: Intermediate and Senior Age Divisions Judges' Score Sheet – Activity II (Plan)
D: Intermediate and Senior Age Divisions Judges' Score Sheet – Activity II (Presentation)
E: Identification and Knowledge Answer Sheet Example - Activity III (all age divisions)

The appendices on the following pages should be used to understand the procedures and answer sheets of the contest. All questions and references to particular wildlife species are examples and will not necessarily be the same species in a particular contest.

Appendix A: Junior Division Formats, Answer Sheets, and Judges' Score Sheets

Activity I
Written Wildlife Management Plan
Junior Division Answer Sheet and Format

Note:

This is an example of the information the Junior Division contestants will be given for this activity to use in developing a wildlife management plan and sketch in accordance with the Landowner Objectives and Habitat Conditions to be provided at the contest and the current habitat conditions. The information in the outline and in the sketch will be scored. Wildlife species to be managed will change with each contest event.

(More space will be allowed for each section than what is shown in this example.)

Instructions:

Complete the outline below to develop your wildlife management plan for the species listed with the landowners' objectives in the *Landowner Objectives and Habitat Conditions* below. Draw a sketch of the habitat on the back of this page to illustrate your plan. Be sure to label the sketch with your information from the outline below and develop a key.

Landowner Objectives and Habitat Conditions:

Landowner Objectives and Habitat Conditions are objectives and conditions describing the habitat, the use of the habitat, and wildlife species found within the contest habitat. These are written observations and outcomes desired by the 'Landowners' that must be considered when evaluating a habitat and prescribing wildlife management practices. These are typically written but may be given verbally to the contestants as well.

Develop a management plan for this property to be presented to the landowners as an outline and a sketch. **The information provided in the outline will be scored**.

Plan Development

Evaluate the habitat for each wildlife species. For each wildlife species, circle 'YES' or 'NO' to say whether the habitat requirements are available or not.

white-tailed deer –	Food:	YES	NO
	Water:	YES	NO
	Cover:	YES	NO
northern bobwhite -	Food:	YES	NO
	Water:	YES	NO
	Cover:	YES	NO

Plan Implementation

List the management practices you will use in your plan for each wildlife species. Describe how each practice will affect the habitat. Describe how each practice will affect the wildlife species.

white-tailed deer –

Management Practice:

What will your practice do for the habitat?_____

How will your practice help or control the wildlife species? _____

(continued to allow multiple management practices to be listed)

northern bobwhite -

Management Practice:

What will your practice do for the habitat?_____

How will your practice help or control the wildlife species? _____

(continued to allow multiple management practices to be listed)

Plan Evaluation

List what you will do to determine if the plan worked for each wildlife species.

Plan Sketch

Draw a sketch to illustrate your written management plan. Include each management practice recommended in your written plan. Place each management practice on the sketch to show exactly where you would implement the practice. Label each management practice using a key to identify each practice and the major parts of the habitat. You may use color pencils to define your label keys to make it easier to understand.

Activities I & II
Written Wildlife Management Plan & Oral Presentation
Junior Division Judges' Score Sheet

Activity II: Written Wildlife Management Plan

Scale for Scoring

Information provided was: 0=not provided 2=poor 4=fair 6=good 8=excellent 10=outstanding

Plan Development

The habitat was evaluated correctly for (wildlife species #1).

0 2 4 6 8 10 _____

The habitat was evaluated correctly for (wildlife species #2).

0 2 4 6 8 10 _____

Plan Implementation

Appropriate management practices for each wildlife species were included for (wildlife species #1).

0 2 4 6 8 10 _____

The effect each practice will have on the habitat was included.

0 2 4 6 8 10 _____

The effect each practice will have on (wildlife species #1) was included.

0 2 4 6 8 10 _____

Appropriate management practices for each wildlife species were included for (wildlife species #2).

0 2 4 6 8 10 _____

The effect each practice will have on the habitat was included.

0 2 4 6 8 10 _____

The effect each practice will have on (wildlife species #2) was included.

0 2 4 6 8 10 _____

Plan Evaluation

An understanding of how to evaluate a management plan for (wildlife species #1) was demonstrated.

0 2 4 6 8 10 _____

An understanding of how to evaluate a management plan for (wildlife species #2) was demonstrated.

0 2 4 6 8 10 _____

II Total (100 pts max) _____

Activity III: Oral Presentations

(0 = did not participate, 20 = participated)

Team Member 1 or Individual Contestant	0	or	20	_____
Team Member 2	0	or	20	_____
Team Member 3	0	or	20	_____
Team Member 4	0	or	20	_____

III Total (top 3 scores; 60 pts. max) _____

Appendix B: Activity I Intermediate and Senior Divisions Answer Sheets

Activity I: Written Wildlife Management Plan
Intermediate and Senior Division Answer Sheets

Note: No extra paper is allowed on contestants' clipboards.

Landowner Objectives and Habitat Conditions are objectives and conditions describing the habitat and wildlife species found within a contest site. These are written observations and objectives of the 'Landowners' which must be considered when evaluating a habitat and prescribing wildlife management practices. These are typically written but may be given verbally to the contestants as well.

Activity I
Written Wildlife Management Plan
Intermediate and Senior Divisions Answer Sheet
EXAMPLE

Note: *Space shown in this example for each section does not reflect the amount of space given during the contest. This outline will be provided to guide in developing the plan. Multiple pages will be used for this answer sheet. The plan must be written in bullet statement format within this outline.*

Plan Development

Evaluate the designated habitat. For the wildlife species to be managed, list in bullet format what requirements are present and what requirements are lacking.

Wildlife Species name_____:
What is present:
What is lacking:

Plan Implementation

Evaluate the designated habitat for each of the wildlife species to be managed and list which management practices you will use for each wildlife species in this habitat at its current state to reach the landowner objectives. State **how**, **when**, **where and why** each management practice will be implemented (ex., "Set Back Succession with prescribed fire in the fall on annual rotating sections of the habitat in the creek bottom"). State the effect each management practice will have on the wildlife species and the effect each management practice will have on the habitat.

Wildlife Species name_____:

- Mgmt. Practice:
  - How
  - When
  - Where
  - Why
- Effect on the habitat:
- Effect on the wildlife species:

Plan Evaluation

List what will be done to determine if the plan worked for **each** wildlife species.

Note: Refer to Appendix C: Intermediate and Senior Divisions Judges' Score Sheet for Activity I to understand the criteria used to judge the wildlife management plans in both age divisions.

Appendix C: Intermediate and Senior Age Divisions Judges' Score Sheet – Activity II

Activity II: Oral Presentation of Written Wildlife Management Plan Judges Score Sheet (Int./Sr.)

Scale for Scoring: Information provided was: 0=not provided 2=poor 4=fair 6=good 8=excellent 10=outstanding

Part 1: Plan Development (50 points maximum)	
The plan demonstrated an understanding of the habitat needs of the wildlife species.	0 2 4 6 8 10
The plan accurately evaluated the existing habitat (what is **adequate** and what is **lacking**) based on management objectives and the needs of (mourning dove).	0 2 4 6 8 10
The plan accurately evaluated the existing habitat (what is **adequate** and what is **lacking**) based on management objectives and the needs of (northern bobwhite).	0 2 4 6 8 10
The plan accurately evaluated the existing habitat (what is **adequate** and what is **lacking**) based on management objectives and the needs of (white-tailed deer).	0 2 4 6 8 10
The plan accurately evaluated the existing habitat (what is **adequate** and what is **lacking**) based on management objectives and the needs of (bluegill).	0 2 4 6 8 10
	Part 1: Plan Development Subtotal _____
Part 2: Plan Implementation (120 points maximum)	
For mourning dove the plan included the appropriate management practices.	0 2 4 6 8 10
For mourning dove the plan fully explained how, when, where & why each practice will be implemented.	0 2 4 6 8 10
For mourning dove the plan listed the effects of each practice on the existing habitat and the wildlife species.	0 2 4 6 8 10
For northern bobwhite the plan included the appropriate management practices.	0 2 4 6 8 10
For northern bobwhite the plan fully explained how, when, where & why each practice will be implemented.	0 2 4 6 8 10
For northern bobwhite the plan listed the effects of each practice on the existing habitat and the wildlife species.	0 2 4 6 8 10
For white-tailed deer the plan included the appropriate management practices.	0 2 4 6 8 10
For white-tailed deer the plan fully explained how, when, where & why each practice will be implemented.	0 2 4 6 8 10
For white-tailed deer the plan listed the effects of each practice on the existing habitat and the wildlife species.	0 2 4 6 8 10
For bluegill the plan included the appropriate management practices.	0 2 4 6 8 10
For bluegill the plan fully explained how, when, where & why each practice will be implemented.	0 2 4 6 8 10
For bluegill the plan listed the effects of each practice on the existing habitat and the wildlife species.	0 2 4 6 8 10
	Part 2: Plan Implementation Subtotal _____
Part 3: Plan Evaluation (40 points maximum)	
An understanding of how to evaluate a management plan for (mourning dove) was demonstrated.	0 2 4 6 8 10
An understanding of how to evaluate a management plan for (northern bobwhite) was demonstrated.	0 2 4 6 8 10
An understanding of how to evaluate a management plan for (white-tailed deer) was demonstrated.	0 2 4 6 8 10
An understanding of how to evaluate a management plan for (bluegill) was demonstrated.	0 2 4 6 8 10
	Part 3: Plan Evaluation Subtotal _____
	Total (210 pts max.) _____

Appendix D: Intermediate and Senior Divisions Judges' Score Sheet for Activity II

Activity II
Written Wildlife Management Plan Oral Presentation
Intermediate and Senior Divisions Judges' Score Sheet

Scale for Scoring: 0 = no proper demonstration 2 = poor 4 = fair 6 = good 8 = excellent 10 = outstanding

Note: **One score sheet per contestant**

Contestant (50 points maximum)	
Addressed judges with a personal introduction and smile.	0 2 4 6 8 10
Poised throughout presentation (calm, confident)	0 2 4 6 8 10
Voice and speaking (appropriate volume, clear, enunciation)	0 2 4 6 8 10
Grammar	0 2 4 6 8 10
Body language and dress (posture, eye contact, hand gestures and other movements; removed cap or hat and sunglasses, shirt tucked in, as neat and clean as possible for having been outdoors all day)	0 2 4 6 8 10
	Contestant Total_____(50 pts max)

Appendix E: Identification and Knowledge Answer Sheet Example - Activity III (all age divisions)

Note: *The actual answer sheet for the activity will consist of 25 blanks for answers.*

	IDENTIFICATION (please print) **Be sure to write the identification name or number in the blank spaces below.**	**Multiple Choice Answers** **True False** **Yes No**
1.		**A☐ B☐ C☐ D☐**
2.		**A☐ B☐ C☐ D☐**
3.		**A☐ B☐ C☐ D☐**
4.		**A☐ B☐ C☐ D☐**

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**
- **Nonnative and 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

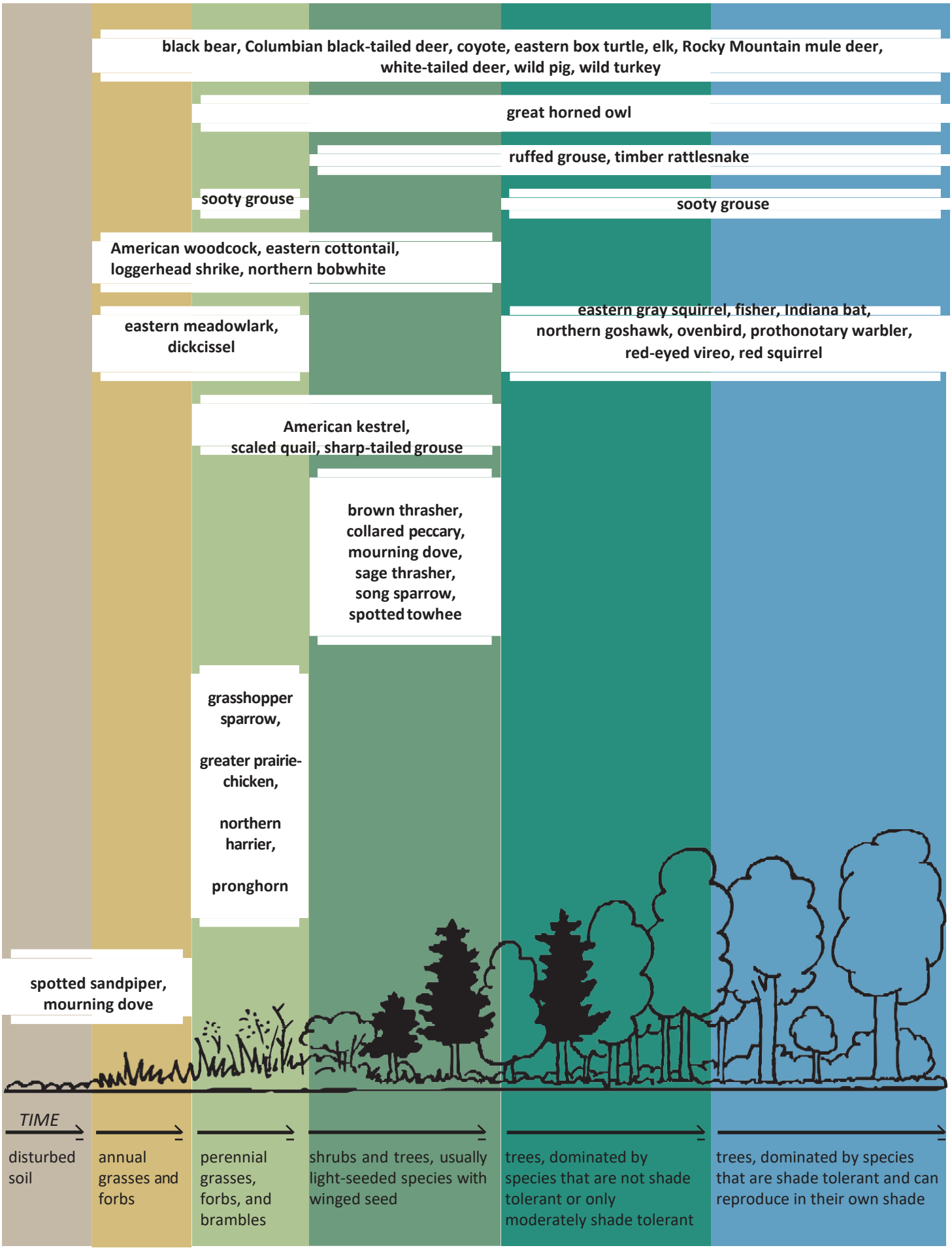
A *species* is a group of individuals that can interbreed and produce viable offspring. A *population* is a group of individuals of the same species interacting and living in a given area. Populations of various species interact to form communities. Therefore, a biotic (living) *community* includes all 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 ofthe 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 a 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 progression during plant succession is called a*sere*. Various vegetation types represent various seral stages, which are also commonly called successional stages.

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 buffalo grass; 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 and represent the second successional stage. Woody species, such as winged sumac, Virginia pine, winged elm, eastern redcedar, and persimmon might become prevalent within 7 or 8 years after disturbance and represent the third successional stage. Various oaks, hickories, yellow poplar, and other tree species may pioneer into the site and dominate the area within 20 years representing the fourth successional stage. Without additional disturbance, such as fire, American beech, white pine, and maples may eventually dominate the forest within 150 years and represent the fifth successional stage. Thus, approximately 5 seral stages (or successional stages) can be expected to compose a sere on many sites within the Eastern Deciduous Forest ecoregion.


black bear, Columbian black-tailed deer, coyote, eastern box turtle, elk, Rocky Mountain mule deer, white-tailed deer, wild pig, wild turkey
great horned owl
ruffed grouse, timber rattlesnake
sooty grouse
sooty grouse
American woodcock, eastern cottontail, loggerhead shrike, northern bobwhite
eastern meadowlark, dickcissel
eastern gray squirrel, fisher, Indiana bat, northern goshawk, ovenbird, prothonotary warbler, red-eyed vireo, red squirrel
American kestrel, scaled quail, sharp-tailed grouse
brown thrasher, collared peccary, mourning dove, sage thrasher, song sparrow, spotted towhee
grasshopper sparrow,
greater prairie-chicken,
northern harrier,
pronghorn
spotted sandpiper, mourning dove
DOMINANT VEGETATION
TIME
disturbed soil
annual grasses and forbs
perennial grasses, forbs, and brambles
shrubs and trees, usually light-seeded species with winged seed
trees, dominated by species that are not shade tolerant or only moderately shade tolerant
trees, dominated by species that are shade tolerant and can reproduce in their own shade

One forest type replacing another also is 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 Trans Pecos), 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, 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*. There are many nonnative invasive plant species that influence succession in most ecoregions.

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 be found only in one or two successional stages. The fact that different wildlife species require different successional stages 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, forest regeneration, 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 grasses and other herbaceous plants (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

Plant succession involves a change in plant species composition over time. This field in east Tennessee is moving from the second successional stage (perennial grasses and forbs represented by broomsedge bluestem, goldenrod, and thoroughwort in picture) into the third successional stage (shrubs and pioneering trees, represented by winged sumac, sweetgum, and eastern redcedar in picture).

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

groundcover 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.

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 and 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 bobwhites primarily eat various plants, seed, mast, and insects, whereas 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), cogon grass (native to southeast Asia), and Japanese stilt grass (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 agricultural 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

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.

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

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 canbe 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 also may benefit. However, species, such as ovenbird,wood thrush, and eastern gray squirrel, which prefer mature deciduous forest, will be forced to use anotherarea.

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 usableby 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 23).

Increased interspersion also can 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

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.

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.

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 25). In summary, the edge is not what is necessarily important, but rather the composition and structure of the vegetation.

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

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

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 forests 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.

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 or suburbia creeping into a rural area. 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.

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.

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.

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 over browsing has eliminated the forest understory and thus negatively affected many other wildlife species that require understory vegetation for nesting, feeding, roosting, or escape cover.

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, thedeer population must be reduced to limit damage. In thiscase, the cultural carrying capacity (determined by human tolerance) is lower than the biological carryingcapacity.

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 foodis 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 nonmigratory 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 lower-quality 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 states, 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 needed 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 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.

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.

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.

Ecoregions

Areas of the country are separated into ecoregions having similar climate, vegetation, and wildlife. They are described in very general terms in this manual. Wetlands and urban areas are found within all ecoregions.

At the end of an ecoregion description is a list of wildlife species found within to be studied for the contest. Contest information will always provide which ecoregion to study in preparation. Only the wildlife species listed will be used in the contest.

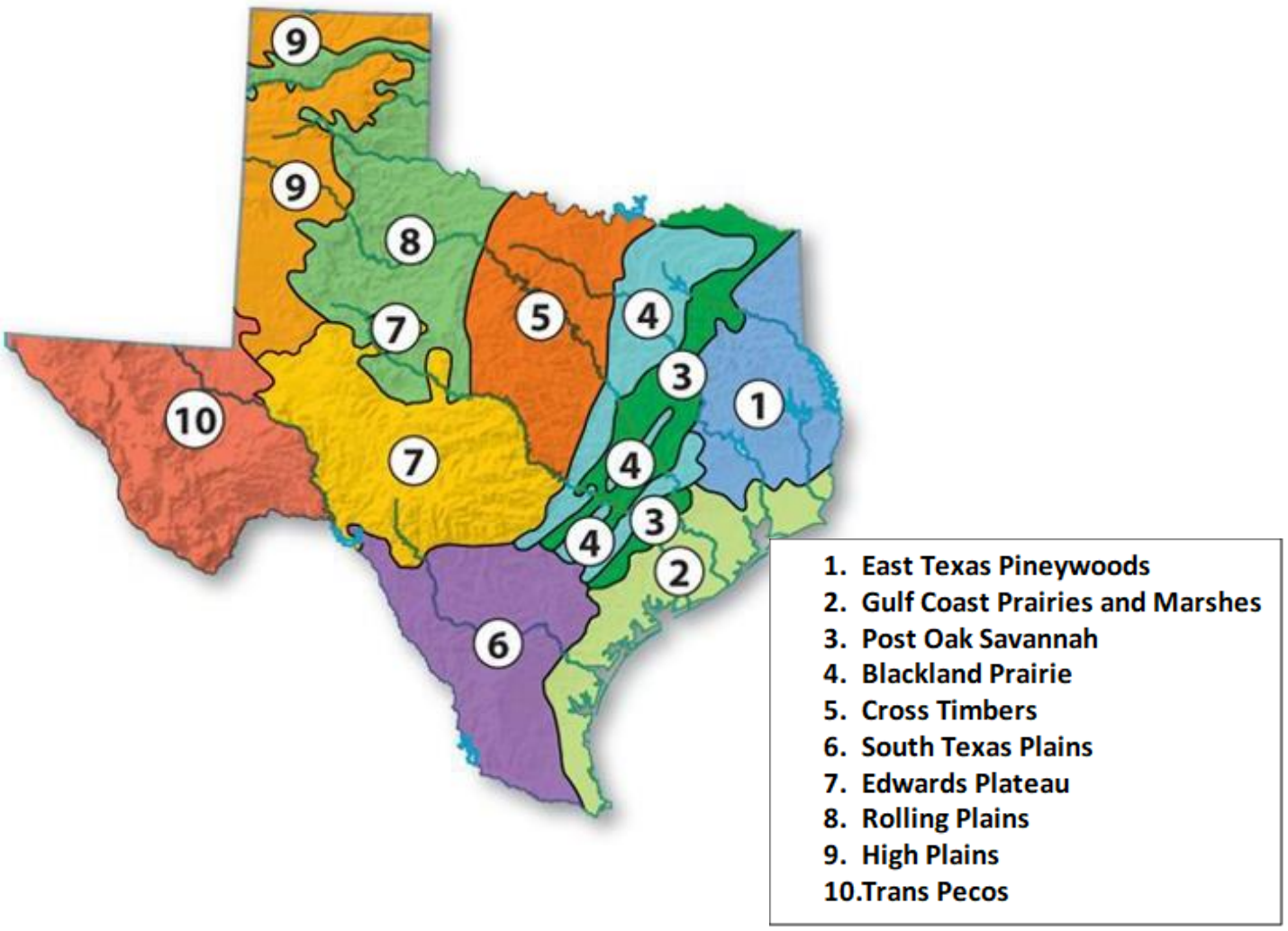
The ecoregion description is followed by a table that identifies wildlife management practices for each of the wildlife species that occur in that ecoregion. An 'X' in a box in the column under a species name indicates that the corresponding management practice in that row is applicable for that species in this ecoregion. Specific information on recommended wildlife management practices can be found in the **Wildlife Species** section on each wildlife species page.

2023 Contest Ecoregion

Trans Pecos

Texas Ecoregions

This graphic provides the ecoregions found in Texas. For a study of wildlife and habitat management, youth should learn the ecoregions of our state and understand the differences and the habitat each can provide, as well as why. Additional information can be found on the Texas Parks and Wildlife Department website; https://tpwd.texas.gov/education/hunter-education/online-course/wildlife-conservation/texas-ecoregions



Trans Pecos

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. Extreme differences in the daily high and low temperatures 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. Cottonwoods, willows, tamarisk, mesquite, and a variety of grasses and forbs dominate riparian areas. The abundance and variety of vegetation and presence of water compared to the surrounding desert makes riparian areas very attractive to wildlife.

Dwayne Elmore

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

Dwayne Elmore

Typical nonnative invasive plants in the Trans Pecos ecoregion include African rue, Malta star thistle, Russian knapweed, medusa head, bufflegrass, and salt cedar (tamarisk).

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 wastewater 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 also are common and represent the final successional stage, except along riparian areas where shrubs and trees are common.

Wildlife associated with Trans Pecos

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
muledeer
Texas horned lizard
bluegill
largemouth bass

Trans Pecos	American kestrel	black-throated sparrow	blue-winged teal	crissal thrasher	Gambel'squail	golden eagle	ladder-backed woodpecker	southwest willow flycatcher	white-winged dove	black-tailed prairie dog	coyote	desert cottontail	mountainlion	pronghorn	mule deer	Texas horned lizard	wild pig	bluegill
Habitat Management Practices																		
Develop Conservation Easement						X		X										
Control Nonnative Vegetation	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
Create Snags	X						X		X									
Develop Field Borders	X										X	X			X			
Conduct Forest Management																		
Leave Crop Unharvested			X		X				X			X			X			
Conduct Livestock Management	X	X	X	X	X	X	X	X	X	X	X	X		X	X			X
Provide 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/Dam/Levee			X															X
Set-back Succession	X	X	X	X		X		X	X	X	X	X	X	X	X	X		
Conduct Tillage Management	X		X						X			X			X			
Provide Water Developments for Wildlife		X	X	X	X				X				X	X	X			
Population Management Practices																		
Decrease Hunting/Fishing					X					X	X	X	X	X	X			X
Increase Hunting/Fishing										X	X	X	X	X	X			X
Conduct Wildlife Damage Management						X	X			X	X	X	X	X	X		X	
Conduct 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
Control Aquatic Vegetation																		X
Fertilize/Lime Fish Pond																		X
Reduce Turbidity in Fish Pond																		X
Renovate Fish Pond																		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 familiar with the information presented within the species accounts for those species included within the ecoregions 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.

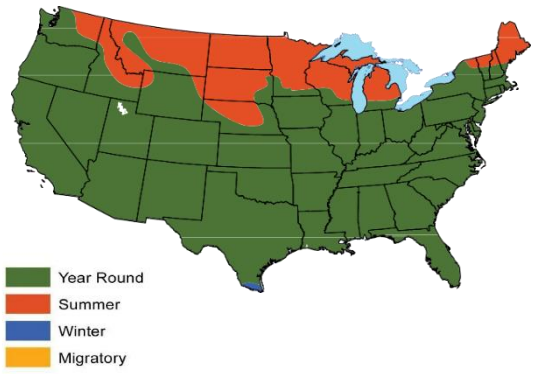
Index to Wildlife Species

Note: Refer to this list for the correct spelling and capitalization of species.

Birds

American kestrel

Robert Burton



Migratory

General information

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 cavities or natural tree hollows) with loose material on the floor and have been noted to readily use man-made nesting boxes. Males 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 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

Develop Field Borders: to increase cover for prey around row crop fields

Conduct Livestock Management: to prevent overgrazing and maintain sufficient cover for prey and maintain early succession vegetation with scattered shrub cover

Provide Nesting Structures: can be used where a lack of natural nesting cavities is limiting the population; boxes can be placed on fence posts or back of road signs 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; *Dozer-clearing* and *Root-plowing* can be used to convert forest to early succession

Conduct Tillage Management: will facilitate hunting prey when waste grain is available

Conduct Wildlife or Fish Survey: observation counts, point counts, and nest box usage rates may be used to estimate trends in populations

Black-throated sparrow

James W. Arterburn

General information

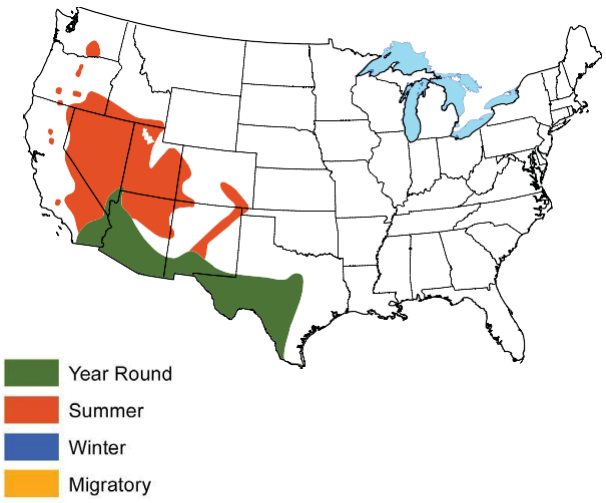
Black-throated sparrows are associated with shrublands, specifically sparsely vegetated desert shrubland, including mesquite, cacti, chaparral, and juniper in the southwest U.S. Their diet is mainly seeds and insects. Black-throated sparrows nest near the ground in small shrubs.

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 Vegetation: when nonnative invasive species begin to compete with native species and degrade habitat quality
Conduct 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
Provide Water Developments for Wildlife: can be beneficial where water is limiting
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

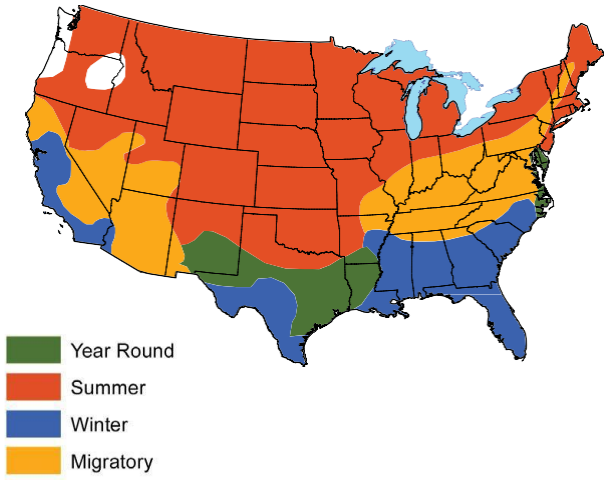


Blue-winged teal

Dave Menke

General information

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 sometimes will be used for nesting if 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 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
Conduct 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/Dam/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
Conduct Tillage Management: delaying cropland tillage, especially wheat, in spring may allow nesting in standing stubble
Provide 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
Conduct Wildlife or Fish Survey: flush counts can provide estimates of nesting teal

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.

Habitat requirements

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

Wildlife management practices

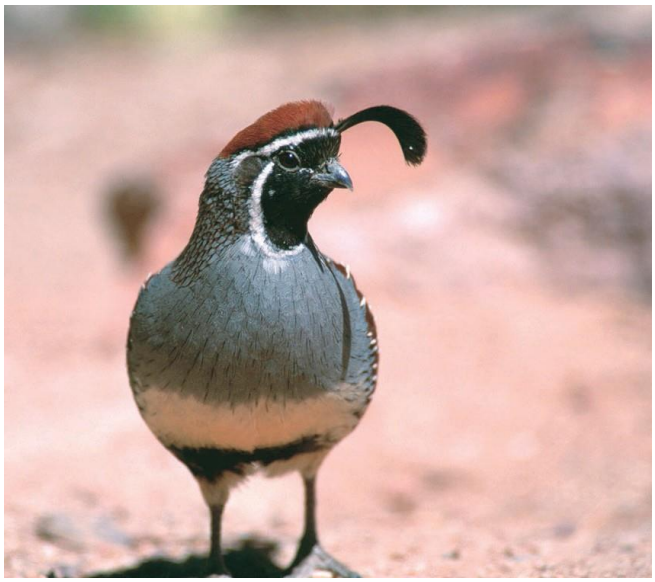
Control Nonnative Vegetation: when nonnative invasive species begin to reduce habitat quality for crissal thrashers
Conduct Livestock Management: should restrict overgrazing and ensure shrub cover is present to provide food and cover; this is particularly important in riparian areas where thick shrub cover is found adjacent to drainage ways (arroyos); 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
Provide Water Developments for Wildlife: catchment ponds, windmills, spring developments, and guzzlers can benefit crissal thrashers
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends.

Greg Lavaty

Gambel's quail

General information

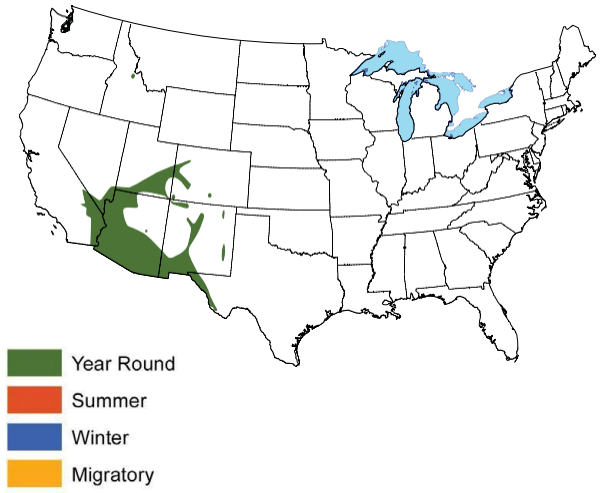
Gambel's quail are upland gamebirds found in arid regions of Arizona, New Mexico, southern Colorado, Utah, southern Nevada and California. Gambel's quail are usually found in brushy and thorny vegetation with scattered grasses and forbs, typical of southwestern deserts. Gambel's quail are also found along the edge of agricultural fields, especially those adjacent to arroyos and irrigation ditches. Dense shrubs and cacti intermingled with small open areas also are 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.



Gary Kramer

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 freestanding 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, scrub oak, desert hackberry, cholla, one- seed juniper, little leaf sumac, catclaw acacia, and various yuccas; shrubs provide important cover for loafing during the day



Wildlife management practices

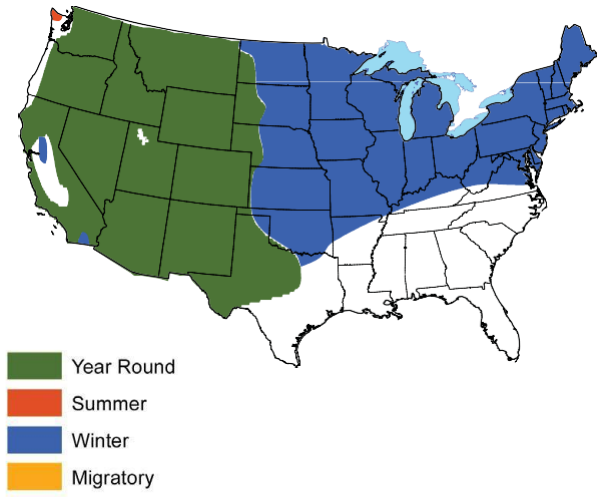
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for Gambel's quail
Leave Crop Unharvested: to provide additional food resource in fall/winter
Conduct Livestock Management: over much of the area where Gambel's quail are found, there are few wildlife management 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
Provide Water Developments for Wildlife: guzzlers, catchment ponds, windmills, and spring developments can be beneficial where water is limiting
Decrease Hunting/Fishing: may be necessary when surveys show a decline in the local population and mortality from hunting harvest is additive or limiting population growth
Conduct Wildlife or Fish Survey: call counts and flush counts are used to estimate trends in Gambel's quail populations

Golden eagle

General information

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. In North America, 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).

Dave Menke



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: 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

Develop Conservation Easement: may protect habitat for golden eagle and prey, especially where urban development is encroaching
Control Nonnative Vegetation: when nonnative invasive species begin to degrade habitat for prey
Conduct 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
Conduct Wildlife Damage Management: livestock depredation permits may be issued in severe cases with control activities carried out by federal agency personnel
Conduct Wildlife or Fish Survey: observation counts are used to estimate trends in populations

Ladder-backed woodpecker

Robert Burton

General information

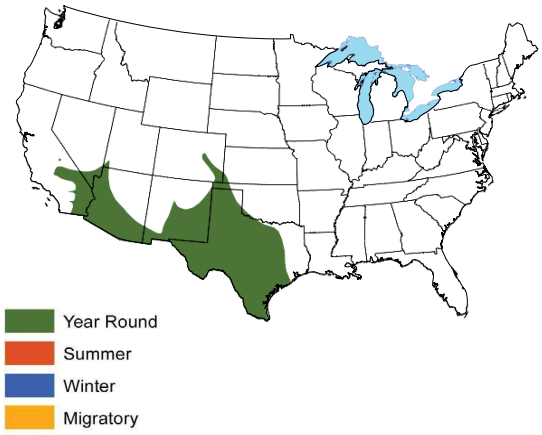
Ladder-backed woodpeckers are small woodpeckers of the southwestern U.S. and Mexico. They get their name from the black and white barring on their backs that resemble a ladder. Ladder-backed woodpeckers
are found in wooded canyons, cottonwood groves, pine and pine oak woodlands, and desert grasslands and shrublands dominated by mesquite throughout the southwestern U.S. south to British Honduras. They also are found in riparian areas and other areas with trees.
In the Trans Pecos 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 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
Conduct 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
Conduct Wildlife Damage Management: when woodpeckers are causing damage to human structures
Conduct Wildlife or Fish Survey: point counts may be used to monitor populations

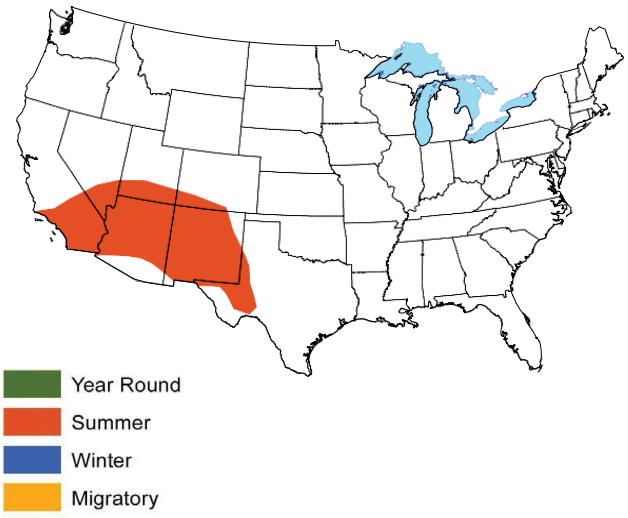


Southwest willow flycatcher

Jim Rorabaugh

General information

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. 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

Develop Conservation Easement: can protect critical habitat for this declining subspecies of willow flycatcher
Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for southwest willow flycatchers
Conduct 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
Conduct Wildlife or Fish Survey: point counts are used to estimate population trends

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 also are 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.

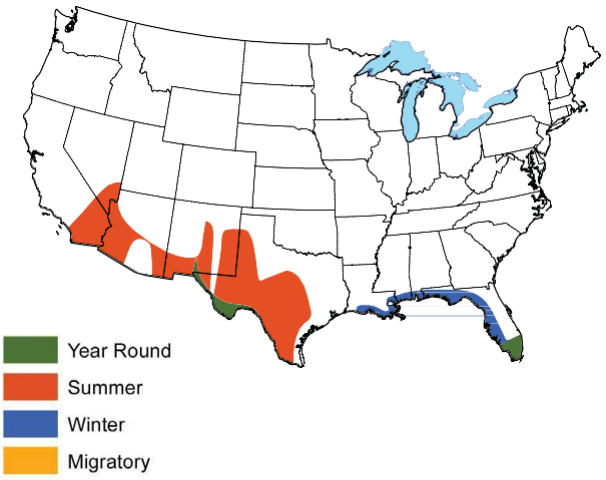
Gray Kramer

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 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

Conduct 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

Conduct Tillage Management: eliminate tillage in the fall to allow access to waste grain

Provide Water Developments for Wildlife: where water is limiting, small ponds, guzzlers, or windmills can provide free-standing water

Conduct Wildlife or Fish Survey: observational surveys and point counts are used to estimate population trends

Mammals

Black-tailed prairie dog

Elise Smith

General information

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 in 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. Prairie dogs often select heavily grazed or trampled areas.

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 Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for black- tailed prairie dogs
Conduct Livestock Management: grazing can promote suitable grassland structure for prairie dogs
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 Hunting/Fishing: 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 Hunting/Fishing: where populations can withstand increased hunting for recreation; can be used to limit population growth where additional prairie dogs are not desired
Conduct 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
Conduct Wildlife or Fish Survey: observation counts, aerial surveys, and extent of colonies are used to estimate population trends
Plant Native Grasses and Forbs: where planting is required to provide forage where limited

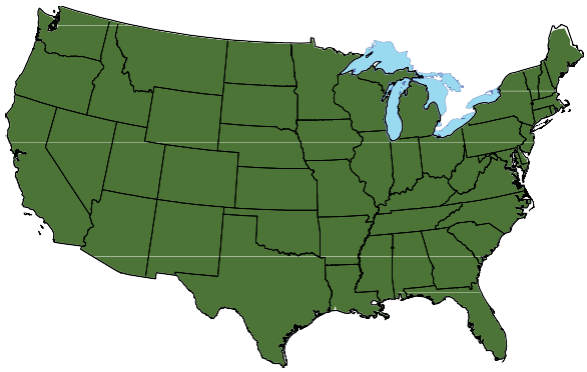
Coyote

General information

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) usually are 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 probably is obtained in diet
Cover: grasslands, shrublands, regenerating forest, mature forest: crevices and burrows along river banks, rock ledges, brush piles, and holes under stumps or abandoned buildings are used as den sites for raising pups



Wildlife management practices

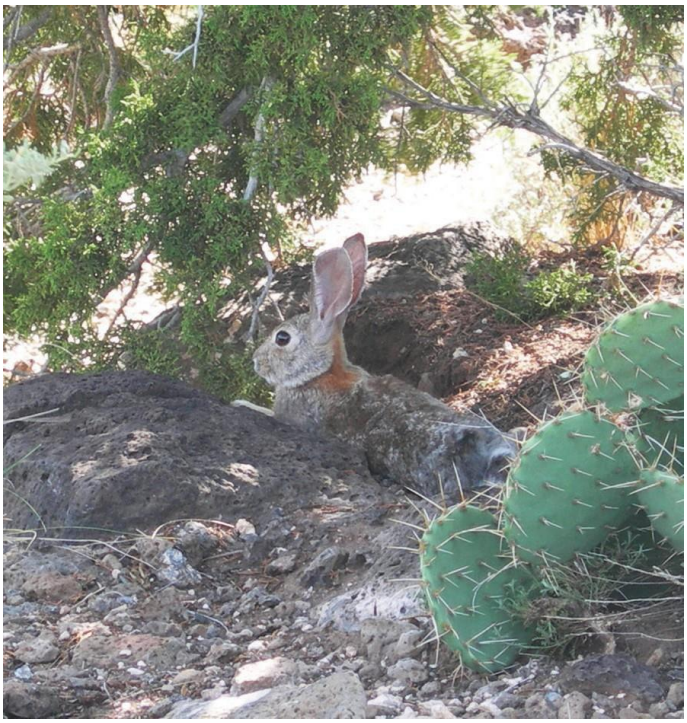
Control Nonnative Vegetation: when nonnative invasive vegetation reduces habitat quality for coyote prey species
Develop Field Borders: to increase usable space for prey species around fields
Conduct Forest Management: (in some ecoregions) *Forest Regeneration* (*Clearcutting*, *Shelterwood*, *Seed-tree*, *Group Selection*) and *Timber Stand Improvement* can improve habitat for prey and lead to more abundant prey ***Conduct 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 Hunting/Fishing: where hunting or trapping has limited population and additional coyotes are desired to control a prey species that is overburdened.
Increase Hunting/Fishing: through hunting or trapping where coyote populations need to be lowered
Conduct Wildlife Damage Management: may be necessary where livestock or pet depredation is a problem
Conduct Wildlife or Fish Survey: track counts, trapper harvest data, and camera surveys are used to estimate population trends

NOTE: Situations in which landowners would manage *for* coyotes are exceptionally rare. However, the coyote is a native predator and plays an important role in many ecosystems. Although management is rarely, if ever, implemented to promote coyotes, management for their prey helps both prey populations and coyote populations and promotes a healthy ecosystem.

Desert cottontail

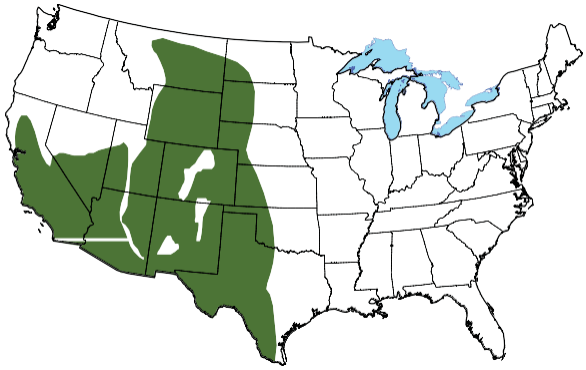
General information

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 ***Trans Pecos*** 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 also are 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 Vegetation: where nonnative invasive vegetation is competing with native vegetation and limiting habitat for cottontails
Develop Field Borders: to increase usable space around row crop fields
Leave Crop Unharvested: to provide additional food and cover, especially corn, alfalfa, and wheat
Conduct Livestock Management: prevent overgrazing to allow ample amounts of herbaceous vegetation for nesting, cover, and forage; livestock should be excluded from food plots
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 ***Trans Pecos*** ecoregion unless sufficient precipitation is available); *Mowing* can be used to maintain herbaceous openings in ***Urban*** areas
Conduct 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 Hunting/Fishing: may be necessary when additional rabbits are desired, and hunting or trapping is limiting growth
Increase Hunting/Fishing: where populations can sustain additional hunting and trapping pressure for recreation and where populations need to be lowered
Conduct Wildlife Damage Management: shooting, trapping, and exclusion techniques can be used where there is damage to ornamental and garden plants
Conduct Wildlife or Fish Survey: observation counts, track counts, and transect flush counts can be used to estimate population trends.

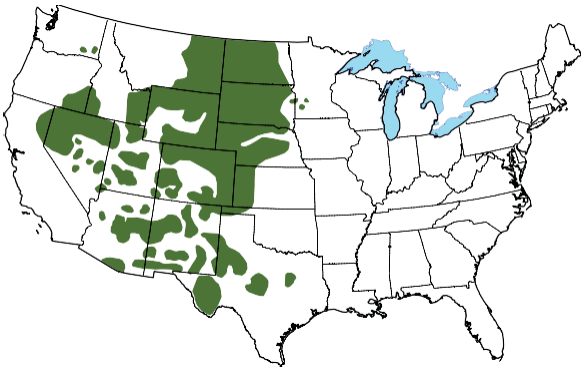
Pronghorn

General information

Pronghorns are hoofed ungulates found in open prairie 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 mammal 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 backward and has a prong which 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

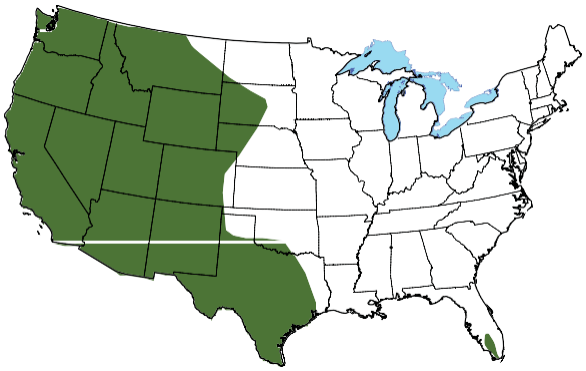


Wildlife management practices

Control Nonnative Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for pronghorn
Conduct 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, and 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*, *Chaining*, and *Root-plowing* are recommended to stimulate additional herbaceous groundcover in large expanses of shrubland
Provide Water Developments for Wildlife: where water is limited or absent within two miles, development of dugouts, windmills, and spring developments is warranted
Decrease Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: when populations can sustain additional hunting pressure for recreation and where populations need to be lowered
Conduct Wildlife Damage Management: may be necessary in areas where crop damage is occurring
Conduct Wildlife or Fish Survey: observation counts are used to estimate population trends

Mountain lion


NPS



General information

The mountain lion (also called cougar, panther, painter, 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 (a.k.a. Florida panther.)

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

Conduct 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*, *Herbicide Applications*, *Dozer-clearing*, and *Drum-chopping* may be used to enhance cover and food availability for several prey species

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

Decrease Hunting/Fishing: may be necessary where mountain lion populations have declined, and hunting pressure may be limiting population increase

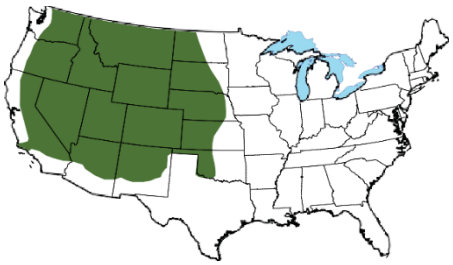
Increase Hunting/Fishing: may be implemented when mountain lion populations are limiting other wildlife species, such as white-tailed or mule deer

Conduct 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)

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

Mule deer


Tupper Ansel Blake



General information

Mule deer occur in western North America (from Texas to California and Northward to Northern Canada). They are adapted to a wide range of western plant community 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). Mule deer that occupy ranges with high elevation migrate to lower elevation in winter for access to preferred forage, avoidance of deep snow cover, and protection from cold winds. Mule deer can cause significant damage (ornamental planting, 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 a relatively tall early successional cover, including native grasses, forbs, and shrubs; rock outcrops and ravines for loafing cover; 50 percent young and mature forest, well interspersed with herbaceous and shrubby cover is optional

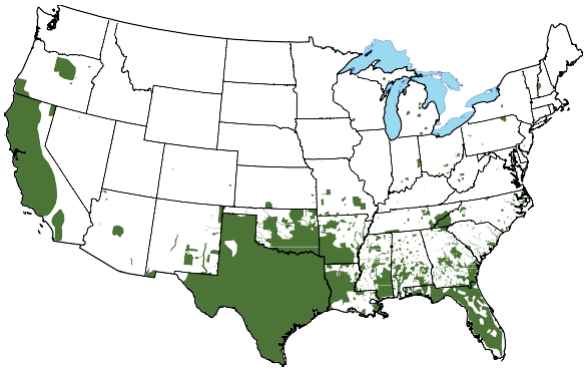
Wildlife management practices

Control Nonnative Vegetation: if nonnative invasive plants are competition with native vegetation and reducing habitat quality for mule deer
Develop Field Borders: (in some ecoregions) to increase fawning cover and forage availability around row-crop fi
Conduct Forest Management: (in some ecoregions) *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) can stop the herbaceous cover and provide additional brushy cover for a few years; *Timber Stand Improvement* can site additional herbaceous cover and browse in the understory where needed
Leave Crop Unharvested: (in some ecoregions) to provide additional food resource, especially near cover
Conduct 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; livestock should be excluded from food plots
Plant Food Plots: (in some ecoregions) 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*, *Disking*, and *Herbicide Application* is recommended to maintain herbaceous cover and revert shrubby areas and young forest back to herbaceous vegetation *Prescribed Fire* also to site the understory for increased forage and soft mast in young and mature forests; *Chainsawing*, *Dozer-clearing* and *Root-plowing* may be used to create additional open areas
Conduct Tillage Management: eliminate fall time of grain crop residue adjacent to cover to make waste grain available as an additional food source
Provide 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 Hunting/Fishing: if hunting pressure is limiting population growth where an increase is desired
Increase Hunting/Fishing: when population can sustain additional hunting pressure for recreation and when population need to be lowered
Conduct Wildlife Damage Management: fencing, repellents, and scare tactics may be helpful to keep deer from ornamental planting vegetable gardens, and crops; reducing the population through shooting is recommended when local overabundance is causing crop depredation and increasing vehicle collisions
Conduct Wildlife or Fish Survey: spotlight surveys, camera surveys, and hunter harvest data help assess population trends

Wild pig

General information

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 indiscriminate 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

Conduct Wildlife Damage Management: may be necessary if wild pigs negatively impact crops, forages, livestock, or other wildlife species; 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

Conduct Wildlife or Fish Survey: camera surveys, track counts, and evidence of rooting are used to estimate population trends

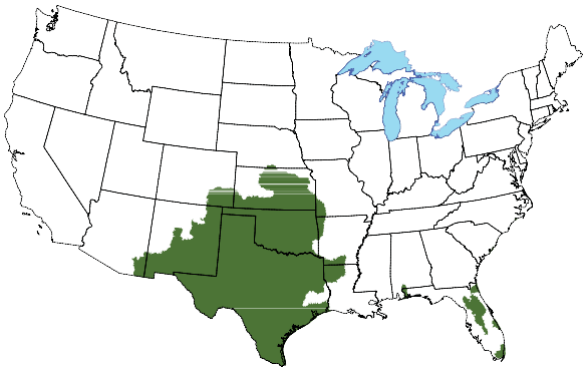
Reptiles

Texas horned lizard

Robert Burton

General information

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 rainwater during heavy rains
Cover: sandy to rocky soils with sparse vegetation of grass, cactus, or scattered shrubs

Wildlife management practices

Control Nonnative 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* and *Chainsawing* can rejuvenate shrublands; it is important that these practices occur during the inactive season to minimize negative effects on the lizards
Conduct Wildlife or Fish Survey: transect surveys are used to estimate population trends

Fish

Bluegill

Eric Engbretson

General information

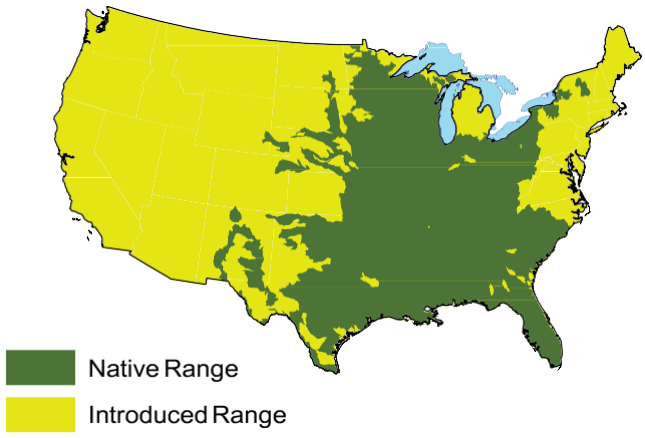
The bluegill is one of the most abundant Sunfish species. It thrives in a variety of conditions, ranging from freshwater lakes, ponds, and slow-moving streams, to brackish waters of coastal areas. The bluegill's native range is the eastern U.S. from southern Canada to Florida and Texas, but they have been successfully introduced throughout the U.S.

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
Water: basic requirements include dissolved oxygen (minimum of 4 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)
Cover: aquatic environments with submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide

Wildlife management practices

Conduct 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/Dam/Levee: if not functioning properly
Decrease Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest
Increase Hunting/Fishing: refer to Wildlife Management Practices on page 224 for specifics on fish harvest
Conduct 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 undesirable 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.

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 management practices specific to 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

Develop 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 also are 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, ***Develop 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 need protection.

Effect of practice

- 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, salt cedar, 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, sickle pod, curly dock, 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. For purposed of this contest, this WMP should only be recommended if the presence of non-native vegetation is mentioned in the verbal or written landowner objectives and Habitat conditions.

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 also is being considered).

Effect of practice

- 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 in ponds and other wetlands

NOTE: Control Nonnative Invasive Vegetation includes both upland and aquatic plants. For this contest this practice is applicable to terrestrial and wetland areas. However, it is not applicable to fish ponds. If aquatic vegetation of any type is problematic in fish ponds, ***Control Aquatic Vegetation*** should be recommended.

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. Down woody trees are snags which have fallen to the ground.

Snags 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 wildlife 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, barred owls and wood ducks, but there is a wide variety of secondary cavity users, from bats and squirrels, to various salamanders and snakes.
The value of snags does not end when they fall. Other wildlife species, such as lizards, 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.

- 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.

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, willows 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 also are 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.

Snags can also form in live standing trees when a large branch or section dies before the main tree. These should be considered in the count if they are of sufficient size to bear a cavity or have cavity holes present.

Effect of practice

- Snags provide roosting and perching sites formany 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

Develop 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 also may include 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. 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.

NOTE: ***Plant Native Grasses and Forbs*** or ***Plant Shrubs*** should not be recommended in order to ***Develop 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.

Field borders around crop fields provide increased usable space for species that require early successional cover. Field borders don't have to be planted. Here, broomsedge, asters, and blackberry have established from the seedbank.

Effect of practice

- 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

Conduct 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*** or ***Dozer-clearing*** and ***Root-plowing)*** should be recommended.

The regeneration method recommended depends on 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). 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 also is used to regenerate longleaf pine where prescribed fire is 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 large bottomland fields that were previously in row-crop agriculture.

Regardless of regeneration method used, it is usually important to make sure food, cover, and water for certain wildlife species are in close proximity. Regenerated stand 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 good to leave relatively large standing dead trees (snags) and live trees with cavities for wildlife that might use them.

Effect of practice

- 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 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.

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.

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.*

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 overstory is harvested. Leaving mast-producing trees is an important consideration when managing for wildlife that eat acorns and other mast.

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.

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.

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 also is practiced effectively in longleaf pine stands.

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 pole 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 of practice

- 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.

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 be gated where they intersect public roads to prevent trespassing and poaching (killing wildlife illegally).

Forest roads should not be constructed perpendicular to slope. Roads such as this should be closed and planted to trees or shrubs.

Forest roads, such as this one planted to clovers, provide nutritious forage as well as travel corridors f o r various wildlife species.

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 of practice

- 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.

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.

Conduct 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 can be adjusted to manipulate the structure of vegetation to favor various wildlife species. Intensity and timing of grazing favor various plant species over others. Thus, available nutrition for livestock and plant species diversity are 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 also can 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 necessary wherever trees, shrubs, or food plots have been planted. Livestock exclusion is 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 of practice

- 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 also may improve habitat structure and composition for various wildlife species that use these areas.

Provide 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 determine which wildlife species use the structures. Nest boxes should be monitored to ensure use by targeted species. Contact your county Extension or state wildlife agency 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.

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.

Effect of practice

- In open areas, nest boxes are useful for bluebirds unless an abundance of nesting cavities are available in trees or fence posts. 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.

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 also are 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 also are 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, joint vetch, winter peas, and lablab, also are 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 blockier 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 need 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.

Effect of practice

- 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.

Warm-season grain plots, such as this corn, can provide an important source of energy through winter for many wildlife species.

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.

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 also is available the following late spring through summer.

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*** or ***Dozer-clearing*** and ***Root-plowing*** (see ***Set-back Succession***).

Native grasses and forbs may be planted where sufficient and desirable native grass/forb cover is lacking.

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, Indian grass, buffalo grass

Examples of desirable native cool-season grasses
Virginia wildrye, Canada wildrye, poverty grass, low panic grasses

Examples of invasive nonnative warm-season grasses
bermudagrass, cogon grass, johnsongrass, crabgrass, dallis grass, goose grass

Examples of undesirable nonnative cool-season grasses
tall fescue, orchard grass, 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 bee plant, annual sunflower, perennial sunflowers, crotons

Examples of invasive nonnative forbs
sericea lespedeza, curly dock, spotted knapweed, sickle pod

Effect of practice

- 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, 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 gamebirds and cottontails.

For purposes of the contest, participants are not expected to determine if each grass or forb species in a habitat is native or non-native . If nothing is mentioned about the vegetation assume only native species exist.

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, ***Conduct Forest Management*** should be recommended.

Shrubs may be planted to create riparian buffers along streams and ponds. Vegetated buffers are important to maintain stream bank 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.

Shrub plantings, such as this hawthorn, provide nesting cover, escape cover, and an important source of soft mast.

Effect of practice

- 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.

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. Ecoregion, 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. If ***Plant Trees*** is recommended, it is assumed that the appropriate site preparation techniques will be performed. Thus, it is not necessary to also recommend mechanical, chemical, or burning treatments to prepare a site for tree planting.

Effect of practice

- 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 was 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

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/Dam/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.

Tree roots can cause dams to fracture, leak, and eventually break.

Billy Higginbotham

This fish pond dam likely will have problems with leakage (if not already) and breakage if the trees are not killed or removed.

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 of practice

- 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

Set-back Succession

General description

Succession is the 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. For the contest 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, ***Conduct 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 ***Conduct 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, trees and shrubs will dominate the site. 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 of practice

- 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 gamebirds. An open structure at ground level facilitates mobility and foraging under a canopy of herbaceous vegetation.
- 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 (because of the open structure at ground level).
- Scarifies (breaks down outside coating) some seeds so they can germinate.
- May release nutrients (from ashes) into the soil.

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 occurred historically. 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 of practice

- 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 small woody species dominate the plant community.

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, ***Conduct Forest Management*** should not be recommended to set-back succession and maintain an early successional community. ***Conduct 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

Disking sets back succession, facilitates decomposition, provides bare ground, and stimulates the seedbank, encouraging early successional species.

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.

necessary to maintain an early successional community. ***Plant Native Grasses and Forbs*** should not necessarily 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. An exception would be if a forested area was being converted to a grassland for grassland obligate species. In that situation, planting native grasses and forbs after clearing trees may be warranted.

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 of practice

- Reduces tree density and encourages earlier successional plant communities.

Dozer-clearing/Root-plowing/Chaining/ Drum-chopping

All four 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.

Bulldozers and loaders are used to clear trees from an area to create early succession and increase herbaceous cover. Bulldozers have a blade in front, whereas a loader has a large wide bucket in front. Dozer-clearing is simply using a bulldozer or loader to clear trees or large shrubs from the site to establish openings and early successional plant communities, both in uplands and wetlands when it is dry enough to get a dozer into the site. Dozer-clearing is often followed by root-plowing to reduce root- and stump-sprouting.

Root-plowing involves a bulldozer with a rear-mounted plow-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.

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.

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 resprout (depending on species), and stem density of brush actually can be greater (but smaller size) following treatment.

Effect of practice

- 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

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 gamebirds 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.

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 of practice

- 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.
- In Urban areas, mowing maintains yards and grassy openings.
- In Urban areas, 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.

John Gruchy

Mowing, or "bush hogging," is often used to set-back or maintain succession in fields. 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.

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.

Effect of practice

- 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.
- Can be used to provide bare ground area adjacent to edge of water source, such as pond, to enable mourning dove access to water.

Conduct Tillage Management

General description

No-till agriculture is recommended over any tillage method. No-till agriculture uses drills and planters that do not overturn the soil. Additionally, the use of cover crops, such as annual clovers, wheat, and brassicas (leafy greens, such as rape, kale, turnips, and radishes), is recommended along with no-till agriculture. Cover crops are sown in the fall, just before or after the existing crop is harvested, then the cover crop is sprayed with herbicide or roller-crimped in spring prior to no-till planting the next crop. Cover crops scavenge and secure nutrients to prevent loss to leaching, increase water infiltration, increase soil-water holding capacity, and help improve soil health by encouraging more organisms, such as earthworms and microbes, in the upper soil layers, which facilitate decomposition and lead to increased nutrient availability.

If no-till agriculture is not possible (some producers do not have access to no-till drills or planters), tilling cropland should be delayed from fall until spring to allow wildlife access to waste grain and to allow wildlife to use standing stubble (if present) for cover. Further, inversion tillage (such as moldboard 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.

NOTE: This practice should be recommended only if a warm-season grain crop, such as corn, soybeans, or grain sorghum, is present and/or if tillage has been used to plant or manage a crop. If a crop is present and tillage has been used, no-till agriculture and cover crops may be recommended in the management plan (Activity III). If a grain crop is present and the written scenario suggests no-till planting is not possible, delayed tillage with implements that do not overturn the soil and cover crops may be recommended.

Effect of practice

- No-till agriculture conserves soil moisture and reduces soil erosion and sedimentation into creeks and rivers. Thus, water quality is improved, which benefits aquatic organisms.
- Cover crops help improve soil health by increasing organic material and detritivores in the upper soil layers. Cover crops provide forage for various wildlife species.
- No-till agriculture and delayed tillage increases supply of waste grain, which is eaten by many wildlife species, and may increase nesting success.

Cover crops, such as cereal rye, radishes, and Austrian winter peas (left), improves soil health by increasing organic material and nutrients available to later crops, and providing forage for various wildlife species. Delaying tillage from fall into spring allows wildlife access to waste grain from harvested crops through winter (right).

Provide 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, bulldozers, or loaders. They 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.

Small ponds can be created where water is relatively scarce to provide water and habitat for several wildlife species.

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

Guzzlers and windmills also are 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 also are useful for providing water in urban settings.

NOTE: ***Provide 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 serious need of repair.

Shallow impoundments can provide excellent habitat for migrating and wintering waterfowl and other wildlife species.

Effect of practice

- 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.

Population Management Practices

Decrease Hunting/Fishing

General description

Regulated hunting, trapping and fishing are primary tools used to manage many wildlife and fish species. The Texas Parks and Wildlife Department (TPWD) set regulations for hunting, trapping, and fishing which include seasons and limits on number taken. Landowners can choose to take the maximum allowed or less than that, depending on species populations and personal management objectives.

NOTE: ***Decrease Hunting/Fishing*** is not a viable option for migratory species, such as waterfowl and mourning dove, because individual landowners cannot influence population levels of these migratory species except to provide or improve habitat to encourage them on a property.

Increase Hunting/Fishing

General description

Regulated hunting, trapping and fishing are primary tools used to manage many wildlife and fish species. Landowners can choose to take the maximum allowed or less than that, depending on local populations and personal management objectives.

Landowners have the option to work with TPWD biologists to develop a plan to hunt and take more than the limit of some species such as white tailed deer, if the population proves to be too large for and detrimental to the habitat.

NOTE: ***Increase Hunting/Fishing*** 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.

Conduct 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

Harvest Trends: if hunting/trapping efforts remain relatively constant, trends in annual harvest rates can be used to estimate trends in populations.

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 Hunting/Fishing*** and ***Increase Hunting/Fishing*** 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 Proportional Size Distributions. Trotlines, rod and reel, and gill nets can be used to sample channel catfish. 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.

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.

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 is ongoing or has been completed recently.

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 the public better accepts them versus 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 employs 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). Licenses and permits are often required. Certain species can be managed only by qualified personnel and not individual landowners.

Even though some tactics are similar, Wildlife Damage Management is not hunting. Use this management practice when a population or single animal is causing damage as described above including damage to habitat or other wildlife species.

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 or when an existing old pond has filled in with sediment and no longer holds sufficient 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 of practice

- 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 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 also is 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, raking and pulling up rooted vegetation.

Billy Higginbotham

Filamentous algae and cattails must be controlled in this pond before fertilization is possible. Dense cattails also can provide cover for many small fish and lead to an imbalanced fish pond.

NOTE: ***Control Aquatic Vegetation*** includes nonnative vegetation. Thus, ***Control Nonnative Invasive Vegetation*** is not applicable for fish ponds.

Effect of practice

- Reduces aquatic vegetation within and around the edge of a pond, making prey more easily available to predator fish.

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 and prevents 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 also can 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 if/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. Ponds that are extremely turbid because of clay particles should not be fertilized.

Effect of practice

- Pond fertilization stimulates phytoplankton production, which is the first step in the foodchain 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. Ponds managed for channel catfish may be turbid because of action from the catfish. This practice should be recommended for catfish ponds only when it is obvious that erosion and sedimentation are causing or contributing to turbidity.

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.

NOTE: if cattle are causing turbid water, ***Conduct Livestock Management*** should be recommended, not ***Reduce Turbidity in Fish Pond***.

Effect of practice

- Improves water quality by removing or settlingsilt.
- Allows sunlight to stimulate phytoplankton.

Renovate Fish Pond

General description

Renovating a fish pond is a drastic measure and should only be considered after other management approaches have been attempted. Renovation involves removing all fish from the pond and restocking with desirable species. 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 largemouth bass per surface acre if the pond is to be fertilized, or 500 bluegill and 50 largemouth bass per surface acre if the pond will not be fertilized. Channel catfish stocking rates vary from 100 to 300 per surface acre depending on whether the pond is unfertilized or fertilized.

Effect of practice

- Draining ponds or using fish toxicants remove unbalanced fish populations and allow establishment of balanced populations of desirable fish

Streams: Create Pools

General description

Pools and riffles are important habitat featuresfor various fishes that inhabit streams. Stream flow varies with elevation change and width of channel. Stream flow is faster where there is more elevation 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 of practice

- 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 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 step log structures can allow fish passage around barriers.

Effect of practice

- 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. Feeders should be cleaned periodically 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 continue to 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.

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 of practice

- Provides a supplemental source of food and cover.

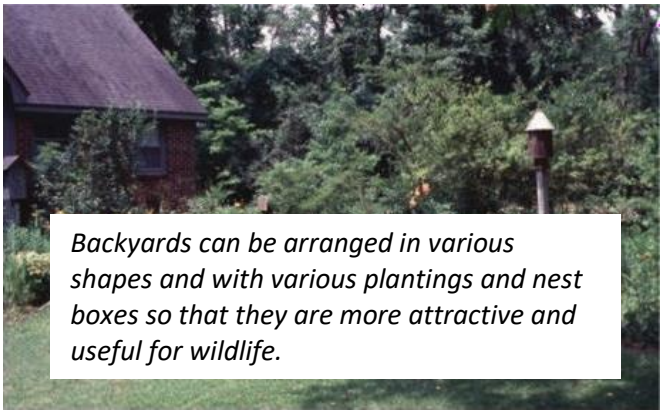
Rooftop/Balcony Gardens

General description

Residential green space is limited in urban areas. 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, may attract more wildlife than stationary water.

Effect of practice

- Provides food, cover, and water, though in small amounts, for wildlife in urban area



Backyards can be arranged in various shapes and with various plantings and nest boxes so that they are more attractive and useful for wildlife.

Appendix A. Glossary

aerate: to supply or expose water with air to increase dissolved oxygen and release harmful gases
afforestation: planting trees in an area that previously was not forested; for example, planting trees in a field coming out of agricultural production
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 anoak 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
hibernaculum (plural, **hibernacula**): the winter den or shelter for various species
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 insect's **insectivore:** an insect-eating animal
intermittent: occurring at irregular intervals
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
latrine: site where various mammal species, such as raccoon or river otter, habitually defecate or urinate
legume: plants that bear seeds in a pod; examples include lespedezas, clovers, soybeans, peas, and black locust
mast: collective term for fruits, trees, shrubs and vines, both hard and soft (fleshy), such as acorns, hickory nuts, persimmon, mulberry, blackberry, and grape
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
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
reforestation: usually refers to planting trees in an area that was previously forested and recently harvested
regenerate: to replace lost or damaged parts with new tissue
regeneration: in forestry, refers to young trees
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
scarify: 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
turbidity: a measure of water clarity (or cloudiness) as influenced by suspension of sediment or other materials, but most often soil particles (usually silt or clay)
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