Arkansas 4-H Wildlife Habitat Education Program

Southeast Mixed Forest & Outer Coastal Plains Handbook

January 2020

Introduction

The National 4-H Wildlife Habitat Education Program is designed to teach youth the fundamentals of wildlife and fisheries science and management. The National Invitational is open only to senior division 4-H members. Junior division 4-H members are eligible to compete at county and state events.

The Arkansas 4-H Wildlife Habitat Education Program (WHEP) is based on the national program. The Arkansas program uses components of the national program which represent our state. This includes regions and wildlife species found in Arkansas. Some wildlife species have been added to the state handbook because of their importance in Arkansas.

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

Arkansas WHEP is designed to train Junior and Senior 4-Hers in stages. Participants are expected to grow in their depth of understanding about wildlife and our natural resources. The Junior Contest helps this age level develop fundamental knowledge to prepare them for competing as Seniors. Juniors focus on identifying wildlife, understanding their habitat needs, and management practices to improve habitat. Senior contestants apply this knowledge when evaluating habitat and preparing a written wildlife management plan.

It is important to understand ecological processes as well as life requirements of various wildlife species before making management recommendations. The **Ecoregions** and **Wildlife Species Descriptions** sections of this handbook provide basic information related to wildlife ecology and management as well as the life requirements of various wildlife species.

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

Wildlife Contest

This handbook and website is a tool for learning about wildlife and habitat management. It also provides information about 4-H wildlife contests and study guides. The study guides are used to develop questions for the contest.

A study region is announced each year. Each region has a limited number of wildlife species eligible for the contest. The state 4-H WHEP practice session typically is held in February and the state contest in April. The 4-H Wildlife O-Rama occurs in June and July.

The state WHEP contest moves to different locations each year to broaden contestants' understanding of the different regions. Check the 4-H Calendar of Events and your local county Extension office for details about registration fees, deadlines, and event dates.

Summary of Arkansas 4-H Wildlife Education Events

WHEP Event	Activity Type	Level
Wildlife Identification	Individual Individual Individual	Cloverbud Junior Senior
Wildlife Foods and Concepts	Individual Individual	Junior Senior
Interpreting Wildlife Habitat from Satellite Images	Individual	Junior
Educational Activity	Individual	Junior
Wildlife Management Practices	Team Individual	Junior Senior
Wildlife Management Plan	Team	Senior
Oral Defense	Individual	Senior

Wildlife O-Rama	Level
Wildlife Identification	Junior & Senior
Wildlife Foods and Concepts	Junior & Senior

4-H Food Plot Project	Level
Project book Video	Junior & Senior

The **Wildlife Identification** event uses actual artifacts, replicas, photos, recordings or other clues representing species and their sign for contestants to identify. Only those species from the Urban and Wetland regions and the announced region are eligible for testing. Typically, there are about 40 - 45 species of birds, mammals, reptiles, and amphibians for contestants to identify.

For **Wildlife Foods and Concepts**, contestants need to know the following about the species in the announced region:

- food each wildlife species consumes;
- key wildlife management concepts and terms;
- habitat needs of the wildlife species; and
- descriptions of wildlife management practices and their implementation.

Interpreting Wildlife Habitat from Satellite Images is important for understanding when and where certain wildlife habitat practices need to be implemented. Junior contestants may be asked to compare which habitat is best for a particular wildlife species. For example, white-tailed deer prefer areas with a lot of edge habitat compared to an eastern fox squirrel, which prefers mature forests. Though not tested specifically about satellite images, Senior contestants may receive a satellite image as part of the scenario for writing a wildlife management plan.

For the **Educational Activity**, Junior contestants attend one or more activities which will be announced the day of the contest.

- One or more presentations about a wildlife topic will be given during the day of the contest. To receive points, the contestant must attend the education activity and respond to questions on a scorecard.
- Contestants will be provided a scorecard at the education activity with one or more questions about the topic being presented.
- These questions may be multiple choice, true/false, short answer, or open ended.
- The contestant will turn in the scorecard to a contest official after the activity to receive points. These will be added to the team score. For teams with four contestants, the lowest individual score will be dropped when tabulating the team score.

The **Wildlife Management Practices** event is where Junior contestants work as a team to match species from the announced region with the recommended practices, while Seniors work individually and evaluate habitat to determine whether or not a particular management practice is necessary. For example, Juniors will indicate "field border" is a management practice recommended for the wild turkey, whereas Seniors must also judge a piece of land and determine whether a field border is necessary to improve wild turkey habitat.

These events are building blocks for preparing a **Wildlife Management Plan**. For Senior 4-H members, preparing the plan is the culminating activity. Seniors work as a team to write the plan based on a scenario having up to six wildlife species from the announced region and a piece of land to judge. Once habitat deficiencies are identified for these species, the team discusses when and where various wildlife management practices need to be implemented.

For **Oral Reasons**, Senior contestants answer questions from a panel of judges about their plan. The mark of a good contestant is being able to write and speak fluently using wildlife concepts and terminology in a meaningful way.

How to Use the Handbook

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

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

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

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

- **Locate and mark the appropriate practices in the Wildlife Management Practices section.** Learning how various wildlife management practices affect wildlife species is critical. Note that not all wildlife management practices listed in the manual are used in every ecoregion. **Wildlife Foods and Concepts** may require information from various portions of the handbook, including **Wildlife Identification**, **Wildlife Management Practices**, Wildlife **Concepts and Terms**, **Interpreting Wildlife Habitat from Satellite Imagery** and **Ecoregion** sections.

Preparing for the Contest

Participants should read and understand the **Wildlife Concepts and Terms** and **Interpreting Wildlife Habitat from Satellite Imagery** sections of the manual. Leaders should explain the concepts and terms and provide local examples to clarify any misunderstanding. This section is important because the activities require understanding of these concepts and terms. Seniors should be able to interpret satellite images, and use these terms and concepts in their presentations during the contest.

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

Leaders can introduce participants to the contest activities through various exercises.

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

Following is a list of websites and agencies with personnel who work with wildlife. Some have field offices in your area. Contact them for assistance when practicing and preparing for this contest. However, be aware that these wildlife professionals may teach something that differs from the study materials, especially if they are not familiar with the contest or its content. The study materials on this website will be the text (i.e., the final word) from which the contestants are evaluated.

- Arkansas Game and Fish Commission
- Arkansas Forestry Commission
- Arkansas Natural Heritage Commission
- Audubon Arkansas
- Natural Resource Conservation Service
- The Nature Conservancy – Arkansas Chapter
- United States Fish and Wildlife Service
- University of Arkansas Cooperative Extension Service

General Rules and Regulations

Contestants and Eligibility

A. A team consists of no less than three and no more than four official entrants who are 4-H members in their county during the current year.
   1. Junior 4-H members compete on Junior teams and Senior 4-H members compete on Senior teams.
   2. Mixed teams comprised of both Juniors and Seniors are not eligible.
   3. County teams are comprised of members from the same county.
   4. Individuals from different counties cannot register as a team.

B. Competing individuals must be official entrants who are 4-H members in their county during the current year. An individual participant may also be a member of the county team. Individuals who are unable to form a county team will be assigned to a team the day of the contest. (See Letter E below.)

C. All individual and team members must be bona fide 4-H Club members who are actively enrolled in a 4-H project or activity.
   1. 4-H membership must be through one of the Cooperative Extension Service's 75 county 4-H programs in Arkansas.
   2. All individual and team members must declare a "home county" for membership in order to qualify for competition. Members cannot compete for awards in more than one county during the contest year.
   3. A youth in 4-H must complete enrollment on 4-H Online including code of conduct and health forms, and receive county agent approval.
   4. Counties may require 4-H members to attend club meetings or perform other activities to qualify as bona fide 4-H members.

D. Age requirements:
   1. Junior individuals or team members are youth who in the contest year are age 9 as of January 1 until December 31 of the year they celebrate their 14th birthday.
   2. Senior individuals or team members are youth who in the contest year are age 14 as of January 1 until December 31 of the year they celebrate their 19th birthday.
   3. Cloverbuds are ages 5 to 9 who are enrolled in 4-H. Cloverbuds must have county Junior or Senior members registered to attend the WHEP state contest, and permission from their county 4-H office to attend the state contest.

E. Individuals from counties who register Junior or Senior participants without a team will be assigned a team that will be made known the day of the state contest. A fair and equitable process will be used to assign registered individuals to teams.
   1. Mixed county teams comprised of 3 or 4 individuals will be formed.
   2. Individuals may be assigned to county teams already having three contestants if necessary. The team(s) receiving the extra member will be selected randomly.

Registration

A. Every person must be enrolled and approved via 4-H Online before attending the event. This includes 4-H youth, coaches, parents, siblings, and county Extension agents.
   1. Every person who attends an Arkansas 4-H WHEP event must meet all county Extension requirements to participate.
   2. No “walk-up” registrations are accepted.
   3. Children 4 years of age and younger are not required to register.

B. Registration is accepted using 4-H Online. Each person must register on or before the announced deadline. A late registration fee will be charged for entries received after

deadline. No additional registrations will be accepted up to seven days before the contest.

1. 4-H members paying by check must provide payment to their county office promptly. County offices are required to collect in advance and deposit all monies from individuals prior to the event.
2. A standard NSF Fee will be assessed on all checks that are returned due to insufficient funds.
3. One check per county is due to the Forest Resources Unit at the State Office prior to the event. 4-H members are not considered fully registered for the event until payment is received from their county office. One check payable to UACES should be accompanied with 4-H Online invoices to indicate amounts for individual payments. No checks from individuals will be accepted at the State Office.

C. Once registered, county agents are responsible for notifying the state WHEP Coordinator of team assignments in counties where two or more teams are registered. Team assignments must be conveyed in writing 15 or more days before the contest.

1. If notification of team assignments is not received by deadline, the WHEP Coordinator will assign county teams.
2. If absences result in a county team with fewer than three members on contest day, individuals from other counties may be assigned to the team.

D. The refund policy is 75% refund for 15 or more working days before the contest, 50% refund for 11 to 14 working days before the contest, and no refund for cancellation 10 days or less before the event.

1. Any refund of participant fees will be disbursed in the form of a check issued by the University of Arkansas. No electronic refunds will be issued for any participant fees that were originally paid by electronic means such as debit cards, credit cards or electronic checks.
2. Exceptions to this refund policy will be based on personal or family illness or death in the immediate family. Participants must notify the county Extension office of cancellation, who will in turn notify the state WHEP Coordinator so alternatives can be considered. The county Extension office is responsible for notifying in writing the WHEP Coordinator of such absences.

Contest Rules

A. All non-contestant children who attend wildlife programs must be accompanied by an adult at all times. After completing contest activities, 4-H Junior/Senior contestants must be accompanied by an adult.

B. Cloverbuds participating in the Wildlife Identification event can work independently or receive assistance from an adult or teen leader.

1. The Cloverbud event is not competitive. Cloverbuds are provided this learning opportunity to help them prepare for participation as Juniors.

2. Cloverbuds must provide their own pencil and clipboard.
3. Cloverbuds are encouraged to talk and ask questions. We want them to learn and have an enjoyable experience.
4. Scorecards are turned into the station monitor with the name and county (printed clearly) to serve as a record of participation. Their scorecards will not be scored.
5. Cloverbuds need to be accompanied by an adult at all times while at WHEP.

C. Junior and Senior contestants compete in individual and team activities. Those who sign up as a team also compete as individuals. Individuals who sign up without a county team will be assigned one.

D. Junior contestants compete as:
1. individuals on Wildlife Identification, Foods and Concepts, Interpreting Satellite Images, and Educational Activity. No talking is allowed.
2. teams on Wildlife Management Practices and will be allowed to talk with team members.

E. Senior contestants compete as:
1. individuals on Wildlife Identification, Foods and Concepts, and Wildlife Management Practices. No talking is allowed.
2. teams on writing a Wildlife Management Plan and will be allowed to talk with team members.
3. individuals answering questions from a panel of judges, though preparation occurs while writing the wildlife management plan. Talking with teammates to prepare for oral reasons is allowed.

F. An Arkansas 4-H Wildlife Advisory Committee periodically assists the state coordinator when needed to help with planning and implementing events and activities associated with the Arkansas 4-H wildlife education program.
1. The committee is comprised of the state WHEP coordinator, county agents, contest judges, and 4-H volunteers.
2. Each year, a region is selected for the contest. Only species which occur within the announced region are used in the contest. An exception are species listed for the Urban and Wetlands regions which are always included in Wildlife Identification. If the announced region is Urban or Wetlands, an additional region will be selected.

G. An official scoring committee tabulates contest results. All decisions of the scoring committee are final. Interference with scoring by contestants, parents, leaders, coaches, or others associated with a team or individual will result in disqualification of that team or individual.

H. The team coach is the only individual who can issue protests about the contest. All protests must be made to the Contest Coordinator (Protest Judge) at any time prior to the awards ceremony the day of the contest. Protests disregarding these procedures

will not be considered. Protests and challenges will be decided by a review board appointed by the Protest Judge. Their decisions are final.

I. A Code of Conduct form must be completed on 4-H Online prior to participation and will be used as the official document for dealing with infractions by 4-H members. If a 4-H member is found in violation of the Code of Conduct and receives discipline issued by a review board, his/her parents will be notified, and the 4-H member may be sent home immediately at the parents' expense and may be suspended from participating in future 4-H activities.

Contest Day Rules

1. Each contestant must provide his or her own pencils and clipboard. The clipboard should be clean without any writing other than the contestant's name. Pencil sharpeners are optional. NOTE: No extra pencils, pencil sharpeners, or clipboards will be available.

A. Senior contestants are to wear field clothing and close-toed shoes to WHEP events. When the contestant's safety is of concern, a lack of appropriate clothing could result in disqualification from a contest activity.

B. Contestants are not allowed to have electronic devices of any kind during the contest. This includes, but is not limited to, cell phones, iPads, iPods, calculators, etc. Such devices must be left with coaches or chaperones during the contest. A contestant found in possession of an electronic device can be disqualified immediately from the entire contest.

C. Only Junior and Senior contestants and designated officials shall be within the perimeter of a Junior/Senior event. All adults, except contest officials, will be separated from contestants while the contest is in progress. At the discretion of the station monitor, adults may be allowed to briefly enter the perimeter and take photos for 4-H journal records.

D. Absolutely no talking by contestants will be allowed during the contest, except when working on designated team activities or as permitted during the Educational Activity.

E. Anyone caught cheating will be disqualified.

F. Scorecards must be turned in to an official judge immediately after each event.

G. The state WHEP contest will not be canceled because of inclement weather, unless lightening or heavy thunderstorms are in the immediate area. Contestants should come prepared. Bring rain gear and plastic to cover the clipboard.

H. An official committee will score the contest and announce results. Their decision is final.

Awards

A. Cloverbuds who complete the Wildlife Identification event will receive a participation ribbon during an awards ceremony.

B. Junior and Senior Individuals achieving the highest accumulative scores will be recognized at an awards ceremony.
   1. Junior individuals achieving the highest accumulative score for Wildlife Identification, Foods and Concepts, Interpreting Satellite Images, and Educational Activity are recognized. First, second, third, fourth, and fifth places will be awarded.
   2. Senior individuals achieving the highest accumulative score for Wildlife Identification, Foods and Concepts, and Wildlife Management Practices are recognized. First, second, third, fourth, and fifth places will be awarded.
   3. In case of a tie, individuals may be asked to answer additional tie-breaker questions of any format. If tie-breaker questions are not used, the individual with the highest score in Wildlife Identification will be declared the winner. If a tie remains, the individual with the highest score in Foods and Concepts will be declared the winner. If a tie remains, the individual with the highest score in Satellite Images (Juniors) or Wildlife Management Practices (Seniors) will be declared the winner. If the tie cannot be broken, a coin toss will be used to determine the winner.

C. Junior and Senior Teams achieving the highest accumulative scores will be recognized at an awards ceremony.
   1. Junior and Senior teams with the highest overall score are recognized. First, second, third, fourth, and fifth places will be awarded.
   2. The Junior team score will be the sum of three individual scores on the team plus the team score for Wildlife Management Practices. If a team has a fourth member, the lowest individual score for each event (i.e., Wildlife Identification, Foods and Concepts, Satellite Images, and Educational Activity) will be dropped.
   3. The Senior team score will be the sum of the three individual scores on the team, plus the team score for Wildlife Management Plan and the three scores for Oral Defense. If a team has a fourth member, the lowest individual score for each event (i.e., Wildlife Identification, Foods and Concepts, Wildlife Management Practices) plus the lowest Oral Reasons score will be dropped.
   4. In case of a tie, the team with the highest team score in Wildlife Management Practices (Juniors) or Wildlife Management Plan (Seniors) will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Wildlife Identification will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Foods and Concepts will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Satellite Images (Juniors) or Oral Reasons (Seniors) will be declared the winner. If the tie cannot be broken, a coin toss will be used to determine the winner.

D. The Senior Team with the highest overall team score that meets eligibility requirements will be offered the opportunity to represent Arkansas at the National 4-H Wildlife Habitat Education Program Invitational.

1. National Eligibility
    a. The team must be certified as the official state entry by the WHEP Coordinator as designated by the Associate Director – 4-H Youth Development.
    b. Contestant must not have reached his or her 19th birthday as of January 1 of the year in which the National 4-H Wildlife Habitat Education Program Invitational is held.
    c. All contestants must be members of Arkansas 4-H during the year in which the National 4-H Wildlife Habitat Education Program Invitational is held.
    d. The contestant, his or her county 4-H staff member, and the Associate Director – 4-H Youth Development must certify as follows on the application form: "The contestant has not participated in post-secondary coursework in judging or selection in the subject area of their national 4-H competition, nor have they participated in training for a post-secondary judging team in the subject area of their national 4-H competition."
    e. To remain eligible to compete in a national 4-H competitive event, a 4-H member MAY NOT (a) work with a collegiate judging team; and/or (b) enroll in college coursework.
    f. The rules of the National 4-H Wildlife Habitat Education Program Invitational allow team members to enter only once. Therefore, a team member who has previously entered and won "First Place - Senior Team" at the Arkansas 4-H Wildlife Habitat Education Program state contest and agrees to attend the national Invitational cannot re-enter the Arkansas state contest. However, such state winners can continue to participate in Arkansas WHEP as WHEP teen leaders.

2. State Eligibility
    a. The team coach must notify the 4-H Wildlife Habitat Education Program Coordinator in writing within 7 days after winning the state contest of the team's intention to attend the Invitational. If the winning team is ineligible, unable to attend, or no notification is received, the second place team will be given the opportunity to represent Arkansas at the Invitational. After being notified, this team will have 7 days to notify the 4-H Wildlife Habitat Education Program coordinator of the team's intention to attend the Invitational. If the second place team is ineligible, unable to attend, or no notification received in 7 days, the third place team will be offered the opportunity, and so on, until a team agrees to attend the Invitational.
    b. To be named a state winner in any category which provides a national trip, a 4-H member must sign a written agreement or contract agreeing to attend the national competition as a member of the Arkansas 4-H delegation. Specifically, 4-H members winning the state 4-H Wildlife Habitat Education Contest must

agree to participate in the national event as an Arkansas 4-H delegate and must not have competed in a prior 4-H Wildlife Habitat Education Invitational. If the 4-H member signs the agreement but does not attend, he/she will be expected to reimburse 4-H for any cost incurred.

c. Although 4-H members of the winning Senior team are no longer eligible for the national Invitational or state contest, they are invited to continue participating in the Arkansas 4-H Wildlife Habitat Education Program as a WHEP teen leader. Responsibilities include assisting with the practice session, state contest, and training the new state winning Senior team.

3. State team composition
    a. In the event a team of three individuals wins the Arkansas state WHEP contest or a fourth team member is unable to participate, the team coach can request that the state WHEP coordinator seek a fourth team member.
    b. The state WHEP coordinator will review the list of individuals who placed in the state contest. The state coordinator will contact the county agent of the senior 4-Her with the highest ranking and who either participated as an individual (i.e., not affiliated with a team) or participated in WHEP for the last time (i.e., graduating from high school). If the county agent is agreeable, the senior contestant will be contacted and offered the opportunity to become a fourth member of the team. If that person refuses, invitations will continue until the list of eligible seniors is exhausted or time runs out. 4-Hers who have the opportunity to participate on a county WHEP team are ineligible to become a fourth team member, unless there are extenuating circumstances and the county agent and team coach(es) are in unanimous agreement of his/her participation.
    c. One team coach and one member of the Arkansas 4-H Wildlife Education Program Advisory Committee will accompany the winning Senior team to the Invitational, unless the committee forfeits this option. In that instance, the county agent selects an assistant coach who will attend the contest. Preferably, the gender of team coaches will reflect the team composition. For teams with both male and female members, preferably one male and one female adult will accompany the team.
    d. Lodging rules and policy followed by the C.A. Vines Arkansas 4-H Center apply to out-of-state trips. No adult(s) can lodge in the same room with unrelated youth. Check policy guidelines for details.
    e. Coaches and assistant coaches must either be an employee of the University of Arkansas Cooperative Extension Service or have a current 4-H Volunteer Application Form, CES-643 on file in the county Extension office and qualify under the CES Youth Protection Policy. Coaches and assistant coaches (Extension employees excluded) must be age 25 before chaperoning an out-of-state 4-H trip. Extension employees must have prior approval from their supervisor before attending.

4. Trip expenses
    a. State contest funds, when available, are used to pay registration fees which include meals and lodging while at the Invitational.
    b. The team is responsible for travel expenses to and from the contest location and any extra expenses associated with registration fees. Local fundraising is encouraged with the local county agent responsible for overseeing the fund account and management.
    c. Teams sometimes elect to arrive at the contest site location a day or two early and prepare for the contest by studying the surrounding habitat, visiting parks, and/or meeting experts in preparation for the contest. State contest funds are not used for these additional expenses.
    d. The Arkansas 4-H Wildlife Habitat Education Program reserves the right not to pay extra activity fees, or any fees deemed outside the purview of the program.

WHEP Teen Leaders

Youth who win the state WHEP contest and represent Arkansas at the 4-H Wildlife Habitat Education Program National Invitational are eligible to continue participating in WHEP as a Teen Leader. Youth are invited to assist in a variety of ways, including:

- WHEP Practice Session by giving an overview of the program at the opening session and assisting with training sessions.
- WHEP State Contest by leading groups through rotations, score room, and/or judging oral reasons.
- Fundraising activities for 4-H Wildlife Programs.

Youth may continue serving as WHEP Teen Leaders and assisting with the program for the duration of their 4-H career. Contact the WHEP Coordinator to learn more about opportunities and provide volunteer assistance for the WHEP program.

Scoring Guide

This section describes how individual and team scores are calculated for the state contest of the Arkansas 4-H Wildlife Habitat Education Program.

Junior 4-H Contestants

Individual Achievement
Junior individuals achieving the highest accumulative score for the events listed below are recognized. First, second, third, fourth, and fifth places will be awarded.

- **Wildlife Identification (60 points maximum):** The total number of correct responses is added together for this score.

- **Wildlife Foods and Concepts (30 points maximum):** The total number of correct responses is added together for this score.
- **Interpreting Wildlife Habitat from Satellite Images (20 points maximum):** The total number of correct responses is added together for this score.
- **Educational Activity (10 points maximum):** The total number of correct responses is added together for this score.

Tie breaker: Judges who prepare contest activities for Wildlife Identification and Wildlife Foods and Concepts will be encouraged to add one or more tie-breaker questions. Tie breakers can be of any format, including open response. These questions will not count toward the total score and will not be graded unless a tie occurs. If a tie occurs, tie breaker questions for Wildlife Identification and Wildlife Foods and Concepts will be added together and the highest score declared the winner.

If a tied score remains after grading the tie-breaker questions (or if no tie-breaker questions are offered), the individual with the highest total score in Wildlife Identification will be declared the winner. If a tie remains, the individual with the highest total score in Wildlife Foods and Concepts will be declared the winner. If a tie remains, the individual with the highest total score in Interpreting Wildlife Habitat from Satellite Images will be declared the winner. If a tie remains, the individual with the highest team score in Wildlife Management Practices will be declared the winner. If the tie cannot be broken, a coin toss will be used to determine the winner.

Team Achievement

Junior teams with the highest overall score are recognized. First, second, third, fourth, and fifth places will be awarded. The team score will include Wildlife Habitat Practices, plus the three scores added together for Wildlife Identification, Foods & Concepts, Interpreting Satellite Images, and Educational Activity. If a team has a fourth member, the lowest individual score will be dropped.

The team score will be comprised of:

- **Wildlife Identification (180 points maximum):** The three highest individual scores are added together.
- **Wildlife Foods and Concepts (90 points maximum):** The three highest individual scores are added together.
- **Interpreting Wildlife Habitat from Satellite Images (60 points maximum):** The three highest individual scores are added together.
- **Wildlife Management Practices Team Event (200 points maximum)**

  Participants are given credit for:
  - putting an "X" in the appropriate boxes; and
  - leaving boxes blank where no "X" is indicated on the wildlife management practice chart.

Answers will be incorrect if:
- boxes that should be marked are left blank; and
- boxes that should not be marked are marked.

All boxes are counted in the scoring. For example, there are 184 possible correct answers, because the region has 23 wildlife management practices multiplied by 8 species on an answer sheet. This activity is worth 200 points maximum, therefore a conversion factor will be used to make the score equivalent to a 200 point scale.

Tie breaker: In case of a tie, the team with the highest score in Wildlife Management Practices will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Wildlife Identification will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Wildlife Foods and Concepts will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Interpreting Wildlife Habitat from Satellite Images will be declared the winner. If a time remains, the team with the highest accumulative individual scores in Educational Activity will be declared a winner. If the tie cannot be broken, a coin toss will be used to determine the winner.

Example of Computations for Junior Individual and Team Scores

4-H WHEP Team	Scores (maximum score)									
	Individual							Team		
	Wildlife ID	Foods & Concepts	Satellite Images	Educational Activity		Individual Score		Management Practices		Team Score
	(60 max)	(30 max)	(20 max)	(10 max)		(120 max)		(200 max)		(560 max)
Jane Doe	42*	22	11	10*		85		152		-
John Doe	34*	27*	20*	10*		91		-		-
Janie Rainy	32*	30*	12*	5		79		-		-
J. B. Goode	31	23*	11*	8*		73		-		-
Team Score	108	80	43	28		-		152		411
	(180 max)	(90 max)	(60 max)	(30 max)						

*The highest individual scores for Wildlife ID, Wildlife Foods and Concepts, Interpreting Wildlife Habitat from Satellite Images, and Educational Activity are added together for the team score. For teams with four members, the score for the lowest scoring individual is dropped.

Senior 4-H Contestants

Individual Achievement
Senior individuals achieving the highest accumulative score for the events listed below are recognized. First, second, third, fourth, and fifth places will be awarded.

- **Wildlife Identification (60 points maximum):** The total number of correct responses is added together for this score.
- **Wildlife Foods and Concepts (30 points maximum):** The total number of correct responses is added together for this score.
- **On Site Recommendation of Wildlife Management Practices (100 points maximum)**

  Participants are given credit for:
  • putting an "X" in the appropriate boxes; and
  • leaving boxes blank where no "X" is indicated on the wildlife management practice chart.

  Answers will be incorrect if:
  • boxes that should be marked are left blank; and
  • boxes that should not be marked are marked.

Tie breaker: In case of a tie, the individual with the highest score in Wildlife Identification will be declared the winner. If a tie remains, the individual with the highest score in Wildlife Foods and Concepts will be declared the winner. If a tie remains, the individual with the highest score in Wildlife Management Practices will be declared the winner. If the tie cannot be broken, a coin toss will be used to determine the winner.

Team Achievement

Senior teams with the highest overall score are recognized. First, second, third, fourth, and fifth places will be awarded. The team score will be the sum of the three individual scores on the team, plus the team score for Wildlife Management Plan and three scores for Oral Defense. If a team has a fourth member, the lowest individual score for each event (i.e., Wildlife Identification, Wildlife Foods and Concepts, Interpreting Wildlife Habitat from Satellite Images, Wildlife Management Practices, Oral Reasons) will be dropped.

- **Wildlife Management Plan (250 points maximum):** One or more judges will use a scorecard to judge a team's wildlife management plan. The scores of the judges will be averaged to determine the team score for the plan.

- **Oral Defense (50 maximum individual points; 150 maximum team points):** One or more judges will use a scorecard to judge an individual's defense of the wildlife management plan. The scores of the judges will be averaged to determine the individual's score for the oral defense. The scorecard is 100 points maximum, therefore the contestant's score will be divided by 2 to convert the score to a 50-point scale. For teams with four contestants, the lowest individual score will be dropped when tabulating the team score.

Tie breaker: In case of a tie, the team with the highest score for the Wildlife Management Plan will be declared the winner. If a tie remains, the team with the highest accumulative individual

scores in Wildlife Identification will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Wildlife Foods and Concepts will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Wildlife Practices will be declared the winner. If the tie cannot be broken, a coin toss will be used to determine the winner.

Example of Computations for Senior Individual and Team Scores

4-H WHEP Team	Scores (maximum score)							
	Individual					Team		
	Wildlife ID	Foods & Concepts	On Site Practices	Individual Score		Oral Reasons	Written Plan	Team Score
	(60 max)	(30 max)	(100 max)	(190 max)		(50 max)	(250 max)	(300 max)
John Doe	42*	22	75*	139		40*	189	-
Jane Doe	34*	27*	67*	128		27*	-	-
Janie Rainy	32*	30*	82*	144		35*	-	-
J. B. Goode	31	23*	57	111		15	-	-
Team score	108	80	224	-		102	189	703
TOTAL	(180 max)	(90 max)	(300 max)			(150 max)		(970 max)

*The highest individual scores for Wildlife ID, Foods & Concepts, On-Site Practices, and Oral Reasons are added together for the team score. For teams with four members, the score for the lowest scoring individual in each event is dropped.

Photo/Illustration acknowledgments

Figure 1. Becky McPeake, University of Arkansas
Figure 2. WHEP national handbook, www.whep.org
Figure 3. WHEP national handbook, www.whep.org
Figure 4. WHEP national handbook, www.whep.org
Figure 5. WHEP national handbook, www.whep.org
Figure 6. WHEP national handbook, www.whep.org
Figure 7. Craig Harper, University of Tennessee.
Figure 8. USDA Forest Service, 2008
Figure 9. Becky McPeake, University of Arkansas
Figure 10. Brian Lockhart, USDA Forest Service, Bugwood.org
Figure 11. Vern Wilkins, Indiana University, Bugwood.org
Figure 12. Dwayne Elmore, Oklahoma State University.
Figure 13. Dwayne Elmore, Oklahoma State University.
Figure 14. John Gruchy, Mississippi Department of Wildlife, Fisheries and Parks.
Figure 15. Craig Harper, University of Tennessee.
Figure 16. Mike Hansbrough, NRCS - Tennessee
Figure 17. Craig Harper, University of Tennessee.
Figure 18. Craig Harper, University of Tennessee.
Figure 19. Craig Harper, University of Tennessee.
Figure 20. Dwayne Elmore, Oklahoma State University.
Figure 21. Dwayne Elmore, Oklahoma State University.
Figure 22. Dwayne Elmore, Oklahoma State University.
Figure 23. Dwayne Elmore, Oklahoma State University.
Figure 24. Craig Harper, University of Tennessee.
Figure 25. Craig Harper, University of Tennessee.
Figure 26. Craig Harper, University of Tennessee.
Figure 27. Craig Harper, University of Tennessee.
Figure 28. Craig Harper, University of Tennessee.
Figure 29. Craig Harper, University of Tennessee.

Ecoregions

Areas of Arkansas can be roughly separated into ecoregions having similar climate, vegetation and wildlife. An **ecoregion** is a geographical unit with characteristic plants, animals, and ecosystems. The state can be divided broadly into three ecoregions: Eastern Deciduous Forest, Southeast Mixed Forest and Outer Coastal Plain, and Mississippi Alluvial Plain. Within these broad ecoregions, there are also other smaller ecoregions which can be found statewide: Tallgrass/Mixed Prairie, Wetlands and Urban.

Each year, one of these six ecoregions is selected for the state contest. In addition, the Urban ecoregion is included in the Wildlife Identification event each year. If the Urban ecoregion is selected, another one of the remaining ecoregions will be announced for addition to the Wildlife Identification event.

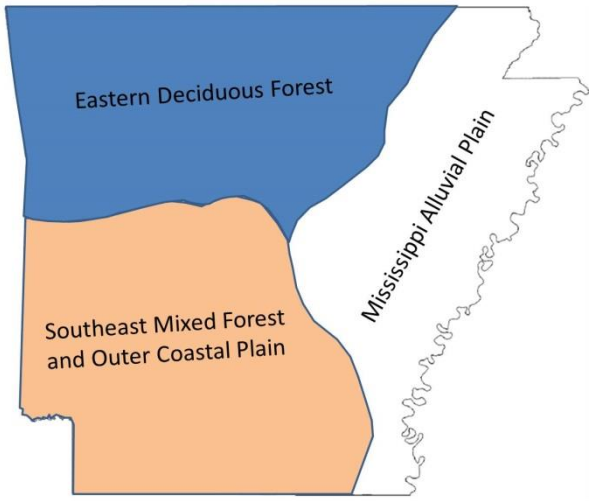


Figure 1. Location of major ecoregions in Arkansas.

At the end of each ecoregion description is a list of wildlife species. These species are eligible for testing at the Arkansas WHEP state contest, and the focus of your studies and preparation for the contest year.

Certain species listed are considered a nuisance in some areas and circumstances. (In the Management Practices section, potential nuisance species can identified by the application of "Wildlife Damage Management" practices.) Contest organizers may exclude such species or center the management practices on why the species are pests and what can be done to decrease problems.

List of Arkansas Ecoregions

Divisional ecoregions:

- Eastern Deciduous Forest
- Mississippi Alluvial Plain
- Southeast Mixed Forest and Outer Coastal Plain

Statewide ecoregions:

- Tallgrass/Mixed Prairie
- Urban
- Wetlands

Southeast Mixed Forest and Outer Coastal Plain

Physical description

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

Dominant vegetation

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

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

Farming and ranching

Many wetlands along major rivers have been drained and forests cleared to grow crops such as cotton, rice, soybeans, corn, and other grain crops.

Large areas of forests have also been cleared and planted to nonnative grasses, especially bermudagrass and bahiagrass, for livestock. Unfortunately, most of these are not beneficial for wildlife.

Figure 12. Planted pines, especially loblolly, are common across the Southeast. Early successional vegetation is provided for a few years until the canopy of the pines closes.

Figure 13. Mature pine stands, especially longleaf, are best managed by thinning to a predetermined basal area, which allows better tree growth and a diverse understory. Prescribed fire is used to manage the composition and structure of the understory.

Plant succession

Figure 14. Annual forbs and grasses represent the initial successional stage. Here, a strip was disked in a field dominated by perennial native warm-season grasses to enhance brooding cover for northern bobwhite. Note the common ragweed and bare ground in the disked strip (center) as compared to the relatively dense native grass on the right.

Figure 15. Perennial forbs and grasses represent the **second successional stage**.

Figure 16. The second successional stage slowly gives way to the third. Here, broomsedge bluestem, blackberry, and various forbs are succeeding to sweetgum, red maple, and eastern redcedar. This transition provides excellent habitat for northern bobwhite, loggerhead shrike, and eastern cottontail.

Various shrubs (such as wild plum) and trees (such as eastern redcedar, sweetgum, and winged elm) represent the **third successional stage** (no photo available). Planted loblolly pine stands often represent a third successional stage.

Figures 17 and 18. These pictures show the same loblolly pine stand 4 years after planting and 8 years after planting. Although it is the same loblolly pine stand, the wildlife species found in this stand 4 years apart are quite different because the structure of the stand has changed dramatically.

Figure 19. Mixed hardwood forest dominated by various oaks, hickories, maples, and sweetgum represent the **fourth successional stage**. Loblolly and shortleaf pine are often a component in these forests. Unmanaged forests often lack a developed understory, such as seen in this picture.

Wildlife associated with Southeast Mixed Forest and Outer Coastal Plain

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

Wildlife Identification

Objectives
Contestants will be able to identify wildlife species present in Arkansas based on visual, auditory and behavioral cues, and descriptions. The ability to identify these wildlife species and understanding their life histories will provide a basis for other contest activities.

Overview
Each team member will answer questions about wildlife found in the announced contest regions. Two regions will be wildlife species from the Urban and Wetlands ecoregions. The other ecoregion with associated species will be announced prior to the contest. All wildlife to be identified in this activity will be taken from the official species list.

This activity will focus on the contestant's ability to identify wildlife species. This includes identification from pictures, artifacts, replicas, or other representations as found in a natural outdoor condition. Wildlife identification can also include questions about life history and behavior that lead to identification. This information can be found in wildlife guides and references from libraries, bookstores and the Internet.

Wildlife species listed under the Urban and Wetlands ecoregions and from one other announced region will be eligible for this event. Minimally, contestants should be able to:

- Identify mammals by fur, skulls, vocalizations, tracks or other sign, such as a beaver's chewed log or a buck's rubbed tree.
- Identify birds by plumage, nests, eggs, tracks and birdsongs.
- Identify the male, female, juvenile and adult of a species.
- Know the unique life histories and behaviors of these wildlife species.

These items will be displayed on tables with corresponding numbers. Contestants are not allowed to touch items on the table unless directed to do so, such as for pressing a button on a device to hear a vocalization for identification.

Contest Rules

1. Each contestant needs to bring pencils and a clean clipboard. The clipboard may be labeled for identification purposes, but no other writing or other marks are allowed on the clipboard.
2. Junior and Senior contestants will complete the scorecard individually. This is not a team event, and thus, no talking or cheating is allowed.
   Cloverbuds – This is a non-competitive activity for Cloverbuds. Cloverbuds can complete the scorecard individually, or with assistance from an adult or teen leader. Talking is allowed.
3. Contestants are required to identify wildlife species from the official species list from the announced ecoregion, plus species listed in Urban and Wetland ecoregions.
4. A list of wildlife species with a corresponding letter or number will be provided. The corresponding letter or number of the species must be placed on the scorecard to receive credit.
5. The same species may be selected more than once for identification. For example, both an antler and track of a white-tailed deer may appear on the contest.
6. Junior and Senior contestants will have 30 minutes to identify about 30 items and record information on the scorecard.

Wildlife Species Descriptions

This chapter contains information on species featured in each ecoregion. Species are listed in alphabetically. 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 Wildlife Management Practices 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. Some recommended websites are:

All About Birds, The Cornell Lab of Ornithology (www.allaboutbirds.org)
Herps of Arkansas, Arkansas Herpetological Society (www.herpsofarkansas.com)
North American Mammals, Smithsonian Institution (http://www.mnh.si.edu/mna/)
Animal Diversity Web, University of Michigan (http://animaldiversity.ummz.umich.edu/)
Publications on Arkansas species & topics (search term "wildlife"), University of Arkansas (http://www.uaex.edu/publications/default.aspx)

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

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

Range map key

Barred owl

General information

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

Habitat requirements

***Diet*:** primarily small mammals, birds, amphibians, reptiles, fish, and invertebrates.

***Water*:** requirements largely unknown. They likely obtain their water needs from the foods they consume.

***Cover*:** mature forests with an abundance of relatively large trees and cavities, often near water

Wildlife management practices

Control Nonnative Invasive Vegetation: where Nonnative invasive vegetation is competing with native vegetation and reducing habitat quality ***Create Snags***: where cavities are lacking for adequate reproduction

Forest Management: shelterwood harvests can result in a more open, park-like forest resulting in a more open understory to favor prey habitat.

Livestock Management: livestock should be excluded from forests to maintain understory for prey

Nesting Structures: can be added to forests lacking trees with large cavities.

Plant Trees: in large open areas to create future habitat

Set-back Succession: low-intensity prescribed fire can be used in forests and woodlands to enhance cover for prey.

Wildlife Damage Management: barred owls can prey upon small pets and domestic poultry. Exclusion practices should be used to discourage damage.

Wildlife or Fish Survey: call counts are used to index populations

Bluegill

General information

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

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 four parts per million); pH between 6.5 and 9.0; and water temperature should reach at least 70 F during summer (one foot below surface in the shade)

Cover: submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed if none are present so water depth can be controlled

Decrease Harvest: refer to wildlife management practices for specifics on fish harvest

Increase Harvest: refer to wildlife management practices for specifics on fish harvest

Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey bluegill populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

Control Aquatic Vegetation: when necessary to discourage rooted aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Channel catfish

General information

Texas Parks and Wildlife

Channel catfish are warmwater fish native to the Gulf coast states and the Mississippi River valley, but they have been introduced to most regions of the United States. They have smooth skin (no scales), a deeply forked tail, and sharp dorsal (top) and pectoral (side) fins that can inflict a nasty cut if the fish is handled improperly. They also have barbels (often called "whiskers") around the mouth. Coloration depends largely on water clarity— they are drab green to blue on the back, shading to white on the belly, but they can appear almost black in clear waters, and yellowish in muddy waters. Young channel catfish have irregular spots on their sides that disappear as they mature. Channel catfish average 2 – 3 pounds, but may grow to 50 pounds. In the presence of largemouth bass and bluegill, predation is heavy upon the catfish eggs and young (called fry). In small impoundments managed for multiple fish species, stocking fingerling channel catfish is the best way to maintain a population. Channel catfish is the most widely cultured (farmed) warm water fish species in the United States. Each year, several hundred million pounds are raised and harvested as food in grocery stores and restaurants. It is also widely sought by anglers on public and private waters for its recreational value as well as its fantastic flavor.

Habitat requirements

Diet: young catfish feed mostly on aquatic insects; adults eat crawfish, aquatic insects, plant material including algae, snails, small fish, and even seeds; commercially prepared rations have been formulated and are used to feed channel catfish in aquaculture (fish farming) operations as well as in farm ponds and other impoundments

Water: obtained from their aquatic environment and food; reservoirs, lakes and ponds; moderately to swift-flowing streams and rivers with gravel, sand, or muddy bottoms; seldom inhabits water with abundant submerged aquatic vegetation

Cover: females typically lay eggs in dark holes or under logs or rocks

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond.

Repair Spillway/Levee: if not functioning properly.

Water Control Structures: should be installed if none are present so water depth can be controlled.

Decrease Harvest: As angler catch rates of channel catfish decline, impoundments are usually restocked with additional fingerlings (rather than reduce harvest) in order to maintain angling opportunities.

Increase Harvest: Increase channel catfish harvest when angler-caught catfish are extremely thin (underweight), which is indicative of a population exceeding carrying capacity of the impoundment. Also, increase harvest whenever the total weight of channel catfish nears or exceeds 1,000 pounds per surface acre during the summer months.
Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey channel catfish 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 too few are present; channel catfish seldom spawn successfully in the presence of largemouth bass and bluegill because of predation upon eggs and fry; therefore periodic restocking is required when channel catfish numbers drop below desired levels.

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) are usually represented in coyote stomachs as carrion; in some cases, coyotes prey heavily on deer fawns, and can limit reproductive success in some limited situations

Water: requirements are not well documented; necessary water is probably obtained in diet

Cover: grasslands, shrublands, regenerating forest, mature forest; crevices and burrows along river banks, rock ledges, brushpiles, and holes under stumps or abandoned buildings are used as den sites for raising pups

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation reduces habitat quality for coyotes or prey species

Edge Feathering: to increase cover and food availability for prey species around fields

Field Borders: to increase usable space for prey species around fields

Forest Management: *Forest Regeneration* (*Clearcutting*, *Shelterwood*, *Seed-tree*, *Group Selection*) and *Timber Stand Improvement* can improve habitat for prey and lead to more abundant prey

Livestock Management: should maintain adequate cover for prey species

Plant Native Grasses and Forbs: where additional early successional cover is needed for prey and planting is necessary

Plant Shrubs: in areas where additional shrub cover is needed to attract prey and provide security cover for coyotes

Set-back Succession: *Prescribed Fire*, *Disking*, *Chaining*, and *Herbicide Applications* are recommended to maintain herbaceous openings; *Prescribed Fire* can be used to enhance forest understory structure and composition; *Chainsawing* can be used to create additional forest openings where necessary

Decrease Harvest: where hunting or trapping has limited population and additional coyotes are desired

Increase Harvest: through hunting or trapping where populations need to be lowered

Wildlife Damage Management: may be necessary where livestock or pet depredation is a problem

Wildlife or Fish Survey: track counts and camera surveys are used to estimate population trends

Eastern cottontail

General information

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

Habitat requirements

***Diet*:** forbs and grasses, browse, and soft mast from spring through fall; in winter, bark of shrubs and trees, as well as buds, grain, and browse

***Water*:** necessary water obtained from diet

***Cover*:** shrub cover, brushpiles, native warm-season grasses and forbs for loafing and escape cover; burrows are also used for denning and escape

Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and limiting habitat for cottontails

Edge Feathering: to increase usable space around fields

Field Borders: to increase usable space around fields

Forest Management: *Forest Regeneration* (*Clearcut*), provides optimal brushy cover for a few years

Leave Crop Unharvested: to provide additional food and cover, especially corn, alfalfa, and wheat

Livestock Management: should exclude livestock from food plots and prevent overgrazing to allow sufficient herbaceous vegetation for nesting, cover, and forage

Plant Food Plots: where additional forage or grain is needed; best situated adjacent to dense brushy cover

Plant Native Grasses and Forbs: where early successional cover is limiting and planting is required to promote additional grasses and forbs

Plant Shrubs: in relatively large openings with few shrubs; field borders, fence rows, and other idle land areas are good places to plant

Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* are recommended to maintain herbaceous openings, especially when litter accumulation or woody encroachment is excessive; *Chaining*, *Prescribed Fire*, and *Herbicide Applications* can be used to rejuvenate shrublands, especially where herbaceous groundcover is shaded out; in areas dominated by mesquite, *Chainsawing* and *Root-plowing* can be used to convert forest cover to early successional communities.

Tillage Management: cropland tillage may be delayed in spring to allow use of standing stubble for cover; tillage may be eliminated in the fall to allow access to waste grain.

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

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

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

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

Eastern fox squirrel

General information

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

Habitat requirements

***Diet*:** a variety of hard mast, acorns, seeds, tree buds and flowers, mushrooms, soft mast, eggs, and corn

***Water*:** necessary water is generally obtained through diet, but free-standing water may be needed in late summer

Cover: mature hardwood and pine forest, woodland, and savannas; nest in tree cavities or build a nest of twigs and leaves

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for eastern fox squirrels; kudzu, nonnative sod grasses, cogongrass, bush honeysuckles, Japanese stiltgrass may be particularly problematic in some areas.

Edge Feathering: can enhance forest structure and increase food availability in forest surrounding fields.

Forest Management: *Forest Regeneration* (*Single-tree Selection*, *Group Selection*) may improve forest or woodland structure and increase food availability; *Timber Stand Improvement* can encourage larger crowns of mast-producing trees and enable oaks, hickories, beech, and others to produce more mast; can also increase soft mast availability and provide snags for potential den sites.

Leave Crop Unharvested: (corn fields) so squirrels can glean waste grain from the field; especially important during years of poor mast production.

Livestock Management: should prevent overgrazing, especially in savannas and woodlands where grazing is allowed; livestock should be excluded from riparian areas, especially in open landscapes where tree cover is limited to riparian areas.

Plant Food Plots: grain food plots, especially corn, can provide an important food source, during winters with poor mast availability.

Plant Trees: in large open areas where tree cover is limiting.

Set-back Succession: *Prescribed Fire* is required to maintain savannas and woodlands; *Prescribed Fire* and *Disking* are used to maintain relatively small early successional openings; *Herbicide Applications* can be used to reduce unwanted tree cover or woody encroachment.

Tillage Management: eliminate tilling corn fields in the fall to provide additional food.

Water Developments for Wildlife: in urban areas, a pool or pan of water may be used if water is not available.

Decrease Harvest: may be necessary when additional fox squirrels are desired and hunting pressure is limiting growth.

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

Wildlife Damage Management: exclusion from buildings, trapping, or shooting may be necessary if damage is occurring.

Wildlife or Fish Survey: observational surveys are most often used to estimate population trends.

Largemouth bass

General information

Largemouth bass are not really bass but members of the Sunfish family. Largemouth bass are the most popular freshwater sportfish in states where they are found. They can be found in freshwater lakes, rivers, large streams, farm ponds, and brackish marshes.

Habitat requirements

Diet: young bass eat insects and other invertebrates (worms, crayfish and zooplankton); adults eat small fish, such as bluegill, and a variety of minnows, as well as tadpoles, crayfish, and even ducklings

Cover: submerged rocks, woody debris and near aquatic vegetation where small fish (prey) hide

Water: basic requirements include dissolved oxygen (minimum of four parts per million); pH should range between 6.5 and 9.0; water temperature should reach at least 70 F during summer (one foot below surface in shade)

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be installed if none are present so water depth can be controlled

Decrease Harvest: refer to wildlife management practices for specifics on fish harvest

Increase Harvest: refer to wildlife management practices for specifics on fish harvest

Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey largemouth bass populations

Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam

Control Aquatic Vegetation: when necessary to discourage rooted aquatic vegetation

Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm

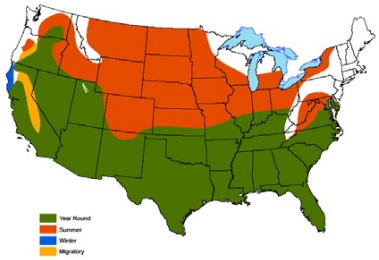
Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles

Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present

Loggerhead shrike

General information

The loggerhead shrike is a migratory bird of prey that requires relatively large openings or fields to hunt prey. Some shrikes remain in the southern tier of the U.S. all year, whereas others migrate from as far south as northern Mexico to southern Canada to breed.



The loggerhead shrike population is declining because of habitat degradation and loss from conversion of grasslands and shrublands to row-crop agriculture or overgrazed, nonnative grass pastures, and aesthetic mowing. The most important vegetation component is nesting cover (dense, thorny shrubs and trees). Areas with herbaceous vegetation and some bare ground are also critical for hunting prey. Shrikes will readily build nests and perch in shrubby areas less than 16 feet tall, but prefer taller trees where available. Scattered, thorny tree and shrub species, such as honey locust, are selected over non-thorny species. Taller trees are selected for perching during courtship displays and while hunting. Loggerhead shrikes uniquely utilize thorns, barbs, and barbed wire fences to impale prey.

Habitat requirements

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

Wildlife management practices

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

Mourning dove

General information

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

Habitat requirements

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

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to compete with native vegetation and reduce habitat quality for mourning dove; sod grasses, such as tall fescue and bermudagrass, are particularly problematic because they have no food value and their structure at ground level limits mobility of ground-feeding doves and their ability to search for seed
Delay Crop Harvest: (in some ecoregions) in spring to avoid nest destruction
Leave Crop Unharvested: for a variety of small grain crops, such as wheat, millets, grain sorghum, corn, and oats, to provide additional food resource
Livestock Management: should prevent overgrazing, which can eliminate preferred forbs that produce seed for mourning dove; in some cases, livestock can be used to reduce vegetation height and increase bare ground; livestock should be excluded from food plots
Plant Food Plots: grain plots may be planting in areas where food is lacking and to facilitate recreational hunting
Plant Native Grasses and Forbs: where food may be limiting, especially to increase some of the many native forbs that are extremely important sources of seed for mourning dove
Plant Shrubs: (in some ecoregions) to provide nesting, roosting, and loafing sites in areas where shrub/tree cover is limiting
Plant Trees: (in some ecoregions) to provide nesting, roosting, and loafing sites in areas where shrub/tree cover is limiting
Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Disking*, *Prescribed Fire*, and *Herbicide Applications* can be used to maintain annual forbs and grasses and provide bare ground; *Chaining*, *Drum-chopping*, *Root Plowing*, *Herbicide Applications*, and *Prescribed Fire* may be used to reduce shrub cover; *Chainsawing* and *Root Plowing* may be used to remove trees and clear forests and promote early successional plant communities
Tillage Management: tillage may be eliminated in the fall to allow wildlife access to waste grain; tillage may be delayed in spring (in some ecoregions) to allow nesting in standing stubble (especially wheat)

Water Control Structures: should be installed if none are present in existing dams or levees to allow water level manipulation
Water Developments for Wildlife: where water is limiting, small ponds, shallow impoundments, guzzlers, and windmills may be created or installed to provide free-standing water
Wildlife or Fish Survey: point counts and observation counts are commonly conducted to estimate trends in populations

Northern bobwhite

General information

The northern bobwhite is a stocky game bird about 6 inches tall. They are considered shrubland obligates, which means they depend on low-growing shrubby cover, but also use grasslands, fallow fields, and savannas and woodlands with well-developed groundcover for foraging, nesting, brooding, and loafing. Ideally, bobwhite habitat is composed of scattered patches of shrubby cover well interspersed with native grasses, forbs, and bare ground. Nests are on the ground, usually made of dead grass leaves, and often located at the base of a clump of native warm-season grasses, such as broomsedge and little bluestem. A typical clutch is about 12 eggs. Both the male and female may incubate nests, with nesting primarily occurring May through August.

Early successional areas dominated by forbs, such as ragweeds, are commonly used for brooding. Northern bobwhites eat a wide variety of seeds, leaves, and insects. Bobwhite chicks primarily eat insects during the first 6-8 weeks of life. Some agricultural crops can provide seasonal food for bobwhites, but they are not a substitute for diverse native plant communities. Northern bobwhite populations have been declining precipitously for more than 40 years. Habitat loss and degradation is the primary reason for the decline.

Habitat requirements

Diet: young quail eat insects and other invertebrates (such as spiders); adult quail eat a variety of seeds (especially legumes, ragweed, crotons, lespedeza, etc.), green vegetation (mostly forbs), invertebrates, various crops (corn, soybeans, wheat, millets, grain sorghum), and mast (such as acorns and blackberries)

Water: necessary water is obtained through the diet

Cover: shrub cover for escape and thermoregulation throughout the year; perennial native grasses for nesting; native forbs for brood rearing

Wildlife management practices

Conservation Easement: can protect critical habitat for this declining species in some ecoregions.

Control Nonnative Invasive Vegetation: nonnative sod grasses, such as tall fescue and bermudagrass, are especially problematic as they limit bobwhite mobility and provide poor cover and structure; there are many other nonnative invasive species that can degrade habitat quality for northern bobwhite across their range.

Edge Feathering: to increase usable space and increase escape cover around row-crop fields

Field Borders: to increase usable space around row-crop fields.

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

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

Livestock Management: grazing pressure should be managed so sufficient groundcover remains for nesting and brood rearing; grazing management should discourage a uniform structure of plants across the landscape; cattle grazing in combination with prescribed fire can mimic historic natural disturbance

events; grazing management should maintain dense shrub cover in some areas; up to one-third of an area can be grazed more intensively to encourage annual forb production for brood rearing cover, assuming the same areas are not repeatedly grazed the same way; livestock should be excluded from food plots.

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

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

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

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

Tillage Management: eliminate fall tillage to provide waste grain

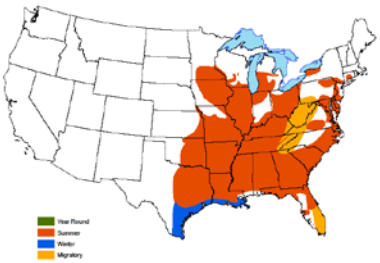
Decrease Harvest: may be necessary if populations are declining in areas of good habitat and where hunting pressure has been excessive.

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

Prothonotary warbler

General information

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



Habitat requirements

Diet: insects, especially ants, beetles, butterflies, moths, mayflies, aquatic larvae; snails and isopods; occasionally various seeds and fruits

***Water*:** necessary water is obtained through the diet

Cover: mature bottomland hardwood forests; cypress swamps; dead standing timber help ensure presence of cavities

Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and reducing habitat quality for prothonotary warblers

Create Snags: where natural cavities are limiting to provide possible cavity sites

Forest Management: *Timber Stand Improvement* can stimulate vertical structure where absent

Livestock Management: should exclude livestock from bottomland hardwoods

Nesting Structures: nest boxes are readily used and will provide suitable nesting cover where natural cavities are limiting

Plant Trees: in large bottomland fields where forest cover is lacking and natural regeneration is not sufficient or of desirable composition

Repair Spillway/Levee: if not functioning properly

Water Control Structures: should be used to manipulate water levels in wetlands

Water Developments for Wildlife: shallow impoundments can be established in bottomland hardwoods for habitat enhancement

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

Raccoon

General information

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

Habitat requirements

***Diet*:** crayfish, birds, eggs, small mammals, insects, lizards, snakes, worms, fish, carrion, grains, seeds, hard and soft mast, and foods prepared for human and pet consumption

***Water*:** require water frequently during warm seasons

***Cover*:** riparian areas, bottomland hardwoods, and along other wetlands; natural tree cavities are used for denning and daytime loafing; raccoons also den in ground burrows under stumps, brush piles, junk piles, old abandoned buildings, and rocky cliffs and ledges

Wildlife management practices

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

Create Snags: where denning sites are limited

Edge Feathering: to increase usable space for prey around fields

Field Borders: to increase usable space for prey around fields

Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*, *Single-tree Selection*) and *Timber Stand Improvement* can stimulate soft mast production and cover for prey

Leave Crop Unharvested: especially cornfields adjacent to bottomland hardwoods and riparian areas

Livestock Management: livestock should be excluded from riparian areas and other wetlands; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas

Plant Food Plots: annual grain food plots, especially corn, may be planted where food is limiting and where an increase in raccoon population is desired (this situation is exceptionally rare)

Plant Shrubs: where soft mast is lacking and to provide corridors across large open areas

Plant Trees: in riparian areas and adjacent to wetlands where few trees are present to maintain riparian corridors; maintain approximately 50 percent deciduous forest cover; also in large open areas where there are few trees

Repair Spillway/Levee: if not functioning properly.

Set-back Succession: *Prescribed Fire* is recommended to rejuvenate old decadent wetland vegetation; *Prescribed Fire* and *Disking* can maintain herbaceous openings; *Prescribed Fire*, *Herbicide Applications*, *Chaining*, and *Root-plowing* are recommended to rejuvenate decadent shrub cover.

Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source.

Water Control Structures: to control water levels and provide water less than 2 feet deep and stimulate emergent vegetation and enhance habitat for prey.

Water Developments for Wildlife: shallow impoundments can provide a water source and additional

habitat for various prey species.
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired (this situation is rare)
Increase Harvest: where populations can sustain additional hunting or trapping pressure for recreation and where populations need to be lowered for various reasons
Wildlife Damage Management: is often necessary when raccoons get into garbage cans, occupy residences or buildings, or prey upon poultry; exclusion is cost-effective; cultural modification, such as using wildlife-proof trash cans, is effective; trap and euthanize is most effective for problem raccoons.
Wildlife or Fish Survey: track counts and camera surveys may be used to monitor population trends.

Red-cockaded woodpecker

General information

The red-cockaded woodpecker is about 7 to 8 inches in length and lives in mature pine forests across the South. (Wildlife biologists often refer to them as "RCWs".) Historically, red-cockaded woodpeckers ranged from east Texas to Florida and northward to Missouri, Kentucky, and Maryland, but its range has been sharply reduced because of fire suppression and hardwood encroachment. The species was federally listed as an endangered species in 1970.

Red-cockaded woodpeckers can be distinguished from hairy woodpeckers by their white cheek patch. Males have a few red feathers or "cockade" on their head, which usually remain hidden unless the male is disturbed or agitated.

Red-cockaded woodpeckers have an unusual social organization. They live in a group called a clan. Each clan typically contains 2 to 9 birds, but there is never more than one pair of breeding birds. Some clans have non- breeding birds called helpers, which generally consist of male offspring 1 to 3 years of age that help incubate eggs, feed young, make new cavities, and defend the clan's territory against other red-cockaded woodpeckers. A clan nests and roosts in a group of as many as 20 cavity trees (called a cluster).

Red-cockaded woodpeckers have very specific habitat requirements. Cavity trees are live pine trees, rarely less than 30 to 40 years old and are often more than 70 years old. Older pines inflicted with red-heart fungal disease makes it easier for red-cockaded woodpeckers to excavate cavities.

Habitat requirements

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

Wildlife management practices

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

necessary where hardwoods have become too large to effectively reduce with fire; *Chainsawing*, *Herbicide Applications*, and *Root Raking* and may be used to clear sites and prepare for planting longleaf or shortleaf pine

Wildlife or Fish Survey: observational counts and cluster monitoring are used to monitor red-cockaded woodpeckers

Red-eyed vireo

General information

The red-eyed vireo is a common migratory songbird found in mature deciduous forests throughout eastern North America and the upper Midwest. They are also found in forested urban parks. They are more often heard than seen, with their persistent song that sounds like they are saying “where-are-you, here-I-am, over-here.”

Red- eyed vireos have olive-green backs with a pale breast and dark red eyes. Red-eyed vireos usually forage in the middle to upper layer of the forest canopy, but often nest in the understory or midstory. The nest is made of twigs, bark, and grasses, usually in an open cup shape and suspended from a branch. They eat insects and fruits.

Habitat requirements

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

Wildlife management practices

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

White-tailed deer

General information

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

Habitat requirements

Diet: forbs, browse, acorns, beechnuts, grains, grasses, and mushrooms; in the northern parts of the range, coniferous browse is important in winter

Water: obtain most of their water from diet, but will drink free-standing water when available

Cover: dense woody vegetation as well as relatively tall early successional cover, including native grasses, forbs, and shrubs

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for white-tailed deer; sod grasses and sericea lespedeza can be particularly problematic in fields and Japanese stiltgrass often reduces forage availability in forests; although white-tailed deer may eat many nonnative invasive plants in some seasons to some extent, control of many of those plants, such as kudzu, Japanese honeysuckle, and Chinese privet, can lead to increased plant species diversity and increased forage quality during various seasons

Edge Feathering: to increase forage availability around fields and enhance fawning cover

Field Borders: to increase forage availability (forbs and brambles) around crop fields

Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Seed-tree*, *Group Selection*) will provide increased browse, soft mast production, and dense escape cover; *Timber Stand Improvement* can provide increased browse and soft mast production and stimulate better cover in stands with a poorly developed understory

Leave Crop Unharvested: to provide additional food resource, especially near escape cover ***Livestock Management***: livestock should be excluded from forests managed for deer to avoid destruction of the forest understory; livestock should be excluded from riparian areas, especially in the Great Plains Grassland Ecoegion; should prevent overgrazing in woodlands and savannas

Plant Food Plots: when naturally occurring food sources are limited, food plots may provide additional nutrition, particularly in late summer and winter of most ecoregions

Plant Native Grasses and Forbs: where early successional cover is limiting and planting is necessary for establishment

Plant Shrubs: where needed to provide additional soft mast, brushy cover, and browse; ravines, field borders, other idle land areas and across large open areas to provide travel corridors

Plant Trees: in large open areas to maintain at least 30 to 40 percent forest cover; where mast producers are lacking, particularly oaks

Set-back Succession: *Prescribed Fire* and *Disking* is recommended to maintain herbaceous openings; *Prescribed Fire* is recommended to stimulate the forest understory for increased forage and soft mast; *Chaining* can be used to rejuvenate shrub cover; in areas dominated by mesquite, *Root-plowing* combined with seeding grasses and legumes may be the best way to increase herbaceous groundcover; *Chainsawing* and *Root-plowing* when converting forest to early successional cover to increase forage and enhance fawning cover

Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source

Water Developments for Wildlife: where lacking (within one-half mile), dugouts, ponds, and shallow impoundments can provide free-standing water

Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired

Increase Harvest: when populations can sustain additional harvest pressure for hunting recreation and when populations need to be lowered because of overpopulation and habitat degradation; in these cases, it is necessary to concentrate increased harvest on females

Wildlife Damage Management Techniques: fencing, repellents, and scare tactics may be helpful to keep deer from ornamental plantings, vegetable gardens, and crops; reducing the population through shooting is recommended when widespread overabundance is causing crop depredation and increasing vehicle collisions

Wildlife or Fish Survey: camera surveys, browse surveys, and hunter observation and harvest data are used to estimate population trends

Wild pig

General information

Wild pigs (feral hogs, wild boars, razorbacks) were first introduced into what is now the United States at Tampa Bay, Florida by the explorer Hernando de Soto in 1539. In addition, early settlers throughout the southeastern United States also raised domesticated swine, some of which escaped and became feral, leading to their establishment throughout the South and California. Today, 36 states have wild pig populations estimated between 5 and 8 million nationwide. Many of these populations became established because of indiscriminant and illegal stockings for hunting purposes.

As an invasive nonnative species, wild pigs cause ecological damage via their rooting behavior and competition for food and space with a number of native wildlife species and predate upon many small amphibian and reptile species. Wild pigs also cause considerable agricultural damage to crops, pastures, livestock, and environmental damage to riparian areas, often resulting in water quality degradation as a result of their rooting and wallowing behavior.

Habitat requirements

Diet: Wild pigs are perhaps the perfect example of an omnivore; approximately 85 percent of their diet is vegetation, but they also prey upon small animals and often scavenge animal carcasses; they especially prefer crops, such as corn and peanuts, and aggressively out-compete native wildlife species for hard and soft mast whenever those food items are available.

Water: Wild pigs must have access to free- standing water for drinking and thermoregulation.

Cover: Wild pigs seek dense cover, such as heavy understory or thick shrubs and grasslands, near or in riparian areas that reduce opportunity for human contact; pig family groups (called sounders) often use streams, rivers, creeks, and associated wetlands as travel corridors to move as they seek food sources.

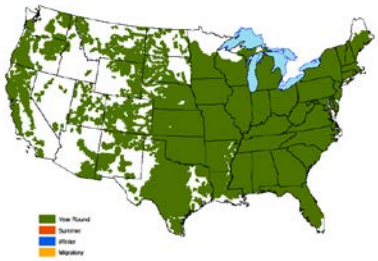
Wildlife management practices

Increase Harvest: the wild pig is an invasive nonnative species that competes with native wildlife for food and in some instances preys directly upon many small vertebrate species, including birds, mammals, reptiles, and amphibians; whenever wild pigs are observed or their sign is documented, control methods, such as trapping, snaring, shooting, and dogging, should be used with an ultimate goal of eradication

Wildlife Damage Management: may be necessary if wild pigs negatively impact crops, forages, or livestock; fencing high-value crops and other areas may be used as a non-lethal method for reducing wild pig damage, but it does not decrease the population

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

Wild turkey



General information

Wild turkeys are large game birds found across the U.S. They are adapted to use a wide variety of vegetation types, from deciduous forest to desert shrub to open grassland interspersed with tree-lined riparian areas. Their distribution is largely limited only by trees or large shrubs needed for roosting at night. Although wild turkeys spend most of their time on the ground, except when the fly up into trees in the evening to roost for the night, they can fly well and often take flight for short distances to escape possible predation.

Breeding occurs in spring when males gobble to attract females. Nests are a slight depression on the ground, usually placed adjacent to a log, shrub, or some other structure to aid in concealment. Shrub cover is often used for nesting, but wild turkeys also nest in open woods and in fields. Nests are lined with leaves and other vegetation and usually contain about 12 eggs. Poults (young turkeys) are precocial, meaning they are able to walk around with the hen and forage for themselves soon after hatching. Herbaceous openings, especially those with a forb canopy and open ground structure, are preferred for brooding. Wild turkeys flock together during fall and winter.

Habitat requirements

***Diet*:** extremely varied; hard mast, especially acorns and beechnuts in the fall and winter; soft mast, such as blackberries, mulberries, and black cherry; insects and other invertebrates, including spiders and snails, are especially important for young poults and hens prior to nesting; miscellaneous seeds; leaves from forbs and grasses; grain from a variety of agricultural crops

***Water*:** obtain water from diet, but may use free-standing water when available

***Cover*:** mature forest, regenerating forest, brushy areas, and old-fields for nesting; mature forest; herbaceous openings; grain fields for foraging; trees or tall shrubs for roosting

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for wild turkeys; common examples include sod-grasses, such as tall fescue, bermudagrass, and others, such as cogongrass, which limit mobility for turkey poults and food availability; kudzu and shrub honeysuckle are other species that often degrade habitat in forested areas

Edge Feathering: can enhance nesting and brooding cover around fields

Field Borders: to increase usable space for nesting and brooding around row crop fields

Forest Management: *Forest Regeneration* (*Clearcut*, *Shelterwood*, *Group Selection*, *Seed-tree*) can enhance nesting and brooding cover and stimulate increased soft mast and miscellaneous seed for a few years after harvest; *Timber Stand Improvement* can improve the structure of the understory for nesting and brood rearing, increase production of soft mast and miscellaneous seed, and enable crowns of desired trees to grow and produce additional mast

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

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

Plant Food Plots: to provide supplemental foods where food may be limiting or increase carrying

capacity where increased wild turkeys is desirable; corn, soybeans, wheat, and clovers are often used
Plant Native Grasses and Forbs: where herbaceous cover is limiting and planting is necessary
Plant Shrubs: where additional soft mast or brushy cover is needed
Plant Trees: where additional hard mast production, especially acorns, is needed and where roosting sites are limited
Set-back Succession: *Prescribed Fire* is recommended to maintain herbaceous openings, rejuvenate shrubland, and improve understory structure and composition for foraging, brooding, and nesting in forests, woodlands, and savannas; *Disking* can be used to maintain herbaceous openings and reduce thatch build-up; *Herbicide Applications*, *Chaining*, *Root Plowing*, and *Drum-chopping* can be used to reduce shrub cover and stimulate more herbaceous groundcover; *Chainsawing* can be used to remove trees and create herbaceous openings, especially where brooding cover may be limiting
Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially when adjacent to tall shrub or forest cover
Water Developments for Wildlife: can be useful when there is little or no free-standing water ***Decrease Harvest***: may be necessary if populations are declining in areas where hunting pressure has been excessive
Increase Harvest: where populations can sustain additional harvest pressure for hunting recreation and where populations need to be lowered
Wildlife Damage Management: may be necessary in rare instances when wild turkeys are depredating crops
Wildlife or Fish Survey: gobble surveys, poult surveys, and hunter success rates are used to estimate population trends

Wood duck

General information

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

Habitat requirements

Diet: acorns are the primary diet item in fall and winter; other hard mast, miscellaneous seeds and soft mast, as well as waste grain (especially corn) also are eaten; insects and other invertebrates are most important for wood duck chicks and hens prior to and during the nesting season

Water: obtained through diet and drink free-standing water regularly

Cover: shallowly flooded bottomland hardwoods, emergent wetlands, swamps, and marshes are commonly used for loafing and foraging cover; tree cavities in forested areas and artificial cavities used for nesting

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for wood ducks; this is applicable in wetlands as well as adjacent uplands where wood ducks may be foraging

Create Snags: where relatively large cavity nesting sites (trees >12 inches in diameter) may be limiting

Forest Management: Forest Regeneration (Shelterwood, Group Selection) in relatively large forested areas that can be flooded will create openings with emergent woody vegetation that will attract foraging and loafing wood ducks; Forest Stand Improvement in bottomland hardwoods that can be flooded can lead to larger crowns of favored trees and increased mast production; woody stem density should increase following FSI and improve cover in stands that can be flooded

Leave Crop Unharvested: especially corn, to provide high-energy food source during fall and winter; this is especially important in fields that can be flooded and those adjacent to a water source used by wood ducks

Livestock Management: should prevent overgrazing in fields that are flooded for wood ducks; livestock should be excluded from bottomland hardwoods and areas where trees and shrubs have been planted

Nesting Structures: nest boxes should be erected where a lack of natural cavities may be limiting the wood duck population; nest boxes for wood ducks should be at least 100 yards apart and should not be placed within sight of each other to prevent dump nesting (if a wood duck hen sees another hen entering

a cavity or nest box, she may be stimulated to enter that cavity and "dump" her own eggs instead of laying in her own nest; thus, heat from incubation is not even over too many eggs and fewer eggs hatch overall)

Plant Food Plots: shallowly flooded grain plots, especially corn, can provide an important source of energy in fall/winter, especially during years of poor mast production

Plant Shrubs: where there is a lack of emergent woody vegetation in open areas that can be flooded

Plant Trees: mast trees planted adjacent to or within open areas suitable for flooding may provide future food and nesting cavities in areas where these trees may be limiting

Repair Spillway/Levee: if not functioning properly

Set-back Succession: *Chainsawing*, *Prescribed Fire*, and *Herbicide Applications* can be used to reduce tree and shrub cover where needed to stimulate more herbaceous cover and provide increase food availability

Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially fields that can be shallowly flooded

Water Control Structures: should be installed in existing dikes if there are none present

Water Developments for Wildlife: shallow impoundments should be created where topography allows, to provide increased feeding and nesting space for wood ducks

Wildlife or Fish Survey: nest box usage rates, brood counts, and flush counts are used to estimate population trends

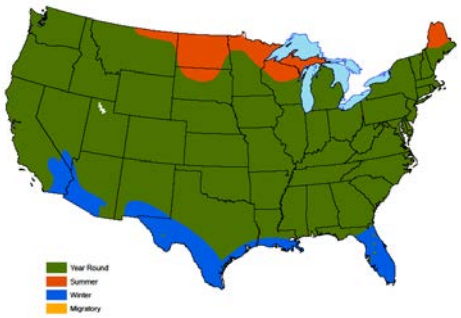
Urban

American robin

General information

American robins use a wide assortment of vegetation types, from mowed grassy areas to forested areas. In urban areas, robins use large open areas and nearby trees and shrubs. Parks, golf courses, and lawns in residential areas are attractive to robins. They are found throughout North America, though they may migrate out of northern latitudes during winters with sustained cold and snow.

Robins build a nest of grass and mud on a tree or shrub limb, but will occasionally nest on building ledges. Robins spend considerable time on the ground feeding on earthworms, but also will perch on branches to eat berries, fruit, and insects.



Habitat requirements

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

Wildlife management practices

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

Big brown bat

General information

Big brown bats are one of 46 bat species in North America. They use a variety of vegetation types, from farmland to mature deciduous forest. Big brown bats are common in urban areas, including cities, parks, and suburban neighborhoods. They frequently use buildings and houses for daytime summer roosts and sometimes as winter hibernacula, but most hibernate in caves.

Big brown bats are insectivores. Lactating females will eat their weight in insects daily. Males and females may roost individually or in small numbers, but males and females usually roost separately. Females may roost together in a maternal colony when pups are born and nursing. Females usually give birth to one or two pups, often in a hollow tree or attic. Big brown bats, as well as all other bat species, are nocturnal and are the only mammals capable of flying. Big brown bats will drink "on-the-wing" by dipping their lower jaw into water. Big brown bats hibernate in the winter in northern latitudes. They do not actively feed during winter months, and rely on stored fat reserves.

Habitat requirements

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

Wildlife management practices

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

Common nighthawk

General information

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

Habitat requirements

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

Wildlife management practices

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

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) are usually represented in coyote stomachs as carrion; in some cases, coyotes prey heavily on deer fawns, and can limit reproductive success in some limited situations
Water: requirements are not well documented; necessary water is probably obtained in diet
Cover: grasslands, shrublands, regenerating forest, mature forest; crevices and burrows along river banks, rock ledges, brushpiles, and holes under stumps or abandoned buildings are used as den sites for raising pups

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation reduces habitat quality for coyotes or prey species
Edge Feathering: to increase cover and food availability for prey species around fields
Field Borders: to increase usable space for prey species around fields
Forest Management: *Forest Regeneration* (*Clearcutting*, *Shelterwood*, *Seed-tree*, *Group Selection*) and *Timber Stand Improvement* can improve habitat for prey and lead to more abundant prey
Livestock Management: should maintain adequate cover for prey species
Plant Native Grasses and Forbs: where additional early successional cover is needed for prey and planting is necessary
Plant Shrubs: in areas where additional shrub cover is needed to attract prey and provide security cover for coyotes
Set-back Succession: *Prescribed Fire*, *Disking*, *Chaining*, and *Herbicide Applications* are recommended to maintain herbaceous openings; *Prescribed Fire* can be used to enhance forest understory structure and composition; *Chainsawing* can be used to create additional forest openings where necessary

Decrease Harvest: where hunting or trapping has limited population and additional coyotes are desired
Increase Harvest: through hunting or trapping where populations need to be lowered
Wildlife Damage Management: may be necessary where livestock or pet depredation is a problem
Wildlife or Fish Survey: track counts and camera surveys are used to estimate population trends

Eastern bluebird

General information

Eastern bluebirds are found across the eastern U.S. They use herbaceous openings, savannas, pastures, parks, backyards, edges of hayfields and cropfields, and other early successional communities well-interspersed with trees and shrubs, for perching, foraging and nesting (where cavities are available). Large open areas without interspersion of hedgerows, fencerows, and scattered trees may not receive as much use by bluebirds as those areas with more structural diversity.

Bluebirds forage in open areas, but typically near trees, shrubs, or a fence that provide perches.

Insects dominate the diet during spring and summer, whereas various fruits are most prevalent during fall and winter. Eastern bluebirds nest in cavities, especially old woodpecker cavities, as well as nest boxes. Clutches are normally 3-6 eggs. Eastern bluebirds may have 1-3 broods per year. Nest box programs have had a major impact in restoring eastern bluebird populations.

Habitat requirements

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

Wildlife management practices

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

Set-back Succession: *Prescribed Fire*, *Disking*, *Herbicide Applications*, *Mowing*, *Chaining*, and *Drum-chopping* can be used to maintain and rejuvenate early successional areas and prevent them from becoming dominated by young trees and shrubs; *Chainsawing* and *Root Plowing* can be used to convert forested areas to savannas and early successional communities
Wildlife or Fish Survey: point counts can be used to monitor bluebird populations; nest boxes should be checked to monitor use and nest success
Mowing: can be used to maintain open areas in Urban environments

Eastern cottontail

General information

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

Habitat requirements

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

Wildlife management practices

Control Nonnative Invasive Vegetation: where nonnative invasive vegetation is competing with native vegetation and limiting habitat for cottontails
Edge Feathering: to increase usable space around fields
Field Borders: to increase usable space around fields
Forest Management: *Forest Regeneration* (*Clearcut*), provides optimal brushy cover for a few years
Leave Crop Unharvested: to provide additional food and cover, especially corn, alfalfa, and wheat
Livestock Management: should exclude livestock from food plots and prevent overgrazing to allow sufficient herbaceous vegetation for nesting, cover, and forage
Plant Food Plots: where additional forage or grain is needed; best situated adjacent to dense brushy cover
Plant Native Grasses and Forbs: where early successional cover is limiting and planting is required to promote additional grasses and forbs
Plant Shrubs: in relatively large openings with few shrubs; field borders, fence rows, and other idle land areas are good places to plant
Set-back Succession: *Prescribed Fire*, *Disking*, and *Herbicide Applications* are recommended to maintain herbaceous openings, especially when litter accumulation or woody encroachment is excessive; *Chaining*, *Prescribed Fire*, and *Herbicide Applications* can be used to rejuvenate shrublands, especially where herbaceous groundcover is shaded out; in areas dominated by mesquite, *Chainsawing* and *Root-plowing* can be used to convert forest cover to early successional communities
Tillage Management: cropland tillage may be delayed in spring to allow use of standing stubble for cover; tillage may be eliminated in the fall to allow access to waste grain ***Decrease Harvest***: may be necessary when additional rabbits are desired and hunting or trapping efforts are limiting growth; low rabbit populations are almost always a result of inadequate habitat, not harvest levels
Increase Harvest: where populations can sustain additional hunting or trapping pressure for recreation or where populations need to be lowered

Wildlife Damage Management: shooting, trapping, and exclusion techniques can be used where there is damage to ornamental and garden plants
Wildlife or Fish Survey: observation counts, track counts, hunter harvest data, and transect flush counts can be used to estimate population trends
Mowing: can be used to maintain herbaceous openings in Urban areas

Eastern gray squirrel

General information

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

Habitat requirements

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

Wildlife management practices

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

appropriate for large open areas that do not represent habitat for gray squirrels; may also be appropriate where composition of wooded areas is lacking mast and limiting gray squirrel population

Decrease Harvest: may be necessary when additional gray squirrels are desired and hunting pressure is limiting population growth

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

Wildlife Damage Management: may be required if squirrels become a nuisance around houses

Wildlife or Fish Survey: observation counts are most often used to estimate population trends

Artificial Feeders: may be used in Urban areas

European starling

General information

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

Habitat requirements

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

Wildlife management practices

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

House finch

General information

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

Habitat requirements

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

Wildlife management practices

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

House sparrow

General information

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

Habitat requirements

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

Wildlife management practices

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

House wren

General information

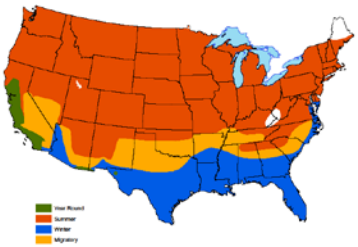
House wrens are found throughout the U.S. during the breeding season, and migrate to the Deep South during winter months. In Urban areas, house wrens prefer older residential areas with large shrubs and trees. House wrens are also found in forests with herbaceous openings at higher elevations, as well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

Habitat requirements

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

Wildlife management practices

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



Northern flicker

General information

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

Habitat requirements

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

Wildlife management practices

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

Opossum

General information

Only one species of native marsupial is in North America, the opossum. It is common statewide, particularly in heavily timbered bottomlands and mountainous regions of the state. Opossums generally inhabit deciduous woodlands near streams or swamps. They take shelter in burrows of other animals, tree cavities, brush piles, and other cover. In urban areas, they sometimes den in attics and garages where they may make a messy nest.

Although opossums have a top running speed of only 7 miles per hour, they are well equipped to escape enemies. They readily enter burrows and climb trees. When threatened, an opossum may bare its teeth, growl, hiss, bite, screech, and exude a smelly, greenish fluid. If these defenses are not successful, an opossum may play dead. Although examination of their skull reveals a relatively small brain case, they are surprisingly intelligent. They rank above dogs in some learning and discrimination tests.

Habitat requirements

Diet: preferred foods are animal matter, mainly insects or carrion; also eat considerable amounts of vegetable matter, especially fruits and grains; persimmon a favorite fruit, but seeds rarely eaten (scats with large numbers of persimmon seeds are more likely to be from raccoons or coyotes); corn and fruits constitute substantial portion of diet in fall and early winter; in urban environments, may visit compost piles, garbage cans, or food dishes intended for dogs, cats, and other pets
Water: open water sometimes needed when sufficient water not obtained from diet
Cover: den in sheltered spots such as hollow logs, brush piles, rockpiles, under exposed roots of uprooted trees or partially undermined trees along streams, or under buildings

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for opossums.
Create Snags*:* provide nesting and escape cover, & insect habitat.
Leave Crop Unharvested**:** especially cornfields adjacent to woodlands.
Livestock Management: exclude livestock grazing from forest to encourage vegetation.
Plant Shrubs: provide soft mast; create cover, corridors and riparian buffers in open areas
Plant Trees*:* fruit trees provide a food source.
Set-back succession*:* apply periodic prescribed fire and herbicides to open understory and favor fruit-bearing shrubs and trees.
Tillage Management: eliminate fall tillage of grain crop residue adjacent to cover to make waste grain available as an additional food source.
Water Developments for Wildlife*:* in areas lacking water, construct a permanent water source from a dugout, shallow impoundment, or small backyard pond.
Decrease Harvest: if hunting pressure is limiting population growth and an increase in opossums is desired.

Increase Harvest: where populations can sustain additional trapping pressure for recreation and/or where populations need to be lowered for various reasons.
Wildlife Damage Management*:* certain individuals may be a nuisance near homes where they may get into garbage, bird feeders, or pet food; accused of destroying poultry, game birds, and their nests, though some experts claim other predators are to blame; closing openings to cages and pens that house poultry and install electric fence wire near top. Fasten garbage can lids with a rubber strap. Opossums typically are not wary of traps and may be easily caught with a cage trap.

Peregrine falcon

General information


USFWS

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

Habitat requirements

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

Wildlife management practices

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

Raccoon

General information

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

Habitat requirements

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

Wildlife management practices

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

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

Rock pigeon

General information

Rock pigeons (commonly called pigeons) are an introduced species found year-round throughout urban and agricultural areas in the U.S. They are considered pests because they are generally protected in urban areas where they develop dense populations and damage buildings and other structures with accumulations of droppings. They also cause severe problems in agricultural areas by contaminating feed. Pigeons also can carry and spread diseases, including salmonella, encephalitis, Newcastle disease, and others, to people and livestock through their droppings. Droppings of rock pigeons may also contain histoplasmosis, a fungal disease that can cause respiratory problems in humans.

Wildlife Damage Management practices are often required to control overabundant rock pigeon populations. Rock pigeons are regularly found around large buildings, parks, and open areas. They create a shallow nest of sticks, leaves, and other vegetation, and nest aboveground and on or around buildings. Rock pigeons primarily feed on the ground and eat small grains, seeds, crumbs, and garbage.

Habitat requirements

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

Wildlife management practices

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

Ruby-throated hummingbird

General information

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

Habitat requirements

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

Wildlife management practices

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

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

Song sparrow

General information

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

Habitat requirements

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

Wildlife management practices

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

White-tailed deer

General information

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

Habitat requirements

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

Wildlife management practices

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

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

Wetlands

American beaver

General information

Beavers occur throughout most of North America. They are found in various wetlands that have permanent water with a variety of shrubs and trees adjacent to the water. Beavers build dams from tree branches, shrubs, and mud to form ponds that stabilize water levels, slow water movement, and provide shelter beneath the ice in winter. Beavers also build lodges from sticks and mud and dig burrows in banks of streams and rivers. Beavers eat the inner bark of shrubs and trees and store cuttings in caches (piles of branches) for use during winter.

The ecological benefits provided by beavers cannot be overstated. Beavers are responsible for creating habitat for many species of birds, mammals, reptiles, amphibians, fish, and invertebrates. Without beavers, the distribution and abundance of many freshwater wetland-associated species would decline dramatically.

Unfortunately, beavers were once such a valuable fur resource that trapping led to their extirpation in many parts of their former range. Today, beavers have rebounded with help from wildlife agency regulations and a lack of available fur market. In some areas, beavers have become a nuisance, as they cut down trees and dam ditches and streams in undesirable places. Their dams often flood crops, destabilize road edges, and kill trees. When beavers construct dams in places that cause problems, removal of the beaver is usually the best solution. If the dam is destroyed and the beavers remain, they will build the dam again.

Habitat requirements

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

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for American beaver
Livestock Management: should prevent livestock access to riparian areas and other wetlands where beaver is a focal species; this may include developing livestock watering facilities in upland areas
Plant Shrubs: where beavers are desired, but not present, deciduous shrubs may be planted along riparian areas where there are few trees or shrubs to make the area more attractive to beavers
Plant Trees: where beavers are desired but not present, deciduous trees may be planted along riparian areas where there are few trees or shrubs to make the area more attractive to beavers
Water Control Structures: a Clemson Beaver Pond Leveler can be installed in beaver dams to maintain water levels
Decrease Harvest: may be necessary where an increased beaver population is desired and trapping pressure has limited growth

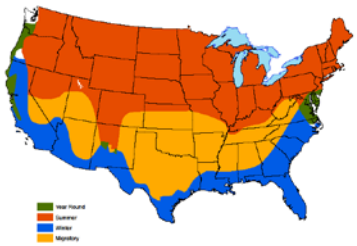
Increase Harvest: where populations can sustain additional trapping pressure for recreation and/or where populations need to be lowered
Wildlife Damage Management: should be implemented where beavers are causing problems for landowners, such as flooding timber, crops, roads, and other areas
Wildlife or Fish Survey: presence and extent of beaver activity (dams, evidence of cutting shrubs and trees) is used to estimate population trends over time

American bittern

General information

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

Habitat requirements



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

Wildlife Management Practices

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

American bullfrog

General information

Bullfrogs inhabit permanent bodies of standing or slow-moving water. Bullfrog tadpoles require two years to metamorphose. They prefer shorelines with dense vegetation adjacent to shallow open water dominated by floating and submerged aquatic vegetation. All habitat requirements are usually found in and around a single pond.

Habitat requirements

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

Wildlife management practices

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

Bluegill

General information

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

Habitat requirements

Diet: a variety of zooplankton (microscopic animal life) during the first few months of life, progressing to insects and their larvae, eggs, earthworms, tadpoles, small minnows, and crayfish
Cover: submerged rocks, woody debris, and aquatic vegetation where small fish (prey) hide *Water*: basic requirements include dissolved oxygen (minimum of four parts per million); pH between 6.5 and 9.0; and water temperature should reach at least 70 F during summer (one foot below surface in the shade)

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be installed if none are present so water depth can be controlled
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest
Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey bluegill populations
Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam
Control Aquatic Vegetation: when necessary to discourage rooted aquatic vegetation
Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm
Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles
Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present
Streams: Create Pools: in streams lacking slow water, add features such as rocks, logs, and dikes to create pools to provide structure for aquatic plants, insects, and locations for spawning; be cautious that "improvements" do not increase bank erosion.
Streams: Remove Fish Barriers: dams or other barriers restrict fish movement during weather extremes (e.g., drought, freezing cold); improve survivability by allowing fish movement to deeper pools or rivers.

Canada goose

General information

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

Habitat requirements

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

Wildlife management practices

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

Common muskrat

General information

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

Habitat requirements

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

Wildlife management practices

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

Crawfish frog

General information

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

Habitat requirements

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

Wildlife management practices

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

Eastern snapping turtle

General information

The eastern snapping turtle is found in most permanent bodies of water, but prefers soft mud-bottomed ponds, lakes, and slow streams with dense vegetation. It is one of the more "aquatic" of the freshwater turtles. It spends most of its time lying on the bottom of deep pools or buried in the mud in shallow water with only its eyes and nostrils breaking the surface of the water.

The primary nesting season is May-June with the female digging a hole and laying about 30 eggs. Eastern snapping turtles are omnivorous and will consume relatively large invertebrate and small vertebrate prey.

If approached, snapping turtles will turn to face the potential predator, lunge forward, and strike quickly with powerful beaked jaws.

Eastern snapping turtles grow slowly, but can attain very large sizes (>50 lbs). They have heavy muscular legs and are often harvested for human consumption.

Habitat requirements

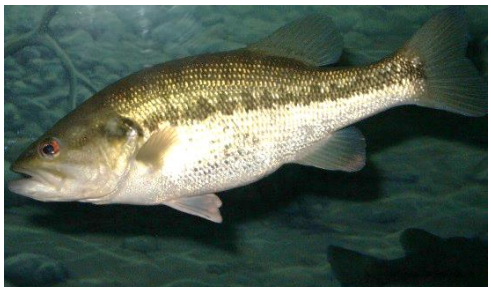
Diet: insects, crayfish, clams, earthworms, fish, frogs, toads, salamanders, snakes, small turtles, birds, and small mammals; also consumes various aquatic plant species
Water: requires permanent bodies of water
Cover: permanent water bodies with muddy bottoms and thick vegetation; hides underwater beneath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

Wildlife management practices

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

Largemouth bass

General information



Largemouth bass are not really bass but members of the Sunfish family. Largemouth bass are the most popular freshwater sportfish in states where they are found. They can be found in freshwater lakes, rivers, large streams, farm ponds, and brackish marshes.

Habitat requirements

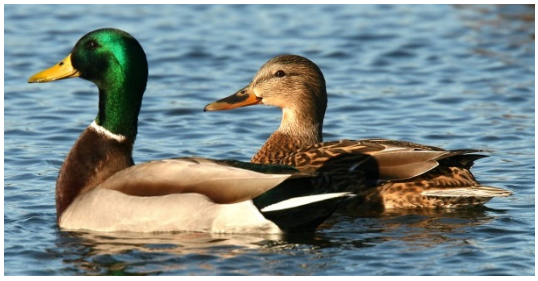
Diet: young bass eat insects and other invertebrates (worms, crayfish and zooplankton); adults eat small fish, such as bluegill, and a variety of minnows, as well as tadpoles, crayfish, and even ducklings
Cover: submerged rocks, woody debris and near aquatic vegetation where small fish (prey) hide
Water: basic requirements include dissolved oxygen (minimum of four parts per million); pH should range between 6.5 and 9.0; water temperature should reach at least 70 F during summer (one foot below surface in shade)

Wildlife management practices

Livestock Management: livestock should either be excluded from fish ponds or only allowed access to a small part of the fish pond; livestock watering facilities should be developed away from the fish pond
Repair Spillway/Levee: if not functioning properly
Water Control Structures: should be installed if none are present so water depth can be controlled
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest
Wildlife or Fish Survey: fishing records, seining, and electro-shocking are used to survey largemouth bass populations
Construct Fish Pond: where no suitable water source is present or where an existing fish pond needs extensive repair, especially to the dike or dam
Control Aquatic Vegetation: when necessary to discourage rooted aquatic vegetation
Fertilize/Lime Fish Pond: fertilize to promote phytoplankton growth when visibility is more than 18 inches below the water surface; add agricultural limestone to increase soil pH if total alkalinity is below 20 ppm
Reduce Turbidity in Fish Pond: by reseeding watershed if soil is eroding into the pond and causing muddy water, by preventing livestock from entering pond, by eliminating bottom-feeding fish, or by reducing suspension of negatively charged clay particles
Restock Fish Pond: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present
Streams: Create Pools: in streams lacking slow water, add features such as rocks, logs, and dikes to create pools to provide structure for aquatic plants, insects, and locations for spawning; be cautious that "improvements" do not increase bank erosion.
Streams: Remove Fish Barriers: dams or other barriers restrict fish movement during weather extremes (e.g., drought, freezing cold); improve survivability by allowing fish movement to deeper pools or rivers.

Mallard

General information



The mallard is a migratory waterfowl with one of the most extensive breeding ranges of any duck in North America, extending across the northern one-third of the U.S., and up to the Bering Sea. Mallards winter south of Canada, throughout the U.S. and south to Central America. Mallards nest in tall grasses and forbs or in shrubby cover. They need open water with associated emergent aquatic vegetation to raise young.

Mallards may be found in any type of wetland with standing water and also use various upland vegetation types for foraging, especially harvested grain fields. Mallards are dabbling ducks, which means they feed at or near the surface of the water by filtering food items, such as invertebrates, seeds, and other plant material. Dabbling ducks are often seen tipping upside down in the water to reach food at the bottom of a wetland. Unlike diving ducks, they feed in much shallower water and do not dive to obtain food.

Mallards have become a nuisance in some areas, particularly urban and suburban parks with ponds where they are fed. Mallards may breed with domestic ducks and with other wild duck species, especially the American black duck.

Habitat requirements

Diet: aquatic plants, insects and other invertebrates, hard mast (especially acorns), grains and other seed are primary components in the diet; ducklings eat mostly aquatic insects
Water: see cover requirements below
Cover: in wintering areas, mallards often loaf on more open water, such as warm-water sloughs, streams, rivers, and flooded fields

Wildlife management practices

Control Nonnative Invasive Vegetation: when nonnative invasive species, such as purple loosestrife, water hyacinth, parrotfeather, hydrilla, and reed canarygrass, begin to reduce habitat quality for mallards
Delay Crop Harvest: (in some ecoregions) hay and crop harvest adjacent to wetlands should be conducted after nesting season
Forest Management: *Timber Stand Improvement* can favor mast-producing species, especially oaks, in bottomland hardwoods that can be flooded to increase mast production
Leave Crop Unharvested: unharvested grains, such as corn and wheat, to provide a winter food source; this does not apply to hay forages or soybeans
Livestock Management: livestock should be excluded from nesting areas
Plant Food Plots: shallowly flooded grain plots can provide an important food source for migrating and wintering mallards
Plant Native Grasses and Forbs: (in some ecoregions) where nesting cover is limiting and planting is necessary to increase coverage of native grasses and forbs

Repair Spillway/Levee: if not functioning properly
Set-back Succession: *Prescribed Fire* should be used to rejuvenate dense vegetation in nesting areas and to increase or maintain proper water and vegetation interspersion in emergent wetlands that become dry in summer; *Disking* emergent wetlands and fields that will be flooded later will stimulate annual grasses and forbs that are important food plants; *Herbicide Applications* can be used to control unwanted woody species; *Chainsawing* can be used to create openings in bottomland forests that can be flooded
Tillage Management: eliminating fall tillage can provide waste grain in the winter
Water Control Structures: should be used to control water level in wetlands managed for mallards and other wildlife
Water Developments for Wildlife: shallow impoundments can be used to flood grain fields and bottomland hardwoods in winter to provide a valuable food source and loafing areas
Wildlife or Fish Survey: aerial surveys are commonly used to estimate trends in the mallard population

Mink

General information

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

Habitat requirements

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

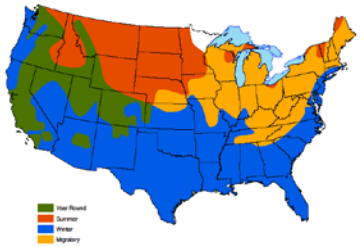
Wildlife management practices

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

Northern pintail

General information

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



Habitat requirements

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

Wildlife Management Practices

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

Raccoon

General information

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

Habitat requirements

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

Wildlife management practices

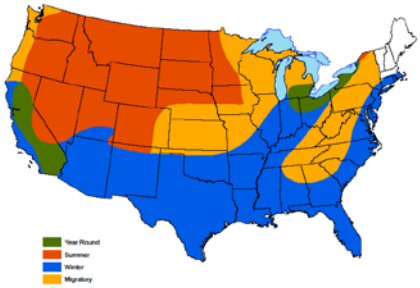
Control Nonnative Invasive Vegetation: when nonnative invasive vegetation begins to reduce habitat quality for raccoons
Create Snags: where denning sites are limited
Edge Feathering: to increase usable space for prey around fields
Field Borders: to increase usable space for prey around fields
Forest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

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

Redhead

General information

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



Habitat requirements

Diet: aquatic plants, such as pondweeds, muskgrass, bulrush seeds, wild celery, water lily seeds, and coontail
Water: see cover requirements below
Cover: open-water wetlands are used for loafing and foraging; wetlands with a mosaic of open water with submerged and emergent aquatic vegetation are used for foraging

Wildlife management practices

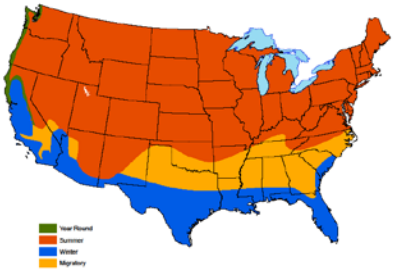
Control Nonnative Invasive Vegetation: when nonnative invasive aquatic vegetation begins to reduce habitat quality for redheads; this is most common when mats of nonnative species begin to form over the water surface and limit diving and foraging by redheads
Livestock Management: livestock should be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

Spotted sandpiper

General information

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

Habitat requirements



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

Wildlife management practices

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

Tiger salamander

General information

The tiger salamander is one of the largest terrestrial salamanders in North America with adults attaining more than one foot in length. Adults inhabit a wide array of vegetation types including bottomland deciduous forests, conifer forests, woodlands, fallow fields, grasslands, meadows, and brushy areas. Free-standing water must be present for breeding. Adults are terrestrial, but make annual, spring migrations to **ephemeral** (temporary) ponds to breed. Ephemeral ponds contain water during only a portion of the year. The breeding season is short and eggs develop rapidly. Larvae are top predators in fishless ponds. They often grow quickly and can reach 4-6 inches in length before transforming in late summer.

Habitat requirements

Diet: adults eat worms, snails, insects, and slugs; larvae eat a wide variety of aquatic organisms, including invertebrates and other amphibian eggs and larvae
Water: ephemeral or semi-permanent ponds are necessary for reproduction; ponds should be fishless if successful reproduction is to occur
Cover: adult tiger salamanders live underground in burrows for most of the year; deep leaf litter and large amounts of downed woody debris are most desirable

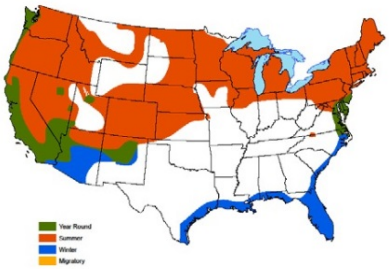
Wildlife management practices

Livestock Management: livestock should be excluded from ponds that may be used as breeding ponds for tiger salamanders; livestock watering facilities should be developed away from pond
Plant Native Grasses and Forbs*:* when converting fields that are currently in row-crop agriculture to tiger salamander habitat
Plant Shrubs: when converting fields that are currently in row-crop agriculture to tiger salamander habitat, or in relatively large open areas that need additional cover
Plant Trees: where additional forest cover is needed
Water Control Structures: should be installed if not present in ponds with levees that are managed for tiger salamanders to enable the pond to be drained, especially if fish are introduced
Water Developments for Wildlife: small, fishless ponds may be created if additional breeding ponds are needed
Wildlife or Fish Survey: cover boards and pitfall traps along drift fences are used to estimate population trends

Virginia rail

General information

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



Habitat requirements

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

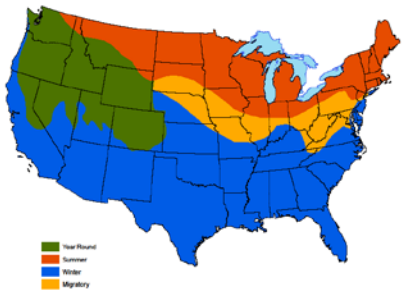
Wildlife management practices

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

Wilson's snipe

General information

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



Habitat requirements

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

Wildlife management practices

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

Wildlife Foods & Concepts - Description

Objective

The objective of the Wildlife Foods & Concepts is for contestants to demonstrate their knowledge and understanding of wildlife management concepts and terminology, wildlife management practices, and the biology and ecology of wildlife species. An understanding of wildlife species occurring in the announced region includes knowledge of their food habits.

Overview

For the Wildlife Foods & Concepts, contestants need to be able to:

- define and apply wildlife management concepts and terms;
- know food habits and habitat needs of wildlife species in the announced ecoregion;
- describe wildlife management practices (Juniors and Seniors) and their application (Seniors only); and
- describe characteristics of the announced ecoregion (Seniors only).

A portion of the Wildlife Foods & Concepts may include stations where contestants will be presented with a wildlife food specimen, photo, or other visual clue for responding to the question. Optionally, this station may be located outdoors and some questions may be related to various habitat features.

Contest Rules

1. Contestants need to bring pencils and a clipboard for this event.
2. Contestants will complete the scorecard individually, thus no talking is allowed.
3. The question format can be multiple-choice, true/false, matching, or fill-in-the-blank.
4. A portion of the event may include stations with visual items for determining the answer to a question, such as a wildlife food sample, picture or other prop.
5. Contestants will be given 30 minutes to answer questions and record information on a score sheet.

Content Areas

Questions may be taken from any portion of the handbook including Wildlife Concepts and Terms, Wildlife Species Descriptions, Wildlife Management Practices, the Glossary, and Ecoregion descriptions.

Juniors

1. *Wildlife management concepts and terms.* Be able to define and apply concepts and terms. Apply concepts and terms to the characteristics of wildlife species in the region. Study materials include Wildlife Concepts and Terms, and the Glossary.

2. *Food habits and habitat needs of wildlife species in the announced ecoregion*. Study the Wildlife Species Descriptions for those wildlife species in the announced region. Be able to identify the category for a food sample (e.g., grasshopper = insect) and which species consumes the sample (e.g., Northern bobwhite). Also know the type of habitat they prefer.

   Note: Foods have been placed in categories of food group definitions to facilitate this portion of the contest. For example, a station displaying a tree branch with leaves and flowers is considered a “leaf

and twig," whereas a flower by itself represents "nectar." To indicate which foods are eaten by specific wildlife species, be familiar with the food group definitions.

3. *Wildlife management practices*. Be able to describe a particular management practice and the tools needed to implement the practice. The section on Wildlife Management Practices has descriptions and photos about each one.

4. *Knowledge and understanding of the ecoregion*. Study the description for the announced ecoregion. Recognize general characteristics such as the geographic location in the state. In the Wetlands ecoregion, know the different types (stages) of wetlands.

Seniors

Seniors are expected to demonstrate an in-depth *understanding and application* of the knowledge areas described below.

1. *Wildlife management concepts and terms.* Be able to define and apply concepts and terms. Apply concepts and terms to the characteristics of wildlife species in the region. Study materials include Wildlife Concepts and Terms, and Glossary.

2. *Food habits and habitat needs of wildlife species in the announced ecoregion*. Study the Wildlife Species Descriptions for those wildlife species in the announced region. Be able to identify the category for a food sample (e.g., grasshopper = insect) and which species consumes the sample (e.g., Northern bobwhite). Also know the type of habitat they prefer.

   Note: Foods have been placed in categories of food group definitions to facilitate this portion of the contest. For example, a station displaying a tree branch with leaves and flowers is considered a "leaf and twig," whereas a flower by itself represents "nectar." To indicate which foods are eaten by specific wildlife species, be familiar with the food group definitions.

3. *Wildlife management practices*. Be able to describe a particular management practice and the tools needed to implement the practice. The section on Wildlife Management Practices has descriptions and photos about each one. Additionally, know under what conditions a management practice can be implemented, including the specifics about when and where it can be applied. For example, understand that seed-tree removal as a forest practice is typically used for regenerating pine stands, not hardwood stands.

4. *Knowledge and understanding of the ecoregion*. Study the description for the announced ecoregion. Be able to describe the features of the announced ecoregion, including geographic location in the state and characteristic plant species.

Wildlife Management Concepts and Terms

Wildlife management is both art and science that deals with complex interactions in the environment. Before you can evaluate wildlife habitat and make management recommendations, some basic concepts used in wildlife management should be understood. 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 study and understand them.

Definitions of various words or terms may be found in the **Glossary**. Look up the definitions of words or terms you do not understand in a dictionary, wildlife management or ecology textbook, field guide or the glossary found in this handbook. Extension Wildlife Specialists, Extension educators, and local state agency wildlife biologists can provide clarification if needed. Wildlife management textbooks offer more in-depth reading and explanation.

Concepts and Terms

- Organization of Life: From Species and Communities to Ecosystems, and Landscapes
- Biotic Communities, Climate, and Soils
- 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
- Buffers and Corridors
- Vertical Structure
- Carrying Capacity
- Compensatory and Additive Mortality
- Home Range, Movements, and Migration
- Food Webs
- Pond Dynamics and Balance
- Stream Habitat

Organization of Life: From Species and Communities to Ecosystems and Landscapes

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

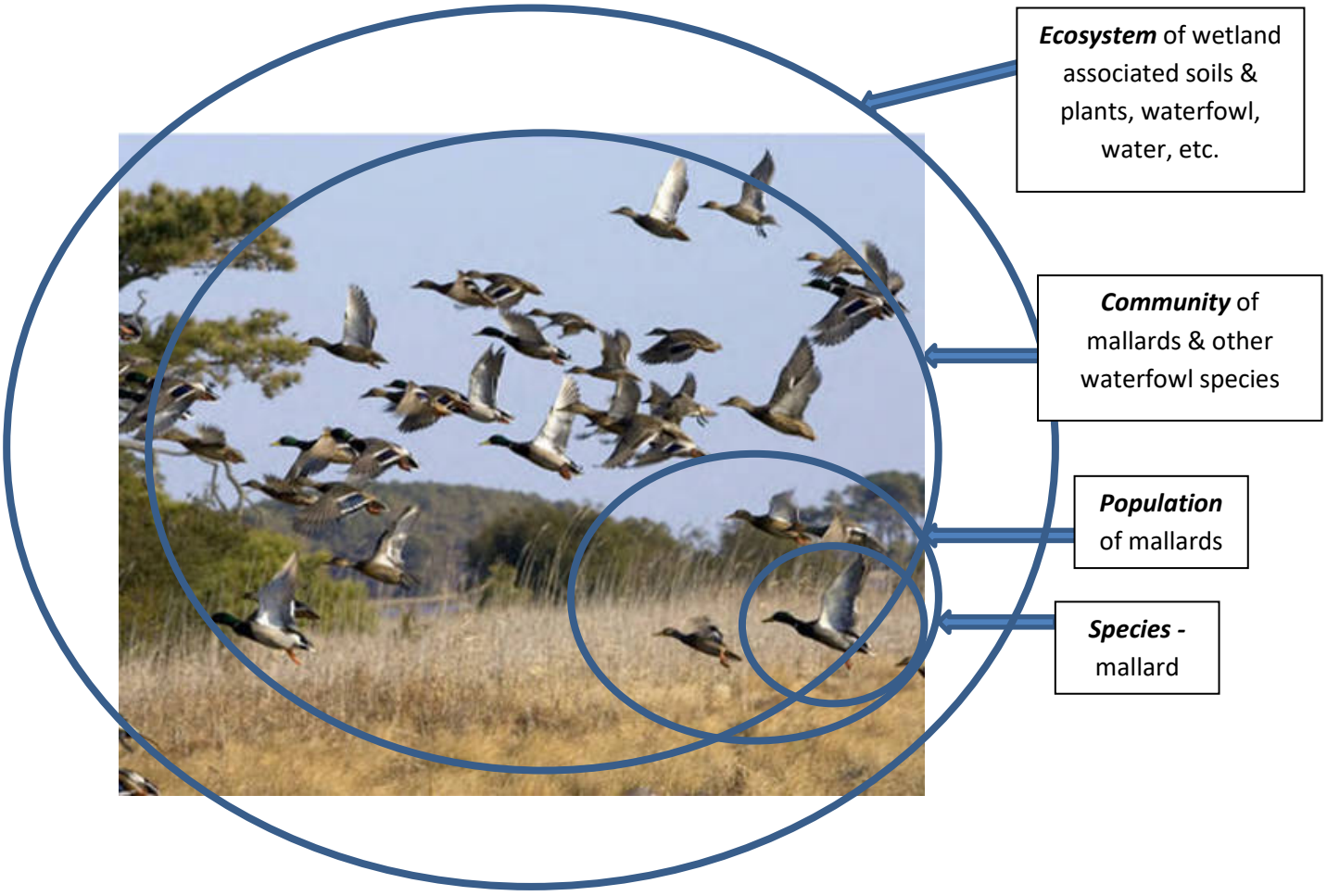


Figure 1. The organization of life from individual to population, community and ecosystem.

Biotic Communities, Climate, and Soils

A biotic (living) community includes all the plant and animal populations living in a defined area. The composition of a biotic community changes over time in response to plant succession and climate (rainfall and temperature). Communities interact with the nonliving, or abiotic, resources (soil, air, water and sunlight).

The relationship between climate (rainfall and temperature) and soils affects vegetation and types of wildlife species which live in a particular area. The Eastern Deciduous, Grassland – Tallgrass/Mixed Prairie, and Southeast Mixed and Outer Coastal Plain Forest ecoregions of the state reflect different climate and soil conditions, though they may be blurred along boundaries where these ecoregions meet. Within these ecoregions, Wetlands and Urban ecoregions can be found.

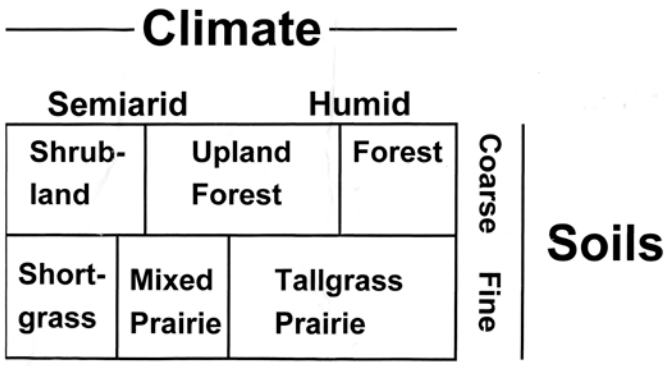


Figure 2. The type of climate and soil determines the type of plant community found in a particular region in the United States.

Much discussion has occurred nationally and globally about climate change. In Arkansas, data from a weather station at the U of A Southwest Research and Extension Center in Hope suggests periodic cycles of heat/drought and cooling/flooding are normal for that part of the state. The Center has temperature and rainfall data spanning almost 100 years and is reportedly the second oldest continuous weather dataset in Arkansas. Their data indicate unpredictable warming and cooling cycles have occurred with relative frequency over the past 100 years.

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

Figure 3. Plant succession involves a change in plant species composition over time. This field represents an early successional stage with blackberry, persimmon, and scattered oak trees pioneering into perennial grasses (switchgrass and broomsedge).

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 handbook. 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 big bluestem and Indiangrass; a thicket of brambles and blackberries; or a fallow field of annual forbs, such as common ragweed, horseweed, and fleabane.

Depending on climate in a particular ecoregion, there may be several or only a few successional stages that compose a sere. For example, in the Eastern Deciduous Forest ecoregion where annual precipitation may average 40+ inches, annual grasses and forbs represent the initial successional stage following soil disturbance. Perennial grasses, forbs, and brambles dominate by year 2 or 3 after the disturbance. Woody species, such as winged sumac, winged elm, eastern redcedar, and persimmon might become prevalent within 7 or 8 years after disturbance. Various oaks, hickories, yellow-poplar, and other tree species may slowly pioneer into the site and dominate the area within 20 years. Without additional disturbance, such as fire, maples may eventually dominate the forest within 150 years and represent the fifth successional stage. Approximately 5 seral stages (or successional stages) can be expected to compose a sere on many sites within the Eastern Deciduous Forest ecoregion. 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 in Arkansas can be found in the *Ecoregions* section of this handbook. 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 called the ***climax seral stage.*** The climax seral stage is dominated by plant species that can reproduce and replace themselves without additional disturbance. In ecoregions with sufficient rainfall (such as Eastern Deciduous Forest and Southeast Mixed Outer Coastal Plain Forest), early successional plant communities ultimately succeed to forests. In drier ecoregions (such as Great Plains Grasslands, Prairie Brushland, and Hot Desert), fewer seral stages compose the sere. In Arkansas, glade habitat along rocky hillsides is a mico-habitat in which some plant species found in drier ecoregions can be found. (The Arkansas Natural Heritage Commission's website has information about glades, as well as other natural areas.) Vegetation communities of perennial grasses, forbs, shrubs, and cacti may represent the climax seral stage. Disturbance events, such as fire, grazing, ice and wind storms, lightning, and flooding, continually set-back succession and the process starts over.

Although succession is set-back through natural disturbances, many natural disturbances have been disrupted by humans. 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 called ***arrested succession***.

Plant succession is an important concept for wildlife managers. As succession takes place and vegetation composition changes, the structure (density and height of vegetation, or cover) of the vegetation change. These changes affect the type of food available for wildlife. **As vegetation structure and food availability change, the wildlife species that use the area also change, because different wildlife species have different habitat requirements**.

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

Figure 4. Plant species in the second successional stage of perennial grasses and forbs are represented by broomsedge and goldenrod in this picture The third successional stage of shrubs and pioneering trees is represented by winged sumac, sweetgum, and eastern redcedar.

Figure 5. Oak or pine savannas and woodlands represent early successional vegetation with scattered trees. However, without continued fire, savannas and woodlands will change into forests.

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

Differentiating successional stages can be difficult where grasslands, savannas, woodlands, and forests all occur. Grasslands are areas dominated by herbaceous plants (grasses, forbs, sedges, and brambles) and very few, if any, trees. Savannas and woodlands are areas with sparse to moderate tree cover and a well-developed understory of herbaceous plants. Forests are dominated by tree cover. In areas with abundant precipitation, grasslands, savannas, and woodlands will become 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.

Descriptions of a typical successional stage can be found in the regions section of this handbook.

Conceptual learning tools

To illustrate the concept of plant succession, the following diagrams and photos are provided. In previous WHEP handbooks, successional stages were numbered to help define plant communities and the structure they represent. Most wildlife biologists describe plant succession in terms of the composition and structure of the plant communities, rather than stating "stage two," for example. These successional stage numbers were used as a teaching tool for plant succession. Although the stage numbers are no longer applied in the contest, they are presented here as a way to help learn this concept.

Stage 1: Bare ground
Stage 2: Annual forbs and/or grasses
Stage 3: Perennial forbs and grasses
Stage 4: Shrubs
Stage 5: Young forest
Stage 6: Mature forest

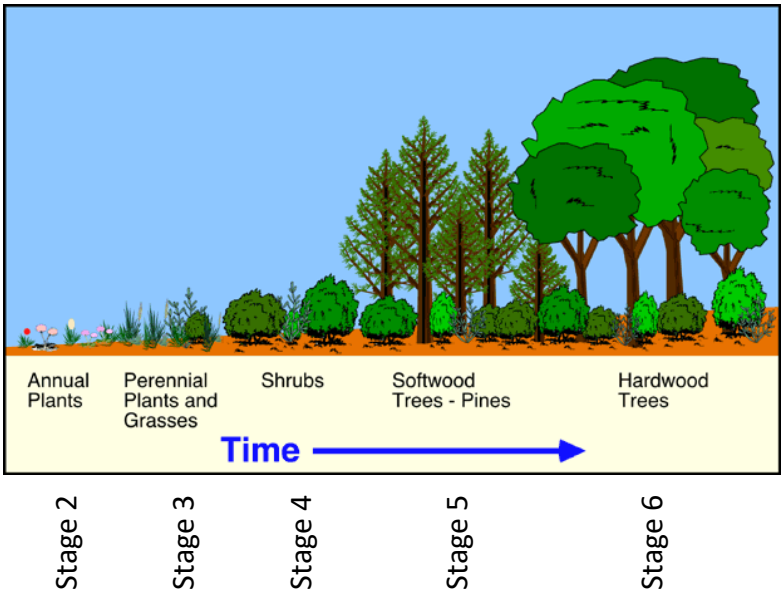


Figure 6. Plant Succession. Illustration from Pidwirny, M. (2006). "Plant Succession". *Fundamentals of Physical Geography, 2nd Edition*. January 27, 2009. http://www.physicalgeography.net/fundamentals/9i.html

Successional stages have been defined and numbered for simplicity, though in reality successional stages can be difficult to distinguish. That's because succession is continual, and one successional stage gradually develops into the next. When evaluating habitat, consider the dominant plants in the area. For example, both annual and perennial grasses and forbs are often present in early successional areas. Brushy areas often slowly develop into young forest, depending on the species present.

Stage 1 – Bare ground.

Stage 2 – Annual forbs and/or grasses.

Stage 3 – Perennial forbs and grasses.

Stage 4 – Shrubs.

Stage 5 – Young forest.

Stage 6 – Mature forest.

Figure 7. Photos illustrating successional stages.

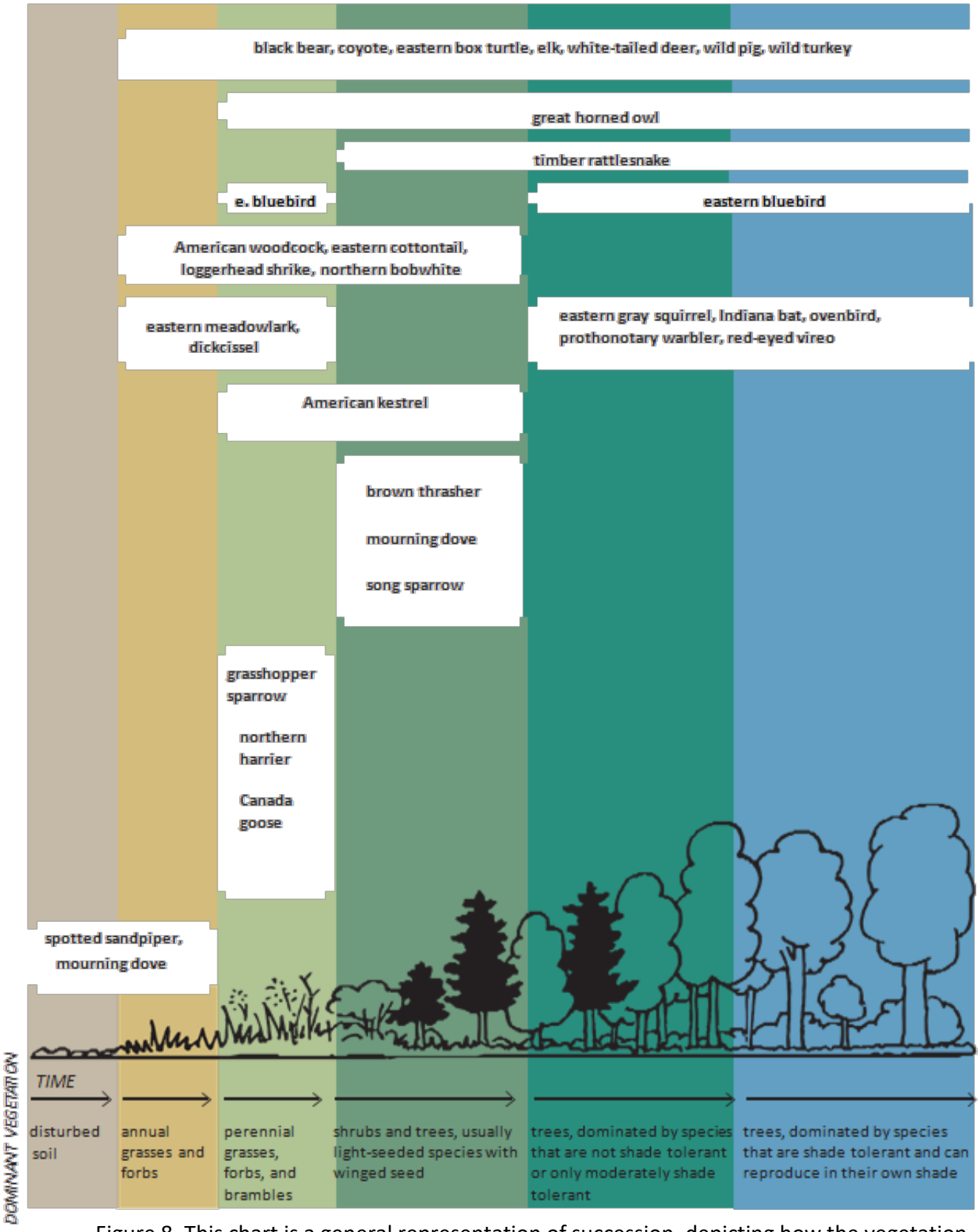


Figure 8. This chart is a general representation of succession, depicting how the vegetation community may change over time and how various wildlife species are associated with various successional stages. Various species from several ecoregions are shown.

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. 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 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, thrive in areas with considerable interspersion of vegetation types. Thus, habitat for these species usually includes several vegetation types or successional stages.

Although the term "habitat type" is often used interchangeably with "vegetation type," it is confusing, technically inaccurate, and should be avoided.

Differences in habitat requirements among some species are subtle, whereas differences in habitat requirements among other species are dramatic. For example, habitat requirements for northern bobwhite and American kestrel are somewhat similar. They both require cover dominated by shrubs, forbs, and grasses. Bobwhites primarily eat various plants, seed, mast, and insects. Kestrels prey on other animals, including small mammals, lizards, and insects. 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. As mast becomes available in the fall, wild turkeys are frequently found in mature hardwood forests when available.

Species richness and diversity

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

Nonnative and invasive species

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

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

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

Nonnative invasive plants and wildlife species:

- contribute to loss of habitat for native wildlife and fish species
- can lead to population declines of native plants and wildlife species
- often outcompete native wildlife and fish for limited habitat resources.

Top Ten Abundant Invasive Plants for Arkansas (Center for Invasive Species and Ecosystem Health, 2012)

1. Japanese honeysuckle
2. Chinese privet
3. sericea lespedeza
4. shrubby lespedeza
5. fall fescue
6. mimosa
7. Japanese privet
8. kudzu
9. johnsongrass
10. chinaberry

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

Figure 6. Cogongrass.

Figure 7. Sericea lespedeza.

Figure 8. Japanese honeysuckle

Focal species management & ecosystem management

Wildlife management generally is 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 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, such as the longleaf pine or shortgrass prairie ecosystems, and allowing the associated wildlife species to respond.

Most landowners have specific objectives or concerns about a particular species. Once the species is determined, resources that may be limiting (such as cover, food, or water) for that species on that property can be identified and the appropriate wildlife management practices can be prescribed. Occasionally, the focal species may be totally incompatible with the area under consideration and management goals and objectives must be changed.
It is best to select wildlife management practices which provide or improve the habitat requirements most lacking or 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.
The size of the area being managed is not a factor when determining whether the approach is focal species or ecosystem management. 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. Even though managing ecosystems would benefit grasshopper sparrows, if increasing the population of grasshopper sparrows over thousands of acres is the objective for the management plan, then it is considered focal species management.

Figure 9. Ecosystem management does not focus specifically on one or more wildlife species, but the health and functioning of the area as a whole.

Figure 10. Most landowners identify focal species when managing their property for wildlife, because not all species benefit from the same wildlife management practices.

Wildlife management practices which improve habitat for some wildlife species may be helpful or 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 wild turkey, then white-tailed deer and eastern cottontail may also benefit. However, species, such as ovenbird, wood thrush, and eastern gray squirrel, which prefer mature deciduous forest, will be forced to use another area.

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 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 abrupt change in species composition and structure (Figure 11) 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 (Figure 12) and increases the amount of "usable space" for many wildlife species by providing suitable cover and food resources.

Figure 11. A hard edge separates the field and trees.

Figure 12. A soft edge has a transitional area of taller grasses and forbs between the field and trees.

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

- both vegetation types are usable by the species and provide some habitat requirement;
- the arrangement of the vegetation types is suitable for the focal species.

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

On the other side of the coin, if vegetation types or successional stages present do not provide any habitat requirement for the species in question, the interspersion and resulting edge is not beneficial. **It is important to realize the presence of edge is not always beneficial for any wildlife species.** The habitat needs for the species needs to be carefully considered.

- Some species which prefer unfragmented interior habitat will not respond well to increased edge. For example, areas of 1 acre in size with an edge width of 150 feet basically have no interior. As the acreage increases, more interior habitat becomes available, and habitat quality improves for those species.

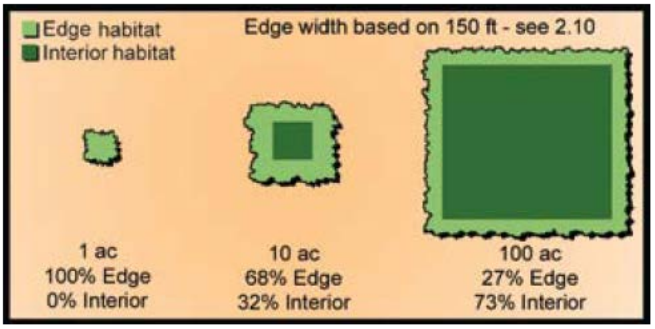


Figure 13. The relationship between edge and interior habitat.

- Some species are found along an edge because the interior of the adjacent vegetation type does not provide any habitat requirement. For these species, the edge is not what is necessarily important, but rather the *composition and structure of the vegetation.* For example, wild turkey and northern bobwhite broods might be found along the edge of a field dominated by tall fescue or bermudagrass. The structure of the vegetation in the field could be too thick at ground level, and the birds cannot walk through it. Practices which promote native warm season grasses and remove sod grasses from the field, or increasing the edge width, would improve mobility and escape cover for these ground-nesting birds. Vegetation management for these birds would increase the carrying capacity of the property.

Figure 14. 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.

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***. Juxtaposition refers to the placing something close together or side by side for comparison purposes. Juxtaposition is important for species which need more than one type of habitat requirement.

Figure 15. The forest and field which a wild turkey needs for nesting and brooding are separated on the left by a barrier (for example a mountain range, river, or highway). The forest and field on the right are next to each other and demonstrate juxtaposition.

Some wildlife species may obtain all of their habitat requirements from only one vegetation type or successional stage (such as eastern gray squirrel, 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, white-tailed deer may forage on acorns in mature mixed-hardwood stands during fall and winter, but use young forest stands with high tree stem densities for escape cover.

Required successional stages should be close to each other to allow for safe travel to and from those areas. Proximity is especially important for species with limited movements and relatively small home ranges.

Interspersion is the frequency of occurrence of different vegetation types. Increased interspersion generally leads to increased "mixing" of vegetation types and often supports a greater diversity of wildlife. However, the vegetation types present and the quality of cover and food resources present in those vegetation types are more important than whether or not there is much interspersion. As interspersion increases, so does the amount of edge. However, as discussed in the section about ***Edge***, increased interspersion is not necessarily beneficial to all species.

Interspersion is easily viewed on satellite images. However, habitat quality cannot necessarily be assessed by viewing satellite images. It is true that where there is increased forest cover, the amount of habitat for eastern gray squirrel is likely increased, and where there is increased grassland cover, the amount of habitat for grasshopper sparrow is likely increased. However, the composition and structure of the vegetation in fields, shrubland, and woods greatly influences habitat quality for many species, and that fine-level analysis is not possible by viewing photos. Walking over the property and taking a closer look is necessary when evaluating habitat for most species.

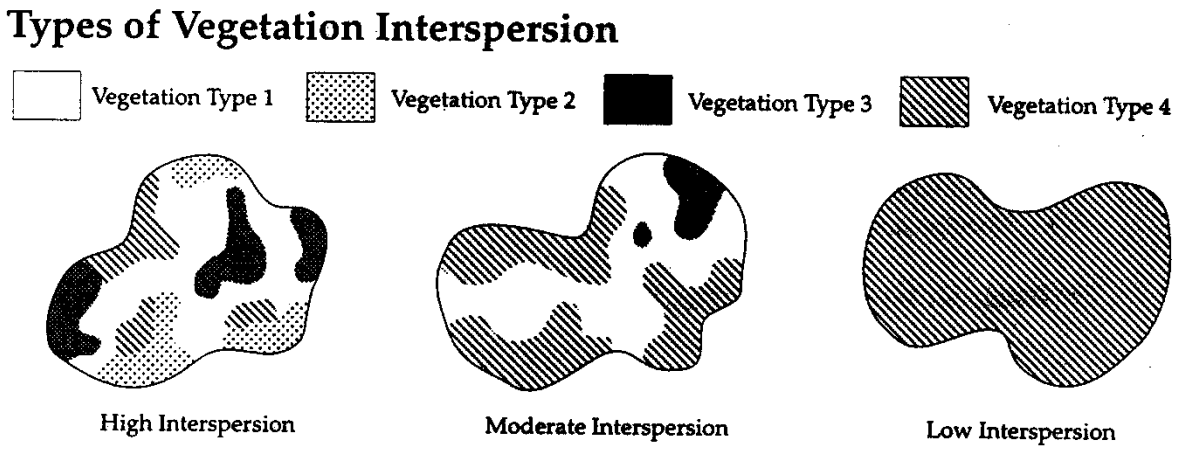


Figure 16. The degree of interspersion or "mixing" of habitat types can be important for some species.

Figure 17. The arrangement of vegetation types and successional stages directly influences animal movements and home range size. Here, nesting cover, brooding cover, and escape cover are all arranged in close proximity (juxtaposed) to favor habitat requirements for northern bobwhite.

Area-sensitive species

Fragmentation is the disruption of vegetation types either by man or by natural processes. All wildlife species do not respond to fragmentation the same way. For some, the edge between a young forest and an older forest may fragment their habitat, whereas others may not respond to fragmentation except under extreme circumstances such as an interstate highway bisecting a forest or prairie 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.

Figure 18. Fragmentation is harmful to area sensitive species. *Photo courtesy of Chesapeake Workshops Unlimited.*

Figure 19. Nesting data for four grassland-nesting birds in prairie fragments in southwestern Missouri demonstrating the negative effect of fragmentation on nesting success for these particular species. Source: "Patterns of Area Sensitivity in Grassland-Nesting Birds" by Maiken Winter and John Faaborg, Conservation Biology 13:6, p. 1424-1436, 1999.

Species	Total nests	Depredated nests	Nesting success
Henslow's sparrow	59	25	39%
Dickcissel	242	128	29%
Grasshopper sparrow	23	15	22%
Eastern meadowlark	47	33	19%

Buffers and Corridors

Areas of suitable habitat or paths that do not restrict movement are required for animals to move from areas within their home range or during migration. These areas are known as corridors. ***Corridors*** are areas of continuous habitat that permit animals to travel securely from one habitat to another. The type of vegetation within and the size (both width and length) of the corridor varies depending on the animal.

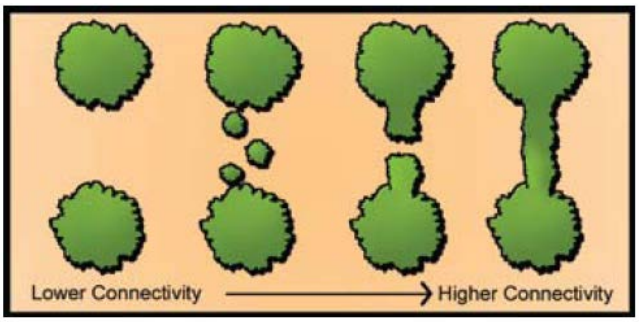


Figure 19. A complete corridor (far right) provides protective cover for wildlife traveling from one area to another. Fragmented corridors offer less protection, but can be better than no corridor at all (far left).

A corridor allows various wildlife species to travel through areas of otherwise unsuitable habitat. In large expansive fields or open areas, riparian buffers, hedgerows or grown up fencerows can act as corridors for wildlife. When landscape becomes broken up (fragmented), only small islands of suitable vegetation might remain. Fragmentation may occur from road construction, urban development, timber harvesting, clearing for agriculture, hurricanes, wildfires, etc. Corridors provide protective travel, escape and nesting cover for certain wildlife species.

However, corridors can be harmful if they are too small. Predators may be attracted to the corridor edge and corridors then become unknowing traps for some animals. Having a narrow corridor increases the chance of a ground nest being discovered by raccoons, skunks, bobcats, and coyotes.

If properly developed, corridors allow animals to meet and mate with other animals of the same species but from different populations, thus maintaining genetic diversity. Corridors also allow animals to find and use islands of suitable habitat that are otherwise not available to them.

Figure 20. A riparian corridor along a stream. *Photo courtesy of the Natural Resources Conservation Service.*

A *riparian buffer* is a type of corridor that occurs along riparian areas, or waterways. A riparian buffer is an area of trees, shrubs, forbs and grasses located adjacent to streams, lakes, ponds and wetlands. Riparian buffers are important for providing habitat and protecting water quality in streams and wetlands. The recommended minimum width is 100 feet, however the width may vary based on various factors including the size and order of stream, as well as topography.

In an urban area, relatively unbroken corridors found along riparian areas and ravines allow wildlife to move into parks and other suitable habitats. Preservation, maintenance, and creation of uninterrupted corridors are very important in urban wildlife habitat management.

Riparian buffers provide shade for summer cooling and cover in the stream or wetland. They provide corridors for wildlife to move from one habitat to another as well as providing nesting cover. Buffers slow overland flow of water and help maintain water quality. They provide structural diversity both adjacent to and within the stream. As trees die then fall into the stream, the large woody debris helps create pools and riffles and provides cover for fish and other aquatic life. Leaves, stems, branches and large woody debris fall into streams, providing nutrition and habitat for aquatic insects, a major food source for fish and amphibians. Insects from the trees fall into the stream and provide a food source for fish, amphibians and other aquatic life. Tree roots improve soil and stream bank stability.

To develop a riparian buffer, implement practices such as planting grasses, forbs, shrubs and trees along streams and wetlands. Fencing off riparian areas from livestock grazing will allow succession to advance, creating a riparian buffer over time. When using forest management practices, especially those that create openings, consider leaving vegetation near bodies of water and promoting growth of existing vegetation near water.

Vertical structure

In most vegetation types, there are distinct layers of vegetation. In a grassland, there is often a litter layer (decaying vegetation on the ground) 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.

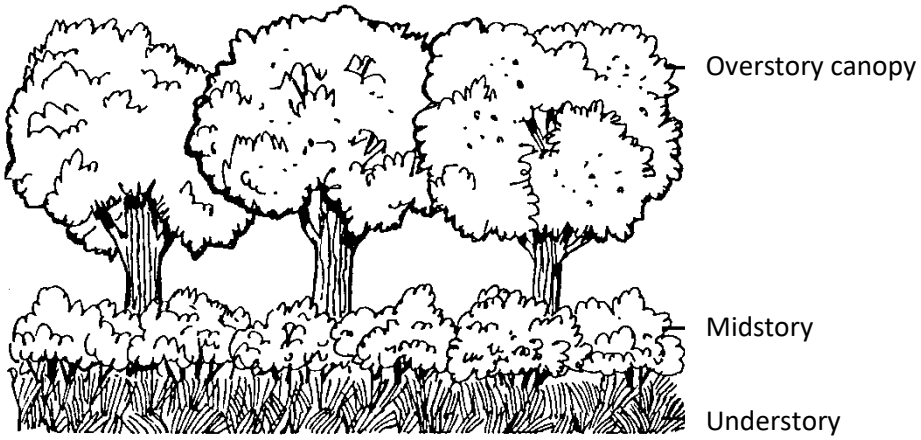


Figure 21. Vertical structure of a forest.

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. 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.

Figure 22. The vertical structure in this mature oak/hickory forest provides cover and food for a suite of forest songbird species that otherwise would not be found here.

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 commonly used to influence understory and midstory structure in forests and woodlands.

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.

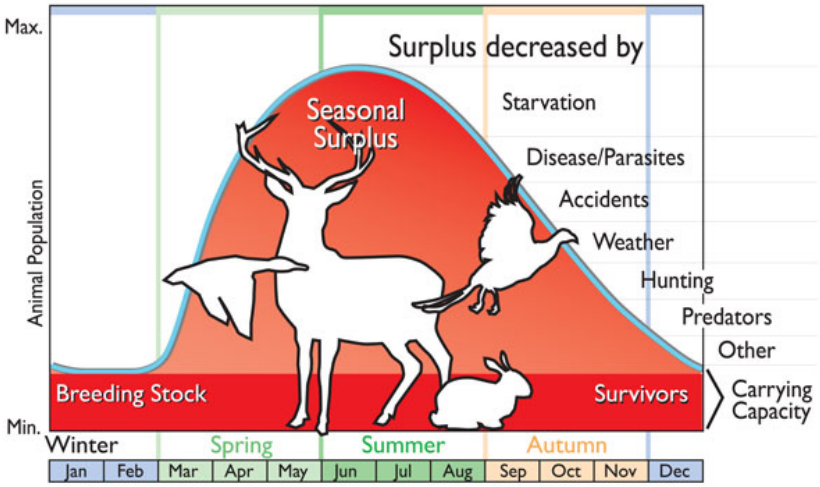


Figure 23. An illustration of factors affecting population fluctuations in relation to carrying capacity.

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.

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. Homeowners generally have low tolerance for deer feeding on expensive landscape plants. The deer population must be reduced to limit damage. In this case, the ***cultural carrying capacity*** (determined by human tolerance) is lower than the biological carrying capacity.

Figure 24. Chronic overbrowsing, by an overabundant deer herd has eliminated the forest understory.

Any area is only able to support a certain number of animals before available food and cover resources are depleted. In Figure 24, overabundant white-tailed deer have exceeded the carrying capacity of the area. Chronic overbrowsing has eliminated the forest understory. A lack of vegetation negatively affects many other wildlife species that require understory vegetation for nesting, feeding, roosting, or escape cover.

Compensatory and additive mortality

Annual mortality is the rate at which animals die per year. The mortality rate for a species is often estimated by biologists to help determine management efforts for that species. Animals die from many causes, including predation, diseases, malnutrition, weather, hunting, accidents, fighting, and others.

All 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 Arkansas 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. More food is available per animal and the likelihood of deer dying from starvation decreases. Mortality from hunting and mortality from malnutrition are ***compensatory***. As mortality from one cause is increased, the mortality rate of another is decreased. To relate this to the WHEP contest, ***Increase Harvest*** is a management practice that contestants 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***. Mortality from one year "adds up" to affect future populations and species survivability. 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 bobwhites survive through summer and fall. Thus, the bobwhite population going into winter may be quite low because of malnutrition, predation, and heat stress through the summer. If the population is at a critically low level, additional mortality from hunting through winter may be *additive*, especially if hunting pressure is equal to that in normal years. As related to WHEP contests, if the population of a game species has declined for some reason and is considered too low to sustain the level of mortality experienced recently by regulated hunting or trapping, the wildlife management practice of ***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 bobwhites to replenish the population when the breeding season begins. However, what if a late winter storm that dumps unusually deep snow and persists for a while? This can limit food availability even further, and 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 weather.

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***. Adaptive management is a structured management approach for addressing uncertainties by testing hypotheses, linking science to decision making, and adjusting implementation, as necessary, to improve the probability of restoration success. Adaptive harvest management has been used in North America to help determine the number of ducks hunters can harvest with the goal of sustainable waterfowl populations.

Home range, movements, migration, and corridors

A **home range** is the area in which an animal lives. Home range size is related to habitat quality. Daily movements include those for normal day-to-day activities. In higher-quality habitat, home ranges tend to be smaller than in poor habitat, because movements necessary to meet life requirements are reduced. A *seasonal home range* is the area an animal uses in a particular season of the year. A seasonal movement, or ***migration***, is made when an animal moves from one seasonal home range to another. Migration may represent movements to and from wintering and nesting areas, such as waterfowl and songbirds.

Migration distances may be short or very long, depending on the species. Long migrations for some species require habitat along the route to stop, rest and eat. Wildlife managers with shorebird and waterfowl habitat consider this in landscape planning, which means habitat conditions might have to be considered among states, countries, or even continents.

Corridors (also described in this section) are areas that do not restrict movement and allow various wildlife species to move from areas within their home range or during migration. The type of vegetation within the corridor and the size (both width and length) of the corridor varies depending on the species. An example of a corridor might include a stream or river with trees and shrubs along both sides (the riparian zone) cutting through a large grassland. The wooded, riparian corridor facilitates movement for squirrels, deer, wild turkey, and other species that require or otherwise seek the security of wooded cover to cross a broad open area. A smaller version of such a corridor would be a hedgerow traversing a large field. Other examples of corridors might include 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***. It takes an enormous number of individual plants (or amount of phytoplankton) to support the other parts of a food web.

- In terrestrial ecosystems, plants are primary producers in a food chain because they supply food at the lowest level of the food chain.
- In aquatic ecosystems, phytoplankton (microscopic algae) is the base of the pond food chain.
- At the next level of a food chain are primary consumers, plant-eating animals or herbivores. Primary consumers include rabbits, mice, deer, and certain other mammals; some insects and fish; and dabbling ducks, geese, and certain other birds. In aquatic ecosystems, zooplankton and aquatic insects feed on phytoplankton.
- Primary consumers are eaten by secondary consumers, or carnivores (meat-eaters). This group includes predators, such as birds of prey, snakes, foxes, cats, and people. In aquatic ecosystems, zooplankton and aquatic insects are eaten by small fish. Small fish are eaten by larger fish.

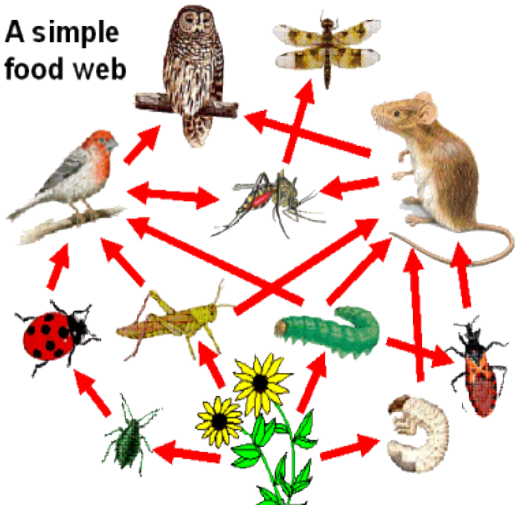


Figure 25. A simple food web. Source: John R. Meyer, North Carolina State University

- Secondary consumers are eaten by tertiary consumers, which may be predators or scavengers, such as turkey vultures, crabs, and sometimes people. Predators 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.
- 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.

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.

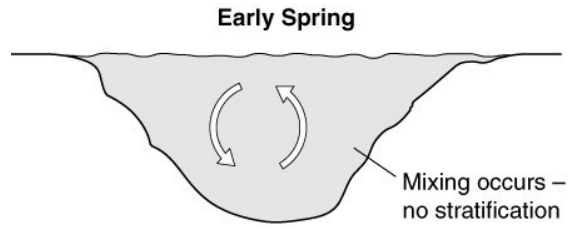
Pond dynamics and balance

Thousands of farm ponds dot the landscape across rural Arkansas. These non-free flowing bodies of water are considered to be ponds when they are less than 20 acres. What's more, they are scenic, functional, and deeply affected by the interplay of a host of environmental factors, such as temperature, oxygen content, nutrients, and biological activity.

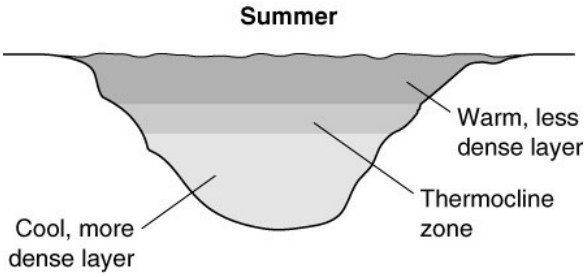
Ponds and temperature

Take the case of changing temperatures within a pond. Water reaches its maximum density, or weight, when its temperature is 39 F. As temperatures either drop below or rise above 39 F, water density lessens. This is important because water density has a major effect on the stratification, or layering, of water. And stratification can sometimes affect oxygen levels available for fish and other aquatic life. To understand how this can happen, take a look at the seasonal stratification process.

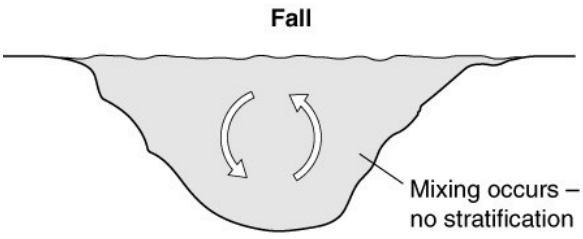
Spring. In early spring, the different layers of water mix. But as surface water warms, it decreases in density or weight. A layer of warmer, less dense water forms on top, while the cooler, denser water forms a layer near the bottom of the pond. Stratification has begun.



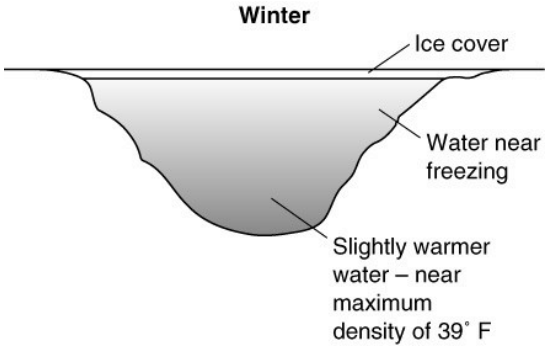
Summer. As summer progresses, so does stratification. The warmer water remains on top, while the cooler water stays below. In between the two layers, a transition zone forms during the summer. This "thermocline" zone is characterized by a rapid change in temperature.



Fall. During fall, stratification disappears, allowing surface and deeper waters to mix. This is sometimes known as the "fall turnover" and may be characterized by a temporary change in water color or turbidity (cloudiness). As water mixes, sediment from the bottom is stirred up, causing the water to become a muddy brown.



Winter. Stratification returns in winter. A layer of colder water (near freezing) forms on top, just beneath the ice cover, while slightly warmer water (near 39 F) stays close to the bottom.



This pattern is the typical way in which stratification plays out over the seasons. But problems can arise if the pond's "turnover" occurs prematurely during the summer. If there is a heavy, cold rain, the cold, dense water sinks, causing oxygen-depleted water at the bottom to mix with the surface waters. The result: There is less oxygen in the surface water. In some cases, "catastrophic oxygen depletion" can even lead to a large fish kill in the pond.

Ponds and dissolved oxygen

In addition to the problems posed by premature turnover, ponds can become oxygen depleted for other reasons—such as when there is an overabundance of microscopic plants (which give the pond a green color) coupled with several cloudy days.

Photosynthesis by aquatic plants produces oxygen during the day. But at night, these plants consume a lot of the oxygen. Therefore, if you have several cloudy days, the plants may not produce as much oxygen by day—and then they deplete the oxygen at night. This can lead to early morning fish kills. Other factors that affect oxygen levels include the following:

- ***Temperature.*** Warmer water holds less dissolved oxygen than cold water.
- ***Biological Oxygen Demand*** (BOD). This is the amount of oxygen required for microbes as they decompose organic materials. Large amounts of decomposing material create a high BOD, lowering dissolved oxygen levels for fish.
- ***Time of year***. If a pond is covered by ice and snow in winter, dissolved oxygen content can plummet, leading to winter fish kills. Seasonal turnover of water can also create low dissolved oxygen levels near the surface.

Ponds and nutrients

Nutrients such as nitrogen and phosphorus are essential for aquatic plants and microbial activity. However, excessive levels of these nutrients can create an overabundance of plant growth. Surface runoff from nearby lawns or fields that have been fertilized can lead to excessive weed growth, including filamentous algae—better known as "pond scum."

Ponds and biological activity

Depending on the depth of the pond, two or three biological zones may be present.

- ***The Littoral Zone*** is close to shore. It has an abundance of rooted and floating plants, and it contains a diverse biological community.
- ***The Limnetic Zone*** is found in deeper water away from the shore. It contains a large amount of microscopic organisms.
- ***The Profundal Zone*** is the lowest zone, found only in deep ponds. It receives little or no sunlight, and organisms rely on the settlement of organic matter to the bottom for survival.

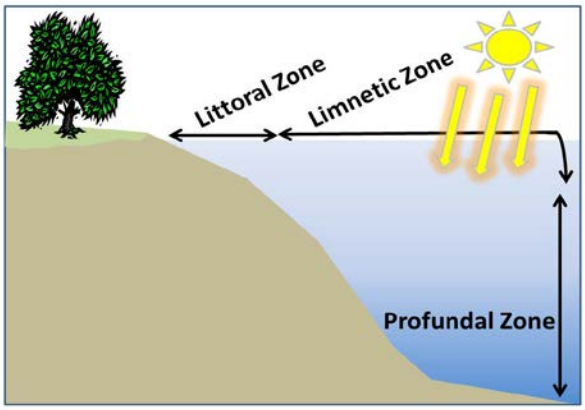


Figure 26. Illustration of pond depths.

All ponds require some aquatic plants to be present for fish habitat and oxygen replenishment. Living trees along the shoreline provide shade, as well as organic matter for fish to feed on. Dead trees in ponds provide habitat for aquatic insects and cover for young fish.

Phytoplankton (microscopic algae) are the base of the pond food chain. Zooplankton and aquatic insects feed on phytoplankton, which are eaten by small fish. Small fish are eaten by larger fish. Managing phytoplankton through fertilizing and liming (if necessary) is the key to producing abundant and healthy fish populations. Suspended mud in ponds blocks sunlight, and algae cannot bloom. Low water levels can cause significant problems also. Improperly constructed or damaged spillways can lead to excessive dam erosion. Low water levels, resulting from damaged spillways or improperly sloped banks, can lead to excessive aquatic vegetation along pond margins.

A properly managed pond can provide excellent fishing. The basics of a well-managed pond are properly stocking the right species, a balanced harvest, proper fertilization, a stable water level and aquatic weed control. Pond balance occurs when a balance between prey and predator fish is established and maintained. In most warm-water ponds, bluegill is the prey species and largemouth bass is the predator species. In cold-water ponds, a trout species is usually the predator, and insects and small fish are prey. Balance between predator and prey is achieved by establishing an adequate food chain for the prey species and controlling the prey and predator species numbers through fishing.

Each pond, no matter how small, is a dynamic aquatic ecosystem. As with any ecosystem, a change in one part of the system will affect the other parts. So be sure to consider all aspects when managing your pond.

Stream habitat

A stream can be defined as a body of water moving in a definite pattern and following the course of least resistance to a lower elevation. Because water volume and rate of land erosion fluctuate along the course of the stream, the bottom and shoreline are relatively unstable. As the water moves, it carries materials that have been picked up—such as gravel, sediment and debris—and redistributes them along the stream course. When water flow is restricted to a narrow area, the stream can create more erosion, resulting in deeper areas or pools. As the stream passes through wider passages, the water flow slows and material is deposited to form areas known as riffles.

Pools and riffles are important habitat features for various fish species that inhabit streams. Pools provide areas for fish to feed and find refuge from fast-moving water that requires more energy for swimming. Riffles are usually preferred areas for spawning. It is important that fish have the ability to move freely between various features in the stream. While 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.

Riparian buffers (such as grass or forest plant communities) are important to filter sediment entering aquatic systems. They can also regulate water areas and provide wildlife habitat. ***Riparian buffers*** are vegetated areas along streams and ponds. They may be forested or grassy depending on the water body. Vegetated buffers are important to maintain streambank stability as the roots of the vegetation along the stream help to hold the soil in place along the stream. Additionally, the above ground vegetation in buffers filters sediment from water moving into the stream or pond after rainfall events. Water quality is impacted by the amount of buffer along these wetlands. Finally, buffers of vegetation provide shade to keep the water temperatures during summer lower, which may allow for cold-water fish species to survive.

Figure 27. Clean water is essential for healthy aquatic life. Water quality is improved and fish populations benefit when sufficient vegetation is present along riparian areas to buffer sedimentation and nutrient run-off.

Acknowledgments: Portions on ponds adapted from Pond Dynamics in Land and Water, Conserving Natural Resources in Illinois, prepared by Duane Friend and Dave Shiley, University of Illinois Extension, October 2005, Number 9.

Definitions of Food Groups

Aquatic Plants: a plant that grows partly or wholly in water, whether rooted in the mud, or floating without anchorage; plants that require constantly moist conditions without standing water are included in this group; for the purpose of this contest, only examples from the following genera will be considered.algae of various genera; American lotus, *Nelumbo*; arrowhead/duck potato, *Saggitaria*; big duckweed, *Spirodela*; bladderworts, *Utricularia*; bulrushes, *Scirpus*; burreeds, *Sparganium*; cattails, *Typha*; coontail *Cerratophylum*; cordgrass, *Spartina*; duckweed, *Lemna*; floating hearts, *Nymphoides*; naiads, *Najas*; pondweed, *Potomageton*; rushes, *Juncus*; sedges, *Carex*; smartweed, *Polygonum*; spikerush, *Eleocharis*; waterlily, *Nymphaea*; watermeals, *Wolffia*; watermilfoil, *Myriophyllum*; waterprimrose, *Ludwigia* and waterweed, *Elodea*

Bark: tough outer covering of trees and shrubs

Birds: may be represented by feathers, bones, skulls, feet or any part that distinguishes the class

Buds: a small protuberance on a stem or branch, sometimes enclosed in protective scales and containing an undeveloped shoot, leaf or flower; the bud may be represented on the branch or stem, or removed from the branch or stem

Carrion: stinking, rotting flesh; to be considered in this group, the item must have a definite odor of decomposition, be presented in a plastic bag or have the words “this stinks” on the display; a dry bone, a dry skin, or other body part does not represent carrion, but will represent other food groups; maggots are a natural occurrence with decomposition and may be present on the carrion, but they should not be considered in grouping the specimen as carrion

Crayfish: small freshwater decapod crustacean that resembles a lobster; regionally, they have many names including crawdads and crawdaddys

Earthworms: terrestrial worm that burrows into and helps aerate soil; often surfaces when the ground is cool or wet; used as bait by those who fish

Eggs: only the eggs of vertebrate species (mammals, birds, reptiles, amphibians, fish) are considered in this category; invertebrate eggs (insect and spider) represent the group of the adult invertebrate

Fish: a poikilothermic (cold-blooded) water-dwelling vertebrate with gills

Forbs: broad-leaved herbaceous plant, not including grasses, sedges, rushes or ferns; forbs may be represented by a single leaf or by the entire plant including the flower

Frogs & salamanders: includes toads; may be represented by the organism in any life stage except the egg

Fungi: kingdom of plantlike spore-forming organisms that grow in irregular masses without roots, stems, leaves and that lack chlorophyll

Grain: includes production agricultural crops of wheat, oats, rye, barley, rice, soybeans and corn; may be represented by the seed, seed head or entire plant including the seedhead. Other crops such as sunflower and milo are classified as “seeds” for purposes of this contest

Grass: leaves of grasses are usually tall and thin with a mid-rib and parallel veins; grasses may be represented by the entire plant including the seedhead, or by a single leaf or group of leaves

Hard mast: includes nuts from walnut, hickory, oak, beech, pecan, almond, and common hazel; may be shown with or without the husk

Insects and spiders: small invertebrate (*without a backbone*) animals; spiders are arachnids that usually has silk-spinning organs at the back end of the body; they spin silk to make cocoons for eggs or traps for prey

Leaves and twigs: this food group is represented by leaves and/or twigs of woody species only; ***not*** forbs, grasses or other herbaceous plants

Lizards: lizards are reptiles of the order Squamata, which they share with the snakes (Ophidians); they are usually four-legged, with external ear openings and movable eyelids

Mammals: any mammal regardless of size fits in this category; may be represented by a photograph, live animal, museum mount or any part of the mammal representative of the class, such as teeth or hair

Mussels: freshwater mollusks that may be represented by the whole organism or just a single shell or group of shells

Nectar: represented by the flower with no other plant parts present; or from a honey bee or hornet nest

Seeds: a fertilized ovule containing an embryo, which forms a new plant upon germination; seeds other than grain (commonly cultivated agriculture crops) – see definition of "grain" for comparison

Soft mast: display must include the soft, fleshy, pulp-covered seed of fruits or berries

Snails: applies to most members of the molluscan class Gastropoda that have coiled shells

Snakes: cold-blooded legless reptiles, which share the order Squamata with lizards

Tubers: represented by either the nutlet of the yellow nutsedge (chufa) or by potato

Turtles: animals with a special bony shell developed from their ribs; "turtle" is often used for aquatic species, but aquatic freshwater turtles are also often called "terrapins;" in North America, "turtle" is usually used to refer to all members of the order, including tortoises, which are predominantly land based

Glossary

aerate: to supply or expose water with air to increase dissolved oxygen and release harmful gases

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

altricial: (of a young bird or other animal) hatched or born in an undeveloped state and requiring care and feeding by the parents

basal area: space or area represented by tree stems at 4.5 feet above ground; for example, a basal area of 60 square feet per acre means that of 43,560 square feet of available space (1 acre), tree trunks represent 60 square feet of that space 4.5 feet above ground

broadleaf: a plant with wide blade leaves such as an oak or cottonwood. Seeds are born from flowering parts in contrast to conifers which bear seeds in cones

browse: *n*. leaves and ends of twigs of woody species; *v*. to eat browse

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

coastal plain: large, nearly level areas of land near ocean shores *("near" being a relative term, as is the case of Arkansas….)*

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

exotic: wildlife species which have never naturally existed in the wild in a particular geographic location

extinct: no longer in existence; a species that has ended or died out

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 (or "litter"): dead and decaying organic matter found on the ground such as leaves, branches and dead plants

habitat: the physical and biological resources (food, cover, water) required by a species within an area of sufficient size (space) for that species

hardwoods: usually refers to non-coniferous trees bearing leaves

herbaceous plants: grasses, forbs, sedges, rushes and ferns; plants having soft rather than woody stems

herbicide: chemicals used to kill or control the growth of undesirable plants

herbivore: a plant-eating animal

home range: the area used by an animal; usually described as the area that encompasses the daily, seasonal, and annual movements of an animal

insecticide: chemicals used to control insects

insectivore: an insect-eating animal

interspersion: the mixing of vegetation types or successional stages; high interspersion represents a lot of mixing; low interspersion represents little mixing

invertebrates: animals lacking a backbone; examples include insects, spiders, mollusks and crustaceans

irrigate: to water through diversion ditches and pipes

juxtaposition: the arrangement of vegetation types or successional stages

keystone species: plant or animal species with a disproportionate influence in its community relative to its abundance

landscape: an area that represents several interacting ecosystems; usually regional in reference

legume: plants that bear seeds in a pod; examples include lespedezas, clovers, soybeans, peas and black locust

mast: seeds of trees and shrubs that are eaten by wildlife. Hard mast refers to nuts such as acorns, while soft mast refers to berries of a variety of species.

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: death of individuals (see definitions for compensatory and additive mortality in *Wildlife Management Concepts and Terms)*

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

precocial: (of a young bird or other animal) hatched or born in an advanced state and able to feed itself almost immediately

regenerate: to replace lost or damaged parts with new tissue

rejuvenate: to stimulate and return to good health and vigor

riparian: the area adjacent to and influenced by a water source such as a creek, stream, river, pond, lake, swamp or other wetland

savanna: an area with scattered trees maintained by fire and/or grazing

scarifies: breaking down the protective coating on various species of seed allowing the seed to germinate; often facilitated by fire or digestion

secluded: occurring in a remote or other area where visibility is obstructed or reduced

sedge: grass-like plant, often associated with moist areas and usually with triangular stems

seedbank: seed occurring naturally in the top few inches of soil

senescent: the growth stage in a plant or plant part (like a leaf) from full maturity to death; old age

sere: a series of successional stages at a particular site, leading to a mature, climax community

seral stage: a successional stage in a sere

silviculture: the process of tending and managing a forest

slash: residue left on the ground after trees are harvested

softwood: usually refers to coniferous trees, though some deciduous trees such as red maple and aspen also have relatively soft wood

species: a type of organism whose members can freely interbreed with each other and genetically are very similar; do not necessarily interact or located together

stagnant: sluggish; not producing to potential

stocking rate: amount of land allotted to each animal for the entire grazable portion of the year

subclimax: successional stage occurring prior to climax stage, but further development is inhibited by some factor(s) other than climate

succession: replacement of one vegetation type or seral stage by another

succulent: having thick fleshy leaves that conserve moisture

sward: surface layer of ground containing a mat of grass and grass roots

terrain: referring to topography

thatch: accumulation of dead grass and leaves on the ground

threatened species: species which are likely to be at the brink of extinction in the near future.

transitional: the process of changing from one form to another

ungulate: a hoofed mammal, such as white-tailed deer, elk, and wild pig

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

Contestant Name:_____ ID Code:_____

Print Clearly

Wildlife Foods & Concepts Scorecard

Directions: Write the letter or answer in the blank. Turn in your completed scorecard to the station monitor.

1._____ 16._____

2._____ 17._____

3._____ 18._____

4._____ 19._____

5._____ 20._____

6._____ 21._____

7._____ 22._____

8._____ 23._____

9._____ 24._____

10._____ 25._____

11._____ 26._____

12._____ 27._____

13._____ 28._____

14._____ 29._____

15._____ 30._____

TOTAL CORRECT:_____

Wildlife Foods

Southeast Mixed Forest & Outer Coastal Plain

Wildlife Species	barred owl	bluegill	channel catfish	coyote	eastern cottontail	eastern fox squirrel	largemouth bass	loggerhead shrike	mourning dove	northern bobwhite	prothonotary warbler	raccoon	red-cockaded woodpecker	red-eyed vireo	white-tailed deer	wild pig	wild turkey	wood duck
Categories																		
Aquatic Plants																		
Bark																		
Birds																		
Buds																		
Carrion																		
Crayfish																		
Earthworms																		
Eggs																		
Fish																		
Forbs																		
Frogs & salamanders																		
Fungi																		
Grain																		
Grass																		
Hard Mast																		
Insects & spiders																		
Leaves & twigs																		
Lizards																		
Mammals																		
Mussels																		
Nectar																		
Seeds																		
Snails																		
Snakes																		
Soft Mast																		
Tubers																		
Turtles																		
Foods prepared for human or pet consumption																		

Interpreting Wildlife Habitat from Satellite Images - Description

Objective
The objective of the Interpreting Wildlife Habitat from Satellite Images activity is for contestants to demonstrate their ability to interpret and apply satellite images to wildlife habitat needs.

Overview
For this activity, contestants need to:

- know habitat needs of wildlife species in the announced ecoregion; and
- identify features and interpret wildlife habitat from satellite images.

This activity includes stations where contestants will be presented with satellite images for responding to questions listed on a scorecard.

Contest Rules

1. Contestants need to bring pencils and a clipboard for this event.
2. Contestants will complete the scorecard individually, thus no talking is allowed.
3. The question format typically is matching and multiple choice, though true/false and fill-in-the-blank questions may be asked.
4. This activity includes stations with satellite images for responding to questions.
5. Contestants will be given 30 minutes to answer questions and record information on a score sheet.

Content Areas
Questions may require knowledge of portions of the handbook including Satellite Image Interpretation, Wildlife Concepts and Terms, and Wildlife Species Descriptions for those species in the announced region.

Juniors and Seniors

Identifying features and interpreting wildlife habitat from satellite images is important for understanding types of habitat present, and where certain wildlife habitat practices can be implemented.

Contestants will be asked to identify map features. A feature, such as a stream, road, or deciduous forest will be marked on the map for identification and selection from a list of map features. Note that the scorecard lists examples of the types of features that may be identified. Some of these features may change from year to year.

Contestants will be asked to compare which habitat is best for a particular wildlife species. For example, white-tailed deer prefer areas with a lot of edge habitat compared to an eastern fox squirrel, which prefers mature forests.

Interpreting Wildlife Habitat from Satellite Images

Study Guide

Satellite images can be used to evaluate potential habitat for wildlife. This is especially helpful when evaluating property from a landscape scale. The proportion of open area to forested area, and the presence or need for riparian corridors or other travel corridors are sometimes not evident "on the ground," thus a view from above is often very helpful.

It is important to realize satellite images do not replace the need for on-site habitat evaluation. While large differences in vegetation types or successional stages (landscape composition) may be evident in satellite images, vegetation composition and structure cannot usually be discerned. Although an image containing almost all Stage 6 eastern deciduous forest could be considered better habitat for Eastern gray squirrels than an image containing almost all Stages 3 and 4, that distinction could not be made for more general species, such as white-tailed deer or wild turkey. The dominant tree species and structure of the understory in the forest would greatly influence habitat quality for deer and turkeys. Likewise, the species of grass, forbs and shrubs would influence habitat quality in Stages 3 and 4. These fine-scale habitat features must be evaluated on the ground, thus assessing satellite images as habitat for various wildlife species is often not possible without on-site verification.

Interpreting Satellite Images

When looking at satellite images, imagine how the countryside would look if you were a bird flying over or if you were in an airplane. For example, buildings look like squares or rectangles, silos appear round, woods are rough and hayfields are smooth.

Satellite images are like maps. They are full of useful and interesting information, provided you have a key. They can show us how much an area has changed, how well our crops are growing, where a fire is burning, or when a storm is coming. Wildlife scientists use satellite images to prepare habitat suitability models and identify priority areas for wildlife conservation. They help map where habitat practices can be implemented on someone's property.

To unlock the rich information in a satellite image, you need to:

1. Look for a scale
2. Look for patterns, shapes, and textures
3. Define the colors (including shadows)
4. Find north
5. Consider your prior knowledge

These tips come from the Earth Observatory's writers and visualizers at NASA, who use them to interpret images daily. They will help you get oriented enough to interpret satellite images for 4-H WHEP.

1. Look for a Scale

One of the first things people want to do when they look at a satellite image is identify the places that are familiar to them: their home, school, or place of business; a favorite park or tourist attraction; or a natural feature like a lake, river, or mountain ridge. Such satellites zoom in on small areas to collect fine details down to the scale of individual houses or cars.

You can learn different things at each scale. For example, when tracking a flood, a detailed, high-resolution view will show which homes or farms are surrounded by water. The wider landscape view shows which parts of the county are flooded and perhaps where the water is coming from. A broader view would show the entire region—the flooded river system or the mountain ranges and valleys that control the flow. A hemispheric view would show the movement of weather systems connected to the floods.

The level of detail depends on the satellite's spatial resolution. Like digital photographs, satellite images are made up of little dots called pixels. The width of each pixel is the satellite's spatial resolution. Depending on the image resolution, a city may fill an entire satellite image with grids of streets or it may be a mere dot on a landscape. Before you begin to interpret an image, it helps to know what the scale is. Does the image cover 1 mile or 100? What level of detail is shown?

Wildlife biologists who work with private landowners need to identify different map features at a small scale when writing a habitat plan. For the 4-H WHEP contest, the level of detail for wildlife habitat planning from satellite imagery generally will be between 1000 to 3000 feet per inch. (Note that the length of the scale on Google Earth images on screen is about one and a half inches when printed on paper.)

2. Look for patterns, shapes, and textures

If you have ever spent an afternoon identifying animals and other shapes in the clouds, you'll know that humans are very good at finding patterns. This skill is useful in interpreting satellite imagery because distinctive patterns can be matched to external maps to identify key features. Bodies of water—rivers, lakes, and oceans—are often the simplest features to identify because they tend to have unique shapes and they show up on maps.

Straight lines and geometric shapes in this image are a result of human land use. Roads cut diagonally across the squares that define farm fields. Other obvious patterns come from the way people use the land, such as from this image taken south of Clarendon, Arkansas. Farms usually have geometric shapes—circles or rectangles—that stand out against the more random patterns seen in nature. A straight line anywhere in an image is almost certainly human-made, and may be a road, a drainage ditch, a power line right-of-way, or some kind of boundary made visible by land use.

When a forest is clearcut, the clearing can be often square or run along a roadway as in the image below from Saline County. Riparian corridors have been left along streams. Planted trees appear as a series of herring-bone lines that form along roads. Various shades of green identify timber stands of different ages. Logging decks appear as rectangular-shaped patches of bare ground. These can be distinguished from the greenish cast of a pond or lake.

Geology shapes the landscape in ways that are often easier to see in a satellite image. Mountain ranges tend to run in long, sometimes wavy lines. Geologic features create visible textures. Cliffs can be squiggly or dark lines framed by shadows. Mountains look like wrinkles or bumps. The image below is taken along the Buffalo River east of Jasper, Arkansas.

Occasionally, shadows can make it hard to tell the difference between mountains and valleys. This optical illusion is called relief inversion. It happens because most of us expect an image to be lit from the top left corner. When the sunlight comes from another angle (especially from the lower edge), the shadows fall in ways we don't expect and our brains turn valleys into mountains to compensate. The problem is usually resolved by rotating the image so the light appears to come from the top of the image.

3. Define Colors

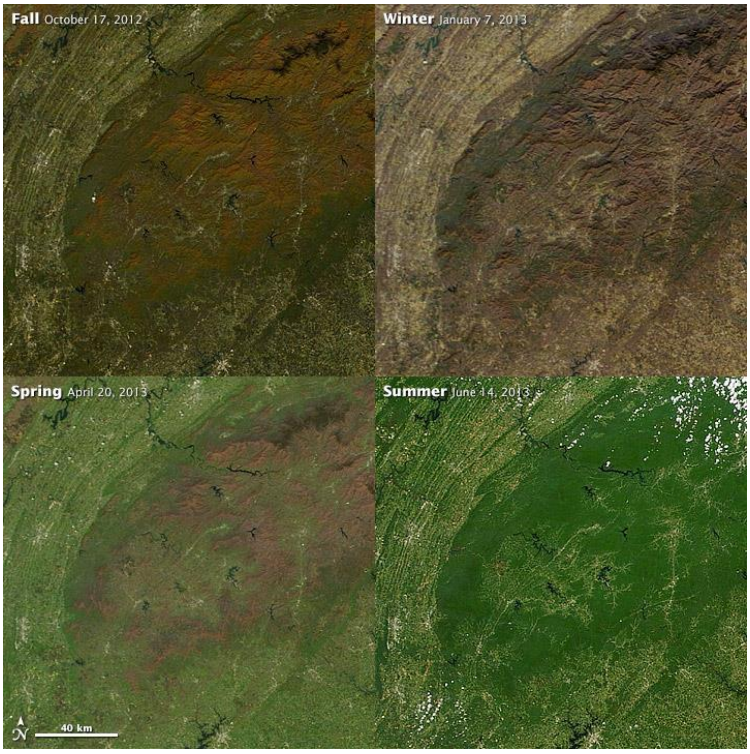
The colors in an image will depend on what kind of light the satellite instrument measured. True-color images use visible light—red, green and blue wavelengths—so the colors are similar to what a person would see from space. False-color images incorporate infrared light and may take on unexpected colors.

Water absorbs light, so it is usually black or dark blue. Sediment reflects light and colors the water. When suspended sand or mud is dense, the water looks brown. As the sediment disperses, the water's color changes to green and then blue. Shallow waters with sandy bottoms can lead to a similar effect.

Sunlight reflecting off the surface of the water makes the water look gray, silver, or white. This phenomenon, known as sunglint, can highlight wave features or oil slicks, but it also masks the presence of sediment or phytoplankton.

Frozen water—snow and ice—is white, gray, and sometimes slightly blue. Dirt can give snow and ice a tan color.

Plants come in different shades of green, and those differences show up in the true-color view from space. Grasslands tend to be pale green, while forests are very dark green. Land used for agriculture is often much brighter in tone than natural vegetation.



In some locations (high and mid latitudes), plant color depends on the season. Spring vegetation tends to be paler than dense summer vegetation. Fall vegetation can be red, orange, yellow, and tan; leafless and withered winter vegetation is brown. For these reasons, it is helpful to know when the image was collected.
The forests covering the Great Smoky Mountains of the Southeastern United States change colors from brown to green to orange to brown as the seasons progress. [National Aeronautics and Space Administration (NASA) images courtesy Jeff SchmaltzLANCE/EOSDIS MODIS Rapid Response Team, GSFC.]

Bare or very lightly vegetated ground is usually some shade of brown or tan. The color depends on the mineral content of the soil. When the ground is white or very pale tan, especially in dried lakebeds, it is because of salt-, silicon-, or calcium-based minerals. Newly burned land is also dark brown or black, but the burn scar fades to brown before disappearing over time.

Residential areas, cities, and other densely built areas are typically silver or gray from the concentration of concrete and other building materials. Some cities have a more brown or red tone depending on the materials used for rooftops.

Clouds are white and gray, and they tend to have texture just as they do when viewed from the ground. They also cast dark shadows on the ground that mirror the shape of the cloud. Some high, thin clouds are detectable only by the shadow they cast.

Smoke is often smoother than clouds and ranges in color from brown to gray. Smoke from oil fires is black. Haze is usually featureless and pale gray or a dingy white. Dense haze is opaque, but you can see through thinner haze. The color of smoke or haze usually reflects the amount of moisture and chemical pollutants, but it's not always possible to tell the difference between haze and fog in a visual interpretation of a satellite image. White haze may be natural fog, but it may also be pollution.

Dust ranges in color, depending on its source. It is most often slightly tan, but like soil, can be white, red, dark brown, and even black due to different mineral content.

Colors in Context. Looking at a satellite image, you see everything between the satellite and the ground (clouds, dust, haze, land) in a single, flat plane. This means that a white patch might be a cloud, but it could also be snow or *sunglint.* The combination of context, shape, and texture will help you tell the difference. For example, shadows cast by clouds or mountains can be easy to mistake for other dark surface features like water, forest, or burned land. Looking at other images of the same area taken at another time can help eliminate confusion. Most of the time, context will help you see the source of the shadow—a cloud or mountain—by comparing the shape of the shadow to other features in the image.

4. Find North

When you get lost, the simplest way to figure out where you are is to find a familiar landmark and orient yourself with respect to it. The same technique applies to satellite images. If you know where north is, you can figure out if that mountain range is running north to south or east to west, or if a city is on the east side of the river or the west. These details can help you match the features to a map. Most images are oriented so that north is up. Look for a north arrow or indicator on the image to be certain.

5. Consider your Prior Knowledge

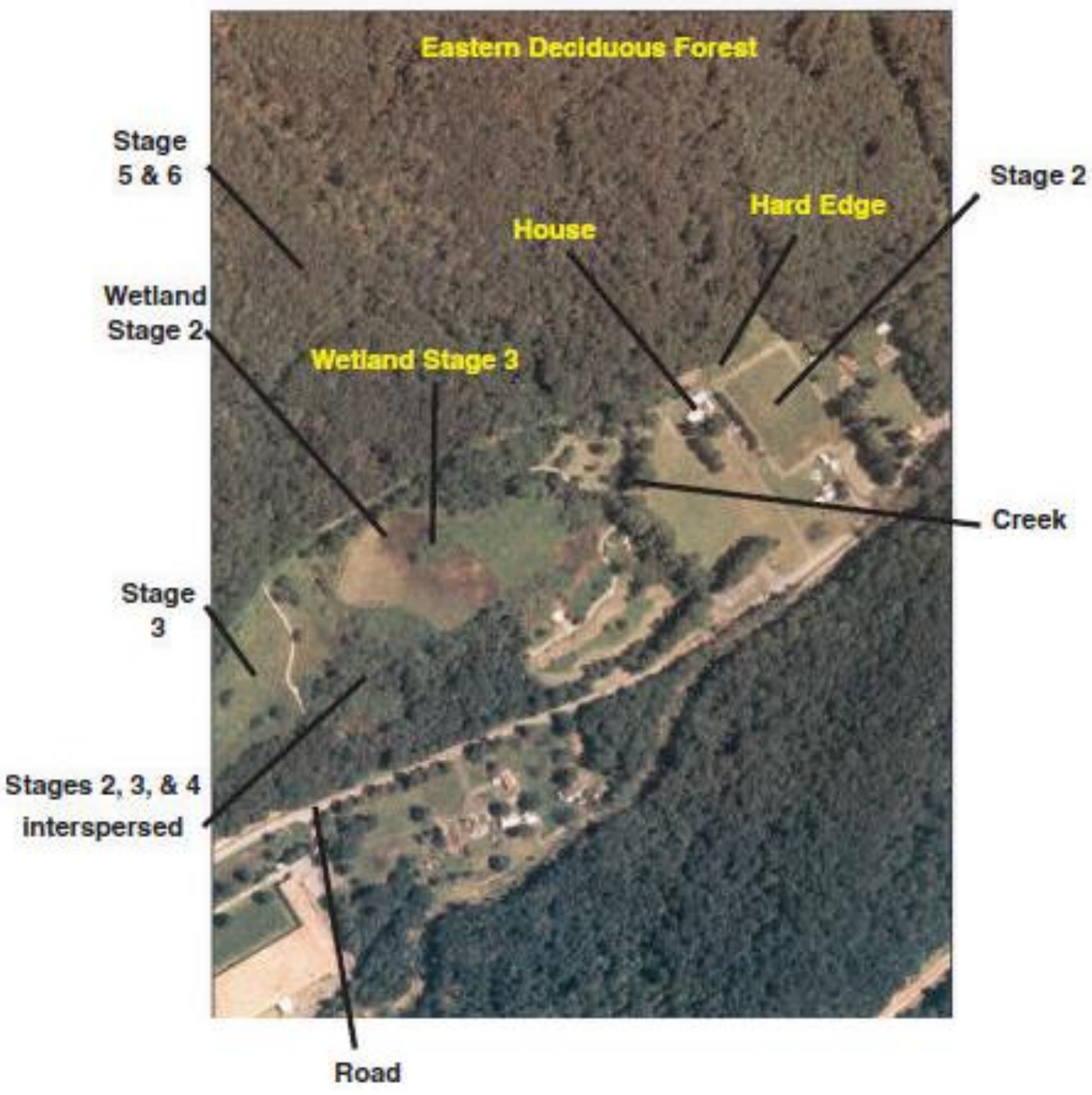
Perhaps the most powerful tool for interpreting a satellite image is knowledge of the place. If you know that a wildfire burned through a forest last year, it's easy to figure out that the dark brown patch of forest is probably a burn scar. Having local knowledge also allows you to connect satellite mapping to what's happening in everyday life, from social studies, economics, and history (for example, population growth, transport, food production); to geology (tectonics); to biology and ecology (plant growth and ecosystems); to politics and culture (land and water use); to chemistry (atmospheric pollution); and to health (pollution, habitat for disease carriers).

What's the best way to build your knowledge? Explore places you know on Google Earth (www.earth.google.com) in your quest to interpret satellite images. Look at what you see on the ground, and compare it to the satellite image.

Adapted with permission from **How to Interpret a Satellite Image: Five Tips and Strategies** by Holli Riebeek, November 18, 2013, at NASA Earth Observatory website. URL:www.earthobservatory.nasa.gov/Features/ColorImage/

Applying Satellite Images to Wildlife Habitat Management

When using satellite images, it is important to be able to identify certain features such as rivers/streams, ponds/lakes, structures (houses, barns, commercial buildings), stages of succession, agricultural land, pasture, hard edge, soft edge, residential/urban areas, roads, power lines, etc. The most important information obtained from a satellite image is the general landscape composition and the interspersion and arrangement of vegetation types and successional stages.



Comparing Wildlife Habitat from Satellite Images

Below are sample satellite images and descriptions, followed by an analysis of their habitat suitability for selected wildlife species.

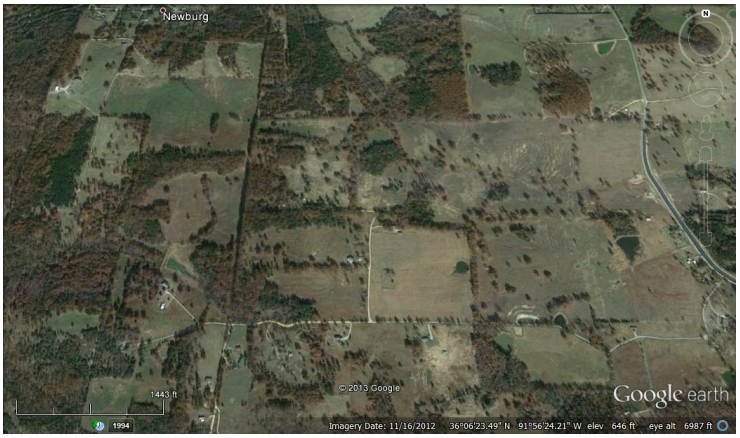


Image 1

Image 2

Image 3

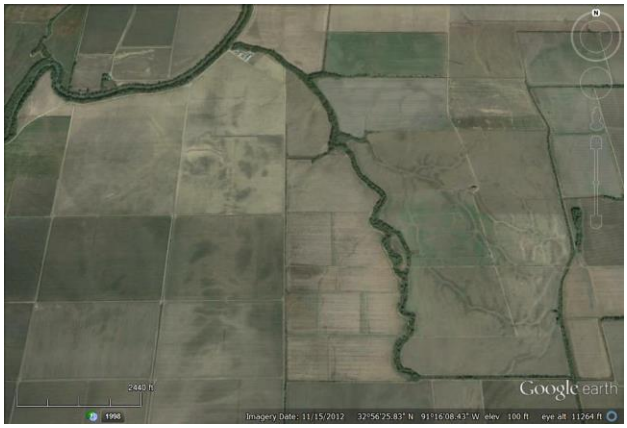


Image 4

Image 1 contains mostly Stage 3 with scattered Stage 4 and some mature deciduous trees located along drainages and field edges. There is a main road and a few secondary roads in the image. There is a pond in the upper left quadrant of the image. The area shown in this image would probably be adequate for species that require interspersion of Stages 2, 3, and 4, with some stages 5 and 6. However, habitat quality is difficult, if not impossible, to determine because the species of grass and forbs as well as the shrubs and trees cannot be identified. Because the fields have obviously been managed, they probably contain non-native species and probably do not provide adequate structure or represent optimal early successional habitat.

Image 2 is a mature deciduous and pine forest, Stage 6. Many tributaries drain into a stream or river running through the middle of the image. Tree species composition, as well as the struc-

ture and composition of the understory, is unknown. Nonetheless, this area would probably provide adequate habitat for wildlife that require mature forest for their habitat needs.

Image 3 contains approximately one-fifth mature pine forest, one-fifth Stage 5 and 6 deciduous forest, one-fifth in Stage 4, and two-fifths Stages 2 and 3. There is a secondary road leading to an area of bare ground on the left border of the image, with a portion of a pond or lake nearby. A power line right of way cuts diagonally across the upper left corner. A number of other roads can be seen running through the pine forest at the upper right quadrant of the image. The area is likely to provide suitable habitat for species that require a mixture of vegetation types and successional stages.

Image 4 is an agricultural setting, composed of cropfields and haylands. Types of crops and plant species in the hay pastures are unknown. Tree/shrub cover is completely lacking, except for along roads and streambanks. With a lack of structural cover, little water and continual disturbance, this area would provide habitat for very few wildlife species.

The habitat quality of these satellite images depends on the focal species and its habitat needs. Being able to assess habitat using satellite imagery will help prepare contestants for this portion of the contest. Determining the best habitat requires knowledge of the particular stages of plant succession preferred by the wildlife species. The summary table is a comparison of best and worst habitat using the four images for several selected wildlife species, followed by a discussion for each species.

Table: Habitat evaluation for wildlife species using four satellite images.

	Satellite Image #	
Species	**Best Habitat**	**Worst Habitat**
American Kestrel	1	2
Bluegill	1	4
Brown Thrasher	3	4
Eastern Bluebird	1	2
Eastern Cottontail	1	2
Eastern Gray Squirrel	2	4
Mourning Dove	4	2
Hairy Woodpecker	2	4
Northern Bobwhite	1	2
Ovenbird	2	4
Raccoon	3	2
White-tailed Deer	3	4
Wild Turkey	3	4
Wood Duck	3	1

- **American kestrels** prefer large open areas in Stages 2 and 3 of plant succession interspersed with areas in Stages 4, 5, and 6 of plant succession. Image 1 fits this well. Image 3 also supplies this type of habitat, but has less area in Stage 2 or 3 of plant succession and is rated lower than area 2. Image 4 has large open areas, but has little interspersion of other plant succession stages. Image 2 does not have any open areas and thus is ranked last.

- **Bluegill** would prefer habitat with ponds or permanent streams, so Image 1 is preferred with 5+ ponds. Image 3 has a portion of a lake and tree-lined stream or marsh which provides suitable habitat, but is more difficult to manage for bluegill because of its size and presumably lack of water control structures. Image 3 is preferred over Image 2 because Image 3 has a lake. Image 2 has a permanent stream which is also suitable habitat, and is preferred over Image 4 because of streambanks protected on both sides with large forested buffers. Image 4 has small possibly intermittent streams and ditches with minimal buffers or forest cover, and therefore less preferred than Image 2. Image 4 is least preferred.

- **Brown thrashers** prefer dense shrub thickets. Image 3 supplies the greatest amount of this type of habitat. Image 1 has more area in Stage 4 of plant succession than either Image 2 or 4. Images 2 and 4 are difficult to judge. In this instance, we would assume there is more shrub cover associated with the woodland area in Image 2 than what is shown in Image 4.

- **Eastern bluebirds** would most prefer Image 1 and least prefer Image 2. They like to nest in tree cavities adjacent to open fields and prefer open fields for feeding. They are found in early successional habitat (Stages 2 and 3) interspersed with shrubs and woodlands (Stages 4, 5 and 6). Image 3 would be second-best because of the woodland-field edge, but has less interspersion than Image 1. Image 4 has a few trees and we presume a few tree cavities, and therefore is third. Image 2 has no open fields and is least preferred.

- For **Eastern cottontails**, Image 1 is the best and Image 2 is the worst. Image 1 is preferred because it has nearly the proper ratios of habitat components for rabbits (one-third grassland, one-third cropland, and one-third shrub cover), and they are well interspersed (mixed together). Image 3 has less interspersion, but more habitat diversity (different kinds of habitat) than Images 2 and 4. Image 4 has plenty of grass and cropland, but little shrub cover. Image 2 has very little to none of the habitat components for rabbits.

- **Eastern gray squirrels**, **hairy woodpeckers** and **ovenbirds** prefer Stages 5 and 6 deciduous woodland, and therefore Image 2 is most preferred. Image 3 would be second and Image 1 third, because of the amount of tree cover. Image 4 is least preferable because it lacks trees.

- **Mourning doves** prefer Image 4 and least prefer Image 2. Since doves prefer open fields for feeding, habitat suitability is based on the amount of open fields available. Second would be Image 1 followed by Image 3, because of the amount of open fields.

- For **Northern bobwhites**, Image 1 is the best and Image 2 is the worst habitat. The reasons are similar to those of cottontail rabbits. However, in some judging instances, images may

be rated differently for bobwhites than cottontails. For example, bobwhites do not need quite as much shrub cover as cottontails.

- **Raccoons** would prefer the areas in Image 3 the most and Image 2 the least. All images have streams or open water that attract raccoons. Image 3 is ranked ahead of others since it has riparian areas and wetlands interspersed with mature trees for denning sites, and with open fields. Image 1 is ranked ahead of Images 2 and 4 because of interspersed successional stages near open water. Because raccoons prefer agriculture habitat, and because some trees are present along riparian corridors, Image 4 barely beats Image 2, which lacks agriculture.

- For **white-tailed deer**, habitat in Image 3 would be most preferred and Image 4 least preferred. Deer prefer woodland areas interspersed with areas in various stages of succession. Image 3 fits this well; it includes three plant succession stages. Image 3 is ranked ahead of 1, since it has larger contiguous areas of Stages 5 and 6. Image 1 is selected over Image 2 because of the interspersed successional stages it offers. Image 4 is too open, so Image 2 is picked third and 4 last.

- For **wild turkey**, habitat in Image 3 is most preferred and Image 4 is least preferred. Generally turkeys need one-fourth to one-half of their range open, and one-half to three-fourths mature woodland. Image 3 is preferred because it has roughly one-half the area in mature woodlands, and nearly one-fourth the area is open. Image 1 is second, as it has both open areas and mature woodland. However, it does not meet the mature woodland requirement as well as Image 3. Image 2 is ranked third because it has more timber than Image 4 and more cover in general. Due to the absence of woodlands, it is doubtful if Image 4 could support a turkey population.

- **Wood ducks** would prefer Image 3 the most and Image 1 the least. Wood ducks prefer wetlands and flooded bottomland hardwood forests. A lack of mature woodlands surrounding water sources, plus smaller sizes of water sources, are of concern in Image 1. Both Images 3 and 4 require improvements equally to attract wood ducks. Image 3 needs flooded timber and Image 4 needs more trees in flooded areas to attract wood ducks.

Resources for Satellite Images

Google Earth (www.earth.google.com) maps are good resources for samples of satellite images. Additional articles and educational activities about interpreting satellite images are available on the NASA Earth Science Week web site, Mapping Our World (http://nasaesw.strategies.org/).

Contestant Name:_____ ID Code:_____

Interpreting Wildlife Habitat from Satellite Images
JUNIORS

Map Features

Letter	**Feature**
1. _____	A. Small stream
2._____	B. River
	C. Pond or lake
3. _____	D. Dirt or gravel road
4._____	E. Highway
	F. Building
5. _____	G. Tree(s)
6._____	H. Gravel or sand bar
	I. Crop field
7. _____	J. Pasture (improved)
8._____	K. Fence row
	L. Bluff
9. _____	M. Island
10._____	N. Power line right-of-way

	Best Habitat *(circle one)*		
11.	A	B	wild turkey
12.	A	B	red-eyed vireo
13.	A	B	channel catfish
14.	A	B	prothonotary warbler
15.	A	B	eastern cottontail
16.	A	B	loggerhead shrike
17.	A	B	wild pig
18.	A	B	northern bobwhite
19.	A	B	white-tailed deer
20.	A	B	red-cockaded woodpecker

Total Score (20 points):_____

Education Activity

Junior Event

Objective

Juniors will learn about a special topic pertaining to wildlife.

Overview

The primary purpose of WHEP is to help 4-Hers learn about wildlife and habitat management. A wildlife professional, park naturalist, or other natural resource professional will give a presentation about a wildlife topic to expand contestants' knowledge or skills. One or more of these presentations will be offered during the contest day. Contestants will receive contest points for attending one or more of these education activities.

A presentation for the Education Activity may occur:

- during the contest as part of the other contest activities; and/or
- after Juniors have been dismissed from the other contest activities (i.e., Wildlife Identification, Wildlife Challenge, and Wildlife Habitat Practices). If Education Activities are offered for credit after dismissal, a flyer will be made available at registration to adults about time and location. Adults will chaperone Juniors to the Educational Activity.

To receive points, the contestant must attend the Education Activity and answer one or more questions on a scorecard.

The contestant must return the completed scorecard to a designated contest official shortly after the presentation concludes to receive points.

Contest Rules

1. This is an individual event for Juniors. Asking other contestants or non-contestants (including the presenter) for answers to the question(s) is not allowed.
    - Question(s) will be about the Education Activity.
    - Question(s) may be multiple choice, true/false, or open ended.
    - Question(s) may ask about the presentation's content, the contestant's opinion about the topic, or some other aspect of the Education Activity.
2. Contestants are not expected to study in advance for the Education Activity.
3. One scorecard will be provided to each individual for each Education Activity.
4. To receive credit, the contestant needs to write his/her name and ID number legibly on the scorecard.
5. Contestants will be allowed up to 10 minutes following the presentation to complete and return their scorecard to the designated contest official.

Scoring the Education Activity

The Education Activity is worth 10 points maximum per individual. If more than one Education Activity is offered for credit, officials will announce the points assigned. For example, several activities may be offered and contestants can select and receive 10 points for attending any one Education Activity. Or contestants may be required to attend two activities, with each activity worth 5 points, for example.

Individual scores will be combined and added to the team score. The Education Activity will be worth 30 points maximum.

For teams with four contestants, the lowest individual score will be dropped when tabulating the team score.

In the event of a tie between team scores, the score from the Education Activity may be used as a tie-breaker.

- **Education Activity or Activities (10 points maximum individual points; 30 points maximum team points)**

- One or more presentations about a wildlife topic will be given during the day of the contest. To receive points, the contestant must attend the education activity.
- Contestants will be provided a scorecard at the education activity with one or more questions about the topic.
- These questions may be multiple choice, true/false, or open ended.
- The contestant will turn in the scorecard after the activity to receive points. These will be added to the team score. For teams with four contestants, the lowest individual score will be dropped when tabulating the team score.

Friday, April 26, 2019

Tallgrass Prairie Quiz

Your Name:

1) A _____ _____ _____ _____ _____ _____ _____ is a type of ecosystem made up of mostly grasses and flowers instead of trees (spelling counts!)

2) Which grass species is NOT native to the Grand Prairie in Arkansas: (circle one)
big bluestem little bluestem bermuda grass Indian grass switchgrass

3) Controlled burns are part of prairie land management because

   a) they help prevent the growth of trees.

   b) by removing dead plant matter, sunlight can reach the soil.

   c) the ashes put nutrients back into the soil.

   d) all the above

4) Name an animal you might find on the Grand Prairie today?

---

5) True / False : The prairie mole cricket is a native insect that has large front legs for digging burrows in the prairie soil.

Wildlife Management Practices
Event Description

Objectives
Wildlife management practices are the tools, techniques, and methods that wildlife professionals use to restore or improve wildlife habitat.

- Juniors work as a team to identify wildlife management practices which benefit selected wildlife species.
- Seniors work individually to evaluate habitat and recommend wildlife management practices for selected wildlife species at a designated management site.

Overview
Each wildlife species can benefit from a number of wildlife management practices which wildlife professionals use to help populations grow, or in the case of nuisance animals, limit their population size and nuisance behaviors. A table has been prepared for each ecoregion linking the species with recommended wildlife management practices. For example, practices which create edge and habitat diversity are selected for white-tailed deer.

- A general description of each wildlife management practice is available in the study guide.
- Specific information on recommended wildlife management practices for each species can be found in the Wildlife Species Descriptions.

Junior Event

In the Junior competition, the team completes a table which lists wildlife management practices in rows and up to eight wildlife species in columns. Junior teams are basically replicating the study table for up to eight species selected by judges. Eligible wildlife species are from the announced region only. This exercise is intended to help Juniors prepare for the Senior WHEP contest when they become eligible. For the Senior contest, contestants judge habitat individually and select which practices are appropriate for selected species at a particular site.

The team places an "X" in each box corresponding to all wildlife management practices for each species. For example, if Bluegill is the selected species for Eastern Deciduous Forest ecoregion, correct practices are: livestock management, repair spillway/levee, water control structures, decrease harvest, increase harvest, wildlife or fish survey, construct fish pond, control aquatic vegetation, fertilize/lime fish pond, reduce turbidity in fish pond, restock fish pond, streams: create pools and streams: remove fish.

Note that not all wildlife management practices are listed for each ecoregion. Only those practices appropriate for the ecoregion are listed. Refer to the specific wildlife management practice chart for the announced ecoregion to study for this event.

Contest Rules

1. This is a team event for Juniors. Talking is allowed.
2. A maximum of eight species from the announced region will be listed on the scorecard.
3. One scorecard will be provided to each team. Each team member needs to write his/her name on the scorecard.
4. It is suggested that one team member with a clipboard and pencil serve as recorder. All team members are expected to participate.
5. On the scorecard, mark an "X" in the box for each wildlife management practice recommended for each species.
6. The "X" should completely fill the box from corner to corner.
7. Contestants will have 30 minutes to complete this event.

Senior Event

Seniors must know which wildlife management practices are appropriate for each species and judge which practices are appropriate for a designated management site. For example, the contestant should know "Create Snags" is a wildlife management practice for wood ducks, and then judge if ample nest cavities are available. A management site will be designated for contestants to evaluate. The management site may or may not be the same area used for writing the wildlife management plan.

Management recommendations in this event should consider each species separately and independently of other species, as if each one was the only species considered on the site. Do NOT consider whether a management practice is beneficial for one species but harmful to another. As a team, you will consider these species/habitat interactions when writing the wildlife management plan.

Note that not all wildlife management practices are listed for each region. Only those practices appropriate for the region are listed. Refer to the specific wildlife management practice chart for the announced region to study for this event. Descriptions of the wildlife management practices are available as study materials. Also, species descriptions include beneficial wildlife management practices and their relevance to each species.

Prior to starting this event, information describing the field conditions will be provided to contestants about the designated management site, either verbally and/or in writing. The field condition sheet describes landowner objectives. Based on this information, an "X" should be marked in the box for each wildlife management practice recommended on a given site.

Contest Rules

1. Seniors work individually on this event, thus no talking is allowed.
2. Read the field condition sheet carefully.
3. A maximum of eight species will be listed on the scorecard.
4. On the scorecard, mark an "X" in the box for each appropriate wildlife management practice.

5. The "X" should completely fill the box from corner to corner. (Note: A drill press is used to place holes through the scorecards to facilitate scoring. Writing a tiny "x" in the middle of the box may result in a loss of points.)
6. Contestants will have 30 minutes to complete this event.

Hints & Insights
The field condition sheet may offer clues about harvest recommendations. For example, if the field condition sheet indicates wild turkeys are increasing, check "Increase Harvest" on the scorecard. If the field condition sheet indicates wild turkeys are decreasing, check "Decrease Harvest" on the scorecard. If the field condition sheet states wild turkeys are increasing and the landowner wants the population to continue growing, then check "Decrease Harvest" on the scorecard. If no mention is made of the population size or goal for wild turkey, or that the population is stable, check both "Decrease Harvest" and "Increase Harvest" on the scorecard.

When deciding whether or not to recommend a wildlife management practice, landowner objectives should determine which practices you recommend. Assess current conditions and determine if a wildlife management practice needs to be applied within the next year. Keep in mind the benefits of a wildlife management practice may not be seen for years. For example, planting mast trees to produce a food source for wood ducks is a sound practice, but those seedlings will not produce acorns for five to 20 years, depending on the species of oak planted. Some of the practices may seem contradictory. For example, Ponds: Deepen Edges discourages the growth of emergent aquatic vegetation, while Water Control Structures could encourage growth. Again, landowner objectives should determine which practice you recommend.

From previous contests, many Seniors make the mistake of automatically selecting all the wildlife management practices listed on the chart for a species. However, at times, the best recommendation is not implementing the practice at all if the habitat is already suitable. For example, do not select "Plant Trees" if the land being judged is a forest full of trees. Wildlife biologists tend to be cautious about implementing unnecessary management practices and destroying otherwise good habitat. Remember the adage, **"if in doubt, leave it out."** Judges have been known to write a field condition sheet in such a manner that only a couple, or even *zero,* management practices were necessary for a particular species!

Scoring Wildlife Management Practices

Understanding how this event is scored may help you perform better and receive a higher score.

Following is an extremely important **helpful hint**:

- When marking a Wildlife Management Practices scorecard, make sure the "X" in the box goes from one corner to the other. If this is not done correctly, the team risks losing points, because of the way the scores are tabulated.
- A drill press is used to place holes through the scorecards to facilitate scoring. Writing a tiny "x" in the middle of the box will result in a loss of points. An "x" that is not seen may be counted as incorrect.

All boxes are counted in the scoring. For example, for Eastern Deciduous Forest ecoregion, there are 240 possible correct answers because there are 30 wildlife management practices × 8 possible species on an answer sheet. Therefore, do not put an X in each box on the chart. This is especially true for Senior competitors when evaluating habitat.

Participants are given credit for:
- putting an "X" in the appropriate boxes; and
- leaving boxes blank where no "X" is indicated on the wildlife management practice chart.

Answers will be incorrect if:
- boxes that should be marked are left blank; and
- boxes that should not be marked are marked.

Wildlife Management Practices

Various Wildlife Management Practices (WMPs) are used to manage wildlife and their habitat. This section describes wildlife management practices and the potential effect they can have on wildlife habitat and populations. The wildlife management practices are grouped according to type of practice (Habitat management, Population management, Pond/Stream Management, Additional wildlife management practices for Urban areas) and listed in alphabetical order within each grouping.

Contestants should be familiar with the wildlife management practice s and able to identify which wildlife management practices might be recommended to improve habitat or adjust populations in the ecoregion used for the state contest. Several practices are commonly used in certain ecoregions, but not in others. It is beneficial to learn as much as possible about any wildlife management practice before recommending it.

Some wildlife management practice s may seem contradictory.

- For Senior contestants**, landowner objectives, as well as specific information given by contest organizers, must be considered to determine the appropriate wildlife management practices.**

- Some wildlife management practices 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 wildlife management practice needs to be applied within the next year. However, the benefits of a wildlife management practice 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 wildlife management practices.

Index to Wildlife Management Practices (WMPs)

Habitat management practices

Population management practices

Fish pond and stream management practices

Additional management practices specific to urban areas

Habitat Management Practices

Conservation Easement

General description

A conservation easement is a legal agreement between a landowner and a land conservation organization (or "land trust") or government agency that places permanent[1] 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. 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 native grasslands, caves, and wetlands that provide habitat for species of conservation concern, such as red-cockaded woodpecker, grasshopper sparrow, Indiana bat, and many others. Conservation easements are also a valuable tool in protecting land in areas where urban and suburban development is rapidly expanding. It is in these areas where property values are exceptionally high and the associated property tax rates often increase to the point landowners are no longer able to keep their property. The specific conservation purpose of the easement varies with the goals and objectives of the land trust or agency and the landowner. Common objectives include protection of a vegetation type or ecosystem, maintenance of a forested or riparian corridor, habitat for various wildlife species, wetland function, and water quality.

Conservation easements can benefit any wildlife species, according to the area protected. However, for purposes of this program, ***Conservation Easement*** should be considered when evaluating property that is under threat of real estate development or some other major land-use change, such as surface mining or wind farming with turbines, which would degrade or alter its current natural resource value. Further, this practice should be restricted to those species that are in serious decline or are associated with rare vegetation types that are in need of protection.

[1] Although the national manual indicates that conservation easements are permanent, in reality some conservation easements are granted for limited timespans, such as 30-year conservation easements offered through NRCS's Wetland Reserve Program in Arkansas. For the purpose of this contest, conservation easements will be considered permanent to avoid confusing contestants as they prepare for the national contest.

Effect on habitat

- Maintain land in a natural state and protect it from real estate development.
- Protect rare vegetation types and habitat features, such as grasslands, wetlands, caves, and large forested tracts.
- Protect habitat for declining, threatened, or endangered wildlife species.
- Maintain corridors for migrating wildlife.
- Protect water quality, especially if riparian areas are included or if watersheds are protected.

Control Nonnative Invasive Vegetation

General description

Nonnative plants have been brought to North America for centuries. Some were introduced accidentally, but most were brought intentionally to provide livestock forage or to be used as ornamentals. Unfortunately, many nonnative plant species have become established and spread far beyond where they were initially introduced. This invasion has been detrimental to native plant communities because many nonnative plants out-compete native species for sunlight and nutrients and exclude them from a particular area. Exclusion of native plants has been detrimental for several wildlife species. Many nonnative invasive plant species do not provide suitable cover, structure, or food for wildlife. As usable space for wildlife decreases, so does the carrying capacity for that area. Thus, populations of certain wildlife species have declined as a result of nonnative invasive species.

Table 1. Examples of invasive, non-native plant species that should be controlled.

Plant type	Examples of Invasive Species
Trees	tree-of-heaven, mimosa, paulownia
Shrubs	Russian olive, privets, bush honeysuckle, saltcedar, multiflora rose
Vines	kudzu, Japanese honeysuckle, Oriental bittersweet
Grasses	tall fescue, bermudagrass, johnsongrass, cogongrass, cheatgrass
Forbs	sericea lespedeza, sicklepod, cocklebur, spotted knapweed
Wetland plants	alligatorweed, purple loosestrife, phragmites, hydrilla, water hyacinth, Eurasian watermilfoil, reed canarygrass.

For additional information about Arkansas invasive plants and animals, visit:

- Top Ten Invasives in Arkansas. Publication about invasive plant species published by the Arkansas Plant Board.
- Arkansas Invasives. Website listing invasive plant and animal species. www.arinvasives.org.

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.

CONTEST HINT: When this wildlife management practice is recommended, it is implied that necessary action will be taken to implement the practice. Applying other practices may not be necessary. Following are some examples.

- If this wildlife management practice of "***Control Nonnative Invasive Vegetation***" 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"***).
- If this wildlife management practice of "***Control Nonnative Invasive Vegetation***" 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 "***Control Nonnative Invasive Vegetation***" applies only to plants within the pond or wetland, not the surrounding watershed (unless the surrounding watershed is also being considered).

Effect on habitat

- Killing nonnative plants where they limit growth of native plants can improve cover and increase foods for many wildlife species.
- Controlling nonnative invasive species often leads to increased plant species diversity, which can provide more types of cover and food for various wildlife species.
- Eliminating nonnative grasses that produce a dense structure at ground level will allow the seedbank to respond and result in better cover for nesting and brood rearing for several bird species, and also increase food availability for many wildlife species as various plants are stimulated and grow from the seedbank.
- Killing nonnative trees and shrubs can increase space for desirable tree and shrub species, which can lead to increased mast production.
- Nonnative species in ponds and wetlands may outcompete native plant species (such as phytoplankton) for nutrients, thereby reducing fish carrying capacity
- Certain nonnative species (such as giant salvinia) may effectively block sunlight and reduce oxygen content, resulting in fish kills.

Figure 1. 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.

Figure 2. Snags provide perching, nesting, denning, and foraging sites for many wildlife species.

Standing dead trees are called *snags*. They provide perching sites and foraging opportunities for many bird species, such as red-tailed hawks, American kestrels, and bluebirds.

Woodpeckers are attracted to snags to feed on the invertebrates under the bark and also to excavate cavities for nesting. Most woodpeckers are ***primary excavators***. That is, they excavate cavities for nesting in snags. Most woodpeckers need relatively soft wood for excavating. Fungi aid woodpeckers by softening dead wood through decomposition. After woodpeckers nest and leave the cavity, other species may move in and use the cavity. These species are called ***secondary cavity users***. Some secondary cavity users enlarge cavities to suit their needs. Most of the secondary cavity users are birds (such as prothonotary warblers and wood ducks), but there is a wide variety of secondary cavity users, from bats and bears, to various salamanders and snakes.

The value of snags does not end when they fall. Other wildlife species, such as salamanders, shrews, mice, and snakes, are closely associated with down woody material. These animals serve important ecosystem functions, such as nutrient recycling and prey for various predators. The food web in some ecosystems is strongly influenced by the presence of snags and down woody material.

In mature forests, snags and down woody material are usually available. 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.

Selection of trees to kill is important. Softwood species (such as conifers, poplars, and maples) and those trees that already have signs of injury and decay are good candidates, because the wood is more easily excavated by woodpeckers and heart rot (rotting in the interior of the tree trunk) may have already begun.

Size of the snag is important. Larger diameter snags (>12 inches diameter) are suitable and used more often by a wider variety of wildlife species than smaller stems.

Snags may be created when they are limiting in both forested and open areas. 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 would sustain populations of secondary cavity users and other species associated with down woody material.

Snags are also used by wildlife species found in fields and field edges, such as bluebirds and American kestrels. Creating snags in these areas may be necessary where the number of snags is limiting.

Effect on habitat

- Snags provide roosting and perching sites for many bird species.
- Snags provide insects as food for woodpeckers and other birds.
- Snags provide woodpeckers with sites for cavity construction.
- Secondary cavity species (such as bluebirds, owls, wood ducks, raccoons) may use old woodpecker cavities for nesting, roosting, or denning.
- When snags fall, they provide sites for denning, reproduction, foraging, and escape for various wildlife species.
- 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.

Delay Crop Harvest

General description

When landowners have an interest in wildlife, it may be beneficial to avoid harvesting crops during nesting and fawning seasons to reduce nest destruction and mortality. It is important to realize crop yield and quality are often reduced dramatically when harvest is delayed, especially when hay harvest is delayed until seedheads form.

Figure 3. Switchgrass grown for biofuels is normally harvested in November. Where wildlife is a consideration, native grass grown for biofuels should be harvested in March to provide cover through winter. Delaying the harvest until March should not reduce yield appreciably.

A much more important consideration than delaying crop harvest is making sure adequate usable space is available across the property for the focal wildlife species, which may mean reducing the amount of acreage cropped or hayed to increase acreage available for wildlife.

NOTE: this practice should be recommended only when a crop is present or is planned for the current growing season.

Effect of practice

Destroying fewer nests and young at a specific time, such as May/June when fawns and initial nests of songbirds are most vulnerable, can help maintain a sustainable population or population increase.

Edge Feathering

General description

Edge feathering involves reducing tree density in woods adjacent to fields. Reducing the number of trees allows more sunlight to enter the forest canopy and stimulates the understory, which provides a more diverse structure of cover from the field into the woods.

Trees are usually thinned approximately 100 feet into the woods along at least one side, if not all sides, of the field where woods are adjacent. Trees are usually thinned more heavily in the 50 feet or so nearest the field (inner zone) by removing or killing at least 75 percent of the trees. Fewer trees (approximately 50 percent) are removed or killed 50 – 100 feet from the woods (outer zone). This gradation of tree density (few too many from field to forest) and sunlight availability (lots too little from field to forest) promotes an ecotone (an area with characteristics of two adjacent vegetation types) from field to forest.

Edge feathering can be implemented around any field with adjacent woods that have not already been thinned sufficiently. ***Edge Feathering*** and ***Establish Field Borders*** are excellent companion practices to enhance habitat for several wildlife species.

Additional information about edge feathering including photos can be found on the internet:

- Edge Feathering, Kentucky Department of Fish and Wildlife, http://fw.ky.gov/Wildlife/Documents/edgefeathering.pdf
- Edge Feathering – Forest Edge Job Sheet, Natural Resources Conservation Services, Missouri Department of Conservation, and MU Extension – School of Natural Resources, http://www.quwf.net/downloads/turnin-the-dirt/ht-job-sheets/js-biol-18.pdf

Effect on habitat

- nesting cover and escape cover are provided for various wildlife species.
- foods (especially forage, browse, seed, and soft mast) are increased for various wildlife species.

Field Borders

General description

Field borders are uncropped areas around crop fields or unhayed areas around hay fields designed to provide nesting, brooding and escape cover for many wildlife species. Field borders also help trap sedimentation and nutrient run-off. Field borders most often consist of native grasses and forbs, but may also include brambles and shrubs, depending on landowner objectives. Field buffers should be a minimum of 30 feet wide, but wider is better. Field borders up to 120 feet wide are highly desirable and recommended to provide adequate usable space for wildlife dependent upon early successional vegetation.

Figure 4. Field borders around crop fields provide increased usable space for species that require early successional cover. Field buffers don't have to be planted. Here, broomsedge, asters, and blackberry have established from the seedbank.

Field borders most often consist of native grasses and forbs, but might also include scattered brambles and shrubs depending on landowner objectives and focal wildlife species. Field borders may be established by allowing natural succession from the seedbank or by planting.

NOTE: ***Plant Native Grasses and Forbs*** or ***Plant Shrubs*** should not be recommended in order to establish ***Field Borders***. However, if there are existing field borders of undesirable species, such as tall fescue, bermudagrass, or sericea lespedeza, ***Control Nonnative Invasive Vegetation*** should be recommended to control those plants. Additional field borders should be recommended only if there are crop fields or hay fields without field borders, if additional field borders are needed around a field, or if existing field borders are too narrow.

Effect on habitat

- Provides increased usable space for many wildlife species.
- Provides nesting and/or brooding cover for many songbirds, bobwhites, and wild turkeys.
- Can provide increased forage and seed availability if desirable forbs are established.
- Can prevent sedimentation and nutrient runoff.

Forest Management

General description

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.

For the contest, **forest management practices 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 Management*** should **not** be recommended for that objective. Instead, ***Set-back Succession*** **(*Chainsawing* and *Root Plowing*)** should be recommended.

Forest management practices promote timber production which can provide income to landowners. 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). When a logger enters property, often roads are built for removing trees. The last section describes forest road maintenance to reduce soil loss while benefitting wildlife.

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. Some wildlife species benefit from these forest stand changes, 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, it is crucial to regenerate stands over time and to make sure regenerating stands are dispersed across the area being managed.

The regeneration method recommended depends upon the forest type and composition, site quality, and landowner objectives.

- The **clearcut** regeneration method (Figure 5) 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 (Figure 6) removes a predetermined number of trees to allow development of seedlings (regeneration) from the understory. Later (usually 6 to 8 years), the trees that were left standing (the shelterwood) are removed after the regeneration has developed (often 5 – 15 feet tall).
- The **seed-tree** regeneration method (Figure 7) 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 (Figure 8) 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 (Figure 9) harvests only select, individual trees out of the stand, not groups of trees. This method can create a diverse structure with small gaps in the forest canopy. This method generally regenerates shade-tolerant species in closed-canopy northern hardwood forests, but is also used to regenerate longleaf pine where prescribed fire is also used to control undesirable species.

Pines are most often planted (artificial regeneration) after harvest to establish a new stand. In terms of the contest, artificial regeneration is distinguished from the practice of **"Plant Trees"** when the objective is to generate income from timber production. Hardwood stands are almost always regenerated naturally and not planted. A common exception is that bottomland hardwoods are often planted when reforesting a large bottomland field that was previously in row-crop agriculture.

Regardless of regeneration method used, it is important to make sure food, cover, and water for certain wildlife species are in close proximity. Regenerated stands should be adjacent to more- developed stands if providing travel corridors and space for wildlife that do not use young stands is a consideration. Also, whenever stands are harvested, it is important to leave relatively large standing dead trees (snags) and live trees with cavities for wildlife that might use them.

Figure 5. **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.

Figure 6. Not all trees are harvested initially when using the **shelterwood** method. Managers can leave trees that might provide an important food source, such as oaks, blackgum, black cherry, and persimmon, until the regeneration has developed. At that time, the remaining ovestory is harvested. Leaving mast-producing trees is an important consideration when managing for wildlife that eat acorns and other mast.

Figure 7. 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.

Figure 8. **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.

Figure 9. Select, single trees are removed in **single-tree selection**. This method favors shade-tolerant species in hardwood stands. Thus, it is sometimes practiced in northern hardwood stands where species such as sugar maple, American beech, and white pine are managed. Single-tree selection is also practiced effectively in longleaf pine stands.

Figure 10. Standing dead trees (snags), as well as relatively large live trees with cavities, should be left when practicing forest management to provide cavities and perches for various wildlife species. *Create Snags* should be recommended where additional snags are needed.

Effect on habitat

- Forest regeneration produces new forest growth with greater stem density, which provides nesting and escape cover for several wildlife species.
- Clearcut, shelterwood, and seed-tree stimulate an initial flush of herbaceous growth for a few years until it is shaded out by the developing trees. Browse and soft mast are increased for a short time after harvest.
- Group selection creates considerable diversity in stand structure, providing characteristics of a young stand and an older stand. Browse and soft mast are increased in the group selection openings for a few years until regenerating trees reduce available sunlight to the forest floor.
- Single-tree selection maintains the overall structure of a mature forest, but an increase in understory growth where individual trees are removed will enhance nesting structure for some species and provide additional browse and soft mast.
- Regenerating stands provide cover for many prey species, which can benefit various predators.
- Snags and live den trees that are left standing provide perching, nesting, denning, and loafing sites for many wildlife species. The practice of **"Create Snags"** should be recommended where additional snags are needed.
- 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, commonly nest adjacent to the brushy material and logs left behind, which simulate a tree blown over during a storm. The brushy debris left behind after a logging operation also provides important cover for various species and actually helps forest regeneration as newly emerging seedlings are protected from browsing.

Timber Stand Improvement (TSI)

TSI may involve any of several practices used to improve the quality and composition of forest stands by shifting resources (sunlight and nutrients) to achieve an objective, which may include wildlife, timber, or aesthetics.

TSI most often involves some type of **thinning**, which reduces overall tree density to influence stand growth and development.

Improvement cuts are implemented in stands past the sapling stage to improve composition and quality by removing undesirable trees.

Regardless, when some trees are removed, the remaining trees are "released" from the adjacent competition for sunlight and nutrients, which often allows them to put on more volume and develop larger crowns that can provide more mast (such as acorns). Increased sunlight entering the forest canopy also allows the understory to better develop, which provides more cover and food (forage and soft mast) for various wildlife species.

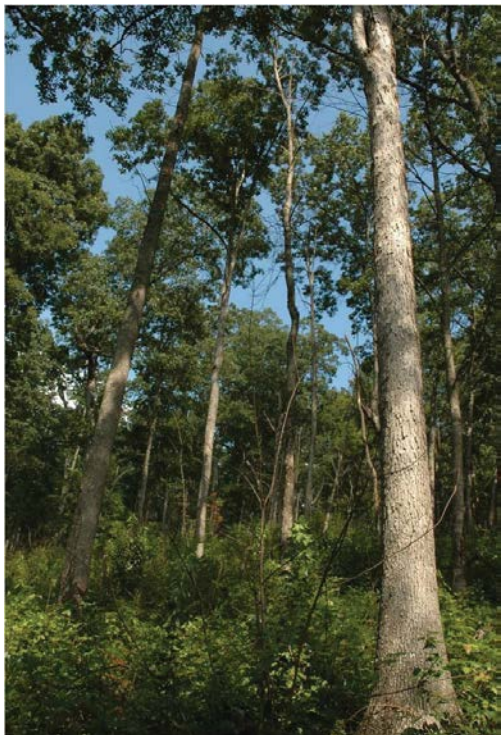


Figure 11. Timber stand improvement (TSI) can be implemented to remove undesirable trees and increase growth of selected trees that remain in the stand. Groundcover is stimulated when additional sunlight enters the stand, providing additional cover and food resources in the stand, which can be maintained with periodic prescribed fire.

Effect on habitat

- Increased understory growth enhances cover and provides additional forage, browse, and soft mast.
- Increased woody stem density in the midstory improves cover for some species.
- Trees retained following TSI are better able to grow larger crowns and produce additional mast.
- Snags and den trees that are left standing and down logs and other coarse woody debris left following TSI provide sites for feeding, denning, drumming, reproducing, hiding, and resting for many wildlife species.

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.

Figure 12. Forest roads should not be constructed perpendicular to slope. Roads such as this should be closed and planted to trees or shrubs.

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.

Figure 13. Forest roads, such as this one planted to clovers, provide nutritious forage as well as travel corridors for many wildlife species.

Figure 14. 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.

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. Those roads that receive considerable traffic from land managers may require gravel. Forest roads should also be gated where they intersect public roads to prevent trespassing and poaching (killing wildlife illegally).

Effect on habitat

- Forest roads planted with native species provide more habitat for wildlife while reducing soil erosion.
- Forest roads provide travel corridors for wildlife in thick forested areas.
- Daylighting along forest roads provides additional edge habitat and browse for wildlife.

Leave Crop Unharvested

General description

Strips or blocks of grain or other crops (such as soybeans) can be left unharvested. This practice is especially valuable if the strips are left adjacent to cover. This practice should be recommended only if there is an unharvested crop present. It is not applicable to food plots.

Effect on habitat

- Provides additional food for many species, which can be particularly important when naturally occurring foods are in low supply and/or in years with poor acorn production.

Figure 15. By leaving strips or blocks of grain unharvested, additional food is available for wildlife. Leaving this food resource can be an important consideration, especially in areas where winters are harsh.

Livestock Management

General description

The intensity and duration of livestock grazing directly impacts the structure (height and density) and composition of the vegetation community and, consequently, habitat quality for various wildlife species. **Stocking rate** is the amount of land allotted to each animal for the entire grazable portion of the year and *is the most important consideration concerning livestock grazing management.*

Stocking rates are adjusted to manipulate the structure of vegetation to favor various wildlife species. Intensity and timing of grazing also favor various plant species over others. Available nutrition for livestock and plant species diversity are also influenced by grazing intensity and duration.

- Heavier stocking rates typically result in shorter vegetation, more open structure, and earlier successional stages (annual and perennial grasses and forbs with little or no woody cover).
- 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. Stocking rates can vary from year to year, livestock species, herd composition, plant type, grazing management intensity, etc. In Arkansas, a rough rule of thumb is 2 acres per animal in a good year and 4 acres per animal in a dry year with an intensive grazing system. Compare this to one cattle operation which moved 300 cattle to various states. In Montana, they pastured 40 acres per cow; in New Mexico, 90 acres per cow; and in Missouri, 4 acres per cow.

This practice can also be used to exclude livestock from an area. Livestock distribution can be controlled with fencing, herding or fire. Livestock exclusion may be necessary for wildlife species that require considerable shrub cover. Livestock exclusion is necessary for many wildlife species that inhabit forests, particularly those species that require a well-developed understory. Livestock exclusion is also required to protect sensitive areas, such as riparian zones and other wetlands where erosion, siltation, and livestock waste can cause problems for associated wildlife and fish and reduce water quality.

This practice should be recommended when evidence of livestock is present or information on livestock use is provided.

Effect on habitat

- Stocking rate can alter the vegetation structure and composition to favor various wildlife species.
- Livestock may be excluded from areas where advanced successional stages and

increased vegetation structure is desirable for various wildlife species.

- Excluding livestock from riparian areas can help reduce siltation, turbidity and stream bank erosion, and reduce stream and pond pollution from livestock waste, which is beneficial for many wildlife and fish species. Excluding livestock from riparian areas may also improve habitat structure and composition for various wildlife species that use these areas.

Figure 16. Grazing can be used to manipulate cover for wildlife. Stocking rate greatly influences the vegetation composition and the resulting structure. Overgrazing severely limits cover and food resources for many species of wildlife. However, more bare ground and shorter structure is beneficial for some species.

Nesting Structures

General description

Some species den, nest, or roost in cavities they don't excavate themselves (such as bluebirds, wood ducks, and owls). If natural cavities are not available, artificial cavities (nest boxes) can be used. Many species need a certain kind of cavity (certain diameter of hole, depth, area) in a certain location (field, woods or water) and at a certain distance above ground (height in feet). The particular design and placement of nest boxes often determines which wildlife species use the structures. Nest boxes should be monitored to ensure use by targeted species.

Recommendations for nest box dimensions are listed in the table below. Contestants do not need to memorize these exact dimensions for the contest, but rather be able to identify which nest box is suitable for which species. Also know locations of nest boxes (nesting habitat) and other features, such as the addition of sawdust to the bottom.

NOTE: Nesting structures for Canada geese, house sparrows, and other invasive species are not recommended because these have become too numerous and are a nuisance in many areas.

Species	Floor space (inches)	Height of box (inches)	Entrance hole diameter (inches)	Hole height above floor (inches)	Mounting height above ground (feet)	Location tips
American Kestrel	8” x 8”	12” – 15”	3”	9” – 12”	10’ – 30’	Open habitats, including meadows, grasslands, parkland, agricultural fields, urban and suburban areas
Big Brown Bat	See *Bats In and Around Your Home (FSA9088), University of Arkansas*					
Eastern bluebird	4” x 4” or 5” x 5”	8” – 10”	1 ½”	6” – 9”	5’ – 10’	Open areas in the sun, pastures, fields or golf courses
Eastern Gray Squirrel	9” x 9”	20”	3” on side of box close to tree trunk	16”	20 – 25’	Young to mature woodlands
Hairy Woodpecker *Place 1” - 2”Sawdust in bottom of box*	6” x 6”	12” – 15”	1 1/2”	9” – 12”	8’ – 20’	Open country, farms and park-like woodlands
House Wren	4” x 4”	6” – 10”	1 1/8” – 1 ¼”	4” – 6”	5’ – 10’	Backyards near buildings
Northern Flicker *Place 3” – 4” sawdust in bottom of box*	7” x 7”	16” – 18”	2 ½”	14” - 19”	6’ – 20’	Open areas with perennial forbs and grasses
Prothonotary Warbler	4” x 4” or 5” x 5”	6” - 8”	1 1/8” - 1 ½”	4” - 5”	5’ – 8’	Above water or if on land, entrance should face water; moist soil bottomlands, flooded river valleys, swamps
Raccoon	10” x 10”	24”	5” x 6” oval	19”	10 – 20’	Streambanks and lands adjacent to wetlands
Wood Duck *Place 3” – 4” sawdust in bottom of box; screen wire beneath entrance hole to floor*	10” x 18” or 12” x 12”	10” - 24”	3” x 4” oval	12” - 18”	3’ – 6’ above water in wooded swamp or 6’ – 30’ elsewhere	Mature woodlands adjacent to flooded woodlands, ponds or open marshlands

Effect on habitat

- In open areas, nest boxes are useful for bluebirds unless an abundance of nesting cavities in trees or fence posts are available. Nest boxes for bluebirds should not be placed any closer than 80 yards apart to prevent territorial fighting between males.
- Nesting structures near water sources provide secure nesting sites for wood ducks where trees with cavities suitable for nesting are limiting. Nest boxes for wood ducks should not be placed any closer than 100 yards apart and ideally, should not be visible from one box to another, to prevent dump-nesting by females not incubating a particular nest.

Figure 17. Nest boxes provide artificial cavities for several species of birds. Nest boxes have been instrumental in helping bluebird and wood duck populations (right) recover from drastically low levels in the early 1900s.

Plant Food Plots

General description

Food plots can be planted to provide a supplemental food source for many wildlife species when naturally occurring food is a limiting factor for maintaining or increasing the population. Food plots are also commonly planted for various game species to facilitate hunting. Keep in mind that food plots supplement other habitat practices. For example, prescribed burning is implemented over larger acreages, produces more vegetation, and results in year-round benefits compared to food plots.

Food plots can benefit nongame species as well as game species. For example, all the seeds that are provided in bird feeders are also planted in food plots! Food plots are often planted to provide grains, such as corn, grain sorghum, and millets, and other plants with large energy-rich seed, such as sunflowers. Leafy forages, such as clovers, rape, chicory, jointvetch, winter peas, and lablab, are also commonly planted. Some plantings may provide both forage and grain or seed, such as soybeans, cowpeas, buckwheat, wheat, and oats.

Food plots benefit upland wildlife (such as deer, wild turkey, sparrows, and elk) and waterfowl as well. Canada geese and mallards often feed in warm- season grain food plots and in winter wheat. Plots of millets, corn, rice, or grain sorghum may be flooded a few inches deep in the fall to provide an additional food source for many duck species through winter.

The size and shape of food plots and their distribution is largely determined by the focal species and habitat quality.

- Food plots may be long and narrow (150 to 400 feet long and 15 to 20 feet wide) or more blocky in shape, depending on the focal wildlife species and the type of food plot planted.
- Relatively small food plots located adjacent to escape cover and arranged in a linear shape may receive more use by animals with small home ranges and associated with brushy cover, such as cottontails or northern bobwhite.
- Larger food plots in more open areas may be necessary and receive more use by some species, such as elk, mallard, mourning dove, and white-tailed deer.

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. Additional habitat management practices should be implemented to provide 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 wildlife management practices used to set-back succession. They should not be recommended in order to plant or maintain a food plot. If food plots are present on an area being evaluated and are in need of repair or replanting, ***Plant Food Plots*** should be recommended if they are still needed. However, if nonnative invasive species are present in a food plot, ***Control Nonnative Invasive Vegetation*** may be recommended. Many of the species listed above as commonly planted in food plots are nonnative, but they are not considered invasive.

Figure 18. Setting one or more 5-foot tall cages in a food plot enables the land manager or hunter to quickly determine if food plots have been grazed. The tall plant material inside the cage indicates this food plot has been utilized. Setting out a trail camera will help determine if white-tailed deer or other species have been using this food plot.

Figure 19. Warm-season grain plots, such as this corn, can provide an important source of energy through winter for many wildlife species

Figure 20. 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.

Figure 21. Cool-season food plots provide nutritious forage fall through spring when availability of naturally occurring forages may be relatively low. Depending on what is planted, such as this winter wheat, a nutritious seed source is also available the following late spring through summer.

Effect on habitat

- Grain food plots, especially corn and grain sorghum, as well as soybeans can supply a high- energy food source through fall and into late winter. Such a food source can influence winter survival for several wildlife species, especially during relatively cold winters and during years with low mast (acorn) production.

- In areas and seasons where nutritious forage is limiting, forage plots can supply highly digestible forage, which can be especially important during late summer and through winter and spring.

Plant Native Grasses and Forbs

General description

Native grasses and forbs are important for cover and food for many wildlife species. Native grasses and forbs represent early successional stages in all ecoregions and may represent the climax successional stage in prairies 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.

NOTE: 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*** to release native grasses and forbs.
- where additional early successional cover is needed. For example, in large forested areas where additional early successional cover might be required to provide habitat for some wildlife species, such as loggerhead shrike, northern bobwhite, or woodcock, it is likely that desirable native grasses, forbs, brambles, and other plants will establish from the seedbank after the forest is cleared by ***Chainsawing*** and ***Root-plowing*** (see ***Set-back Succession***).

Many nonnative grasses (such as tall fescue and bermudagrass) are not recommended for wildlife because they do not provide suitable cover or food for most wildlife, and their competitive nature often prevents native grasses and forbs from becoming established.

Effect on habitat

- Native grasses and forbs provide nesting, bedding, roosting, and/or escape cover for many wildlife species, especially those that require early successional cover.
- Ground-nesting birds usually build their nests at the base of native bunchgrasses, such as broomsedge bluestem, little bluestem, or sideoats grama.
- Although some wildlife, such as elk, readily eat native grasses, forbs provide a greater food source for more species. Many forbs provide forage (leafy material) as well as a seed source. Forbs also provide optimal cover for many small wildlife species, including young upland game birds and cottontails.

Examples of Plant Species					
Desirable Natives			**Undesirable Nonnatives**	**Invasive Nonnatives**	
warm-season grasses	**cool-season grasses**	**forbs and brambles**	**cool-season grasses**	**warm-season grasses**	**forbs**
broomsedge	Virginia wildrye	common ragweed	tall fescue	Bermudagrass	sericea lespedeza
little bluestem	low panicgrasses	pokeweed	orchardgrass	Cogongrass	curly dock
big bluestem		blackberry & dewberry	bromegrasses	johnsongrass	spotted knapweed
sideoats grama		native lespedezas	timothy	crabgrass	sicklepod
switchgrass		beggar's-lice		dallisgrass	cocklebur
Indiangrass		old-field aster		goosegrass	
buffalograss		partridge pea			
		annual & perennial sunflowers			
		crotons			

Figure 22. Native grasses and forbs may be planted where the seedbed has been depleted, such as agriculture lands that have been cropped for decades.

Plant Shrubs

General description

Certain shrub species provide cover and soft mast that benefit many wildlife species. Examples are blackberries, dewberries, and American beautyberries.

- 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 may be planted to create riparian buffers along streams and ponds. Vegetated buffers are important to maintain streambank stability as the roots of the vegetation along the stream help hold the soil in place along the stream. Additionally, the aboveground vegetation in buffers filters sediment from water moving into the stream or pond after rainfall events.

- Riparian buffers provide cover and travel corridors for various wildlife species.
- Riparian buffers of 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.

Shrubs should be planted in winter while they are still dormant.

NOTE: Shrubs should **not** be planted in the woods where there is not adequate sunlight for growth and development. Where additional shrub cover is needed in forested areas, ***Forest Management*** should be recommended.

Effect on habitat

- Can provide additional food and cover for many wildlife species in areas where specific species of shrubs are lacking.
- Shrubs are an important component of travel corridors, which allow wildlife to move safely across open fields between two areas of cover.
- Establishing hedgerows with shrubs may be used to increase interspersion of cover types and create smaller fields in proximity that can be managed differently to meet the various food and cover requirements for different wildlife species.
- Shrub plantings may be useful in some urban settings where desirable cover or soft mast is lacking.
- Shrubs planted to develop a riparian buffer may reduce erosion and sedimentation.

Figure 23. Shrub plantings, such as this hawthorn, provide nesting cover, escape cover, and an important source of soft mast.

Plant Trees

General description

Trees are planted to provide food (hard or soft mast) and cover for many wildlife species. Trees should be planted in winter while they are dormant. Planting a mixture of species is usually recommended when mast production is the objective. Planting a mixture reduces the chances of a mast failure in any given year.

Ecoegion, site, and landowner objectives help determine which species are planted. Examples of hard mast producers that are important for wildlife include oaks, hickories, American beech, and pecan. Examples of soft mast producers that are important for wildlife include persimmon, black cherry, mulberry, apple, and pear.

Trees may be planted to create riparian buffers along streams and ponds. Vegetated buffers are important to maintain streambank stability as the roots of the vegetation along the stream help hold the soil in place along the stream. Additionally, the aboveground vegetation in buffers filters sediment from water moving into the stream or pond after rainfall events.

- Riparian buffers provide cover and travel corridors for various wildlife species.
- Riparian buffers of 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.

NOTE: It may not be appropriate to plant trees in some areas. Some species of wildlife, such as grasshopper sparrows, avoid trees. In prairies that were historically treeless, planting trees is detrimental to some grassland species of wildlife.

Effect on habitat

- Provides hard or soft mast production, depending on the species planted.
- Large areas can be planted for afforestation (planting trees for a forest where there is currently no forest).

- Provides additional nesting, perching, denning, and roosting sites.
- Trees planted to develop a riparian buffer may reduce erosion and sedimentation.

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. In this series of pictures, a large field that was in agricultural production for decades was planted to bottomland hardwood species.

Figure 24. Planting hardwood stand with tree planter attachment in February 2004.

Figure 25. Same hardwood stand in October 2008.

Figure 26. Same hardwood stand in August 2011.

Repair Spillway/Levee

General description

Low water levels can cause significant problems in ponds and impounded wetlands. Improperly constructed or damaged spillways can lead to excessive dam or levee erosion and excessive aquatic vegetation along fish pond margins. The spillway should be repaired if it is eroding or otherwise damaged, keeping the pond or impounded wetland level too low and increasing the chance of the dam eroding during heavy rains. In special cases, leaks around the spillway or levee structure can be stopped with the addition of special clays or plastic liners.

Trees should not be allowed to grow on dams or levees because tree roots can fracture the dam and eventually cause it to leak and break. 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.

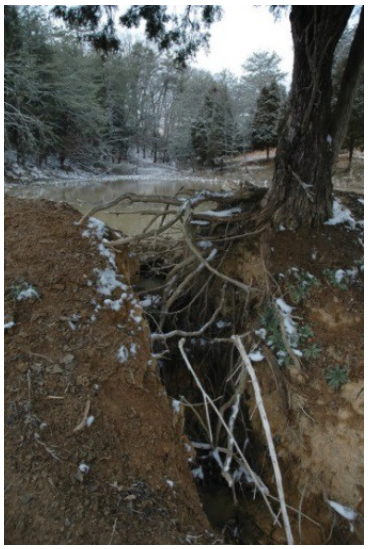


Figure 27. Tree roots can cause dams to fracture, leak, and eventually break.

Effect on habitat

- Eliminates erosion and sedimentation from spillway/levee
- Enables pond or impounded wetland to fill to appropriate level
- Precludes vegetation from establishing around the inside perimeter of a fish pond

Figure 28. This fish pond dam will likely have problems with leakage (if not already) and breakage if the trees are not killed or removed.

Set-back Succession

General description

Succession is the orderly and predictable series of changes in plant species composition through time and occurs in all natural communities. Habitat for many wildlife species is managed by setting back succession in an effort to retain the successional stage(s) beneficial for focal wildlife species.

The three primary techniques used by wildlife managers to set-back succession are **fire**, **mechanical applications, and herbicide applications**. Each of these may be applicable for setting back succession in any ecoregion for various wildlife species, but they may not produce the same effect. One or more may be recommended over another depending on the situation. In some cases, more than one technique may be applied. The recommended technique for setting back succession should be specified and reasons given as to why a particular technique was recommended in the written management plan and oral reasons.

NOTE: Grazing livestock can also arrest or set-back succession in some circumstances, but there are just as many applications for ***Livestock Management*** to advance succession as there are to set-back succession. Wildlife managers typically do not use livestock to set-back succession, but may recommend a stocking rate to livestock producers who are interested in wildlife. For the purposes of this program, ***Livestock Management*** is included as a separate wildlife management practice, because livestock often need to be excluded from an area when managing for many wildlife species.

Prescribed Fire

Prescribed fire is often the most effective and efficient method for managing succession and maintaining early successional plant communities. Prescribed fire can be used in fields, openings, grasslands, savannas, woodlands, and forests. **Intensity, timing, and frequency** of fire strongly influence vegetation composition and structure.

- High-intensity fires and burning in late summer and early fall tend to reduce woody composition more than low-intensity fires or burning in winter or spring.
- Low-intensity fire is recommended when burning a forest understory if damaging trees is undesirable. Like other methods, fire sets back succession temporarily. With the exception of intense fire, frequent burning over time will change vegetation composition more so than less frequent burning.

For example, if an area is burned every 2 years, annual and perennial herbaceous vegetation will be promoted. Where there is adequate rainfall, if that same area is burned every 5 years, considerable tree and shrub cover will be present. If burned every 10 years, the site will be dominated by trees and shrubs. Intensity and timing of fire dictate whether woody species are killed or if only the leaf litter is consumed.

Although a very beneficial practice, prescribed burning is not possible in all locations. Sites in close proximity to urban areas, hospitals, or busy roadways may not be suitable for burning because of safety and smoke management concerns. **Burning should be conducted only when danger of wildfire is low (when the wind, temperature, and humidity allow a controlled burn) and should be conducted under the close supervision of forestry or wildlife professionals experienced with using prescribed fire.** Where fire can be used, it is highly recommended over mowing or mulching to set-back or maintain succession.

Effect on Habitat

- Sets back the successional process by killing existing cover and stimulating fresh plant growth.
- Burning during the dormant season does not significantly alter vegetation composition unless fire intensity is high. Small woody stems may be top-killed, but usually resprout. Burning during the growing season and particularly the latter part of the growing season may more effectively kill small trees and shrubs and encourage more herbaceous cover.
- Burning early successional cover provides an open structure at ground level the following growing season, which is desirable for several small wildlife species, including young upland game birds. An open structure at ground level facilitates mobility and foraging under a canopy of native grasses and forbs.
- Burning consumes litter layer and understory fuels (such as dead leaves and grass), which reduces chance of wildfire and enables the seedbank to germinate.
- Improves seed and invertebrate availability for many species.
- Scarifies (breaks down outside coating) some seeds so they can germinate.
- May release nutrients (from ashes) into the soil.

Figure 29. Prescribed fire is the desired method for setting back succession and manipulating the composition and structure of the understory or groundcover in forests, woodlands, and savannas where fire historically occurred. Fire intensity, fire frequency, and season of burning strongly influence the effect of fire on the vegetation community.

Figure 30. Historically, wildfire occurred periodically in tallgrass prairies which set back succession and reinvigorated new plant growth. Today, trained and certified professionals conduct controlled burns following rigorous safety procedures. Note the nearby buildings in the back of this photo.

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 wildlife management practice to facilitate burning. Also, ***Disking*** should not be recommended to control nonnative grasses (such as tall fescue and bermudagrass). Instead, ***Control Nonnative Invasive Vegetation*** should be recommended to control nonnative invasive species.

Effect on habitat

- Maintains an early successional plant community dominated by grasses and forbs.
- Promotes fresh herbaceous growth and enhances forage and seed availability for many wildlife species.
- Sets back succession where perennial grasses and forbs, brambles, and woody species dominate the plant community.

Figure 31. Disking sets back succession, facilitates decomposition, provides bare ground, and stimulates the seedbank, encouraging early successional species.

Chainsawing

A chainsaw or fellerbuncher may be used to kill or remove trees where trees are not desired for the focal wildlife species or where additional areas of early successional cover are desired. 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 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. Periodic ***prescribed fire***, additional mechanical disturbance (such as ***disking***), or ***herbicide treatment*** then will be necessary to maintain an early successional community. 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.

NOTE: Implementing this practice implies the intention is to increase and maintain an earlier successional community, not a forest.

- ***Forest Management*** should not be recommended to set- back succession and maintain an early successional community. ***Forest Management*** should be recommended to manage and maintain a forest, either through ***Forest Regeneration*** or ***Timber Stand Improvement*** practices.
- ***Plant Native Grasses and Forbs*** should not be recommended when using ***Chainsawing*** or another mechanical method to reduce tree cover and increase early successional vegetation because herbaceous groundcover should establish naturally from the seedbank after tree removal.
- ***Create Snags*** is assumed to be a part of this practice and should not be recommended when killing trees in an effort to increase early successional cover.

- ***Herbicide Applications*** is assumed to be a part of this practice and should not be recommended when spraying girdled trees or tree stumps in an effort to increase early successional cover as part of the wildlife management practice of chainsawing.

Effect on habitat

- Reduces tree density and encourages earlier successional plant communities.

Figure 32. Chainsawing can be used to increase early successional cover in wooded areas. On this property, trees were cut, not harvested, and the site has been burned every 2 years to maintain early succession. Nothing was planted. A forest was converted to an early successional plant community.

Drum-chopping/Chaining/Root-plowing

These techniques involve large equipment and are implemented to reduce woody cover and stimulate more herbaceous cover. They are typically used where shrubs and trees have grown too large for a rotary mower and where prescribed fire may not be applicable.

- **Drum-chopping (or roller-chopping)** involves a bulldozer pulling a large drum (or roller) with sharp metal blades to knock down and chop large shrubs and small trees. Drum-chopping effectively reduces the size of brush and generally increases herbaceous growth. However, chopped brush usually resprouts (depending on species), and stem density of brush can actually be greater (but smaller size) following treatment.
- **Chaining** involves pulling a very large chain strung between two bulldozers running parallel to each other (50 to 100 feet apart) to knock down shrubs and small trees. Brush is knocked over in the first pass, then a second pass in the opposite direction uproots the brush.
- **Root-plowing** involves a bulldozer with a rear-mounted blade that cuts tree and shrub roots and brings them to the soil surface, which significantly reduces sprouting. This technique is often used in brush country, such as south Texas, but also can be used in forested areas of the eastern U.S. following tree removal where the intent is to convert a forested area to an early successional plant community. Root-plowing facilitates this process by reducing sprouting of woody species.

Figure 33. 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.

Figure 34. Chaining is often used in shrub country to reduce woody cover and increase herbaceous cover.

Effect on habitat

- Sets-back succession by reducing dominance of small trees and shrubs, and promotes grasses, forbs, and brambles.
- Promotes more open structure.
- Forage availability and quality may be increased.
- Soft mast and seed production may be increased.
- Woody species usually resprout following drum-chopping, which can be used to maintain a certain height and amount of brush cover.

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.
- Mowing fields of grass simply because the grass is too tall for aesthetics (e.g., cleaning up a fence row) is unnecessary as a wildlife management practice, and should not be recommended if for that reason.

Mowing and mulching are not the best techniques for setting back succession because they promote a deep thatch layer that creates undesirable conditions at ground level for young game birds and ground-feeding songbirds. A thatch layer also limits germination of the seedbank and can reduce plant diversity. **When possible, prescribed burning, disking, or herbicide applications should be used to set-back succession instead of mowing or mulching.**

Figure 35. Mowing, or "bushhogging," sets back succession. However, accumulation of thatch provides undesirable conditions for many wildlife species and limits germination of the seedbank. Mowing is not a desirable practice to set-back succession, and should be used only when more desirable methods are not possible.

Effect on habitat

- Helps maintain perennial grasses and forbs and reduces height of encroaching woody species.
- Helps remove competition from various shrubs and small trees, allowing grasses and forbs to grow better. Maintains low brushy cover of various shrubs and small trees by encouraging resprouting.
- Can improve and maintain nesting cover for some bird species if conducted outside the nesting season.
- Causes thatch build-up, which reduces availability of invertebrates and seed to young bobwhites, 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.

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. 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 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.

Figure 36. 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 on habitat

- In some open areas, encroachment of hardwood trees reduces vegetative diversity and limits many plants important for wildlife. Proper herbicide applications control unwanted woody growth and encourage more herbaceous groundcover.
- Can be used to maintain grasses, forbs, and shrub cover, and thus increase foods and enhance cover for some wildlife species.
- Can be used to prevent unwanted hardwood growth in pine stands, particularly those that have been thinned to allow increased sunlight to reach the ground and stimulate herbaceous plants.

Tillage Management

General description

Tilling cropland can be delayed from fall until early summer to allow wildlife access to waste grain and to allow wildlife to use standing stubble and fallow vegetation for nesting.

When fall tillage is necessary, inversion tillage (such as mold-board plowing, which turns soil over and covers crop residue) should be avoided. Instead, implements such as chisel plows that do not turn the soil over should be used. No-till agriculture would be recommended over any tillage method.

NOTE: This practice should be recommended only if a grain crop is present.

Effect of practice

- Increases supply of waste grain, which is eaten by many wildlife species, and may increase nesting success.

Figure 37. Delaying tillage from fall into spring allows wildlife access to waste grain from harvested crops through winter.

Water Control Structures

General description

Various structures made of concrete, metal, or wood are used to control the water level in ponds and impounded wetlands. They are usually placed within a dam or dike.

Water Control Structures should be recommended when inadequate or no structure is present on an existing dam or dike.

This practice can also be used to control the water level of beaver ponds. A Clemson Beaver Pond Leveler can be placed through the beaver dam, restricting the pond level from exceeding a desired height and helping prevent flooding into undesirable areas, such as crop fields, roads, woods, etc.

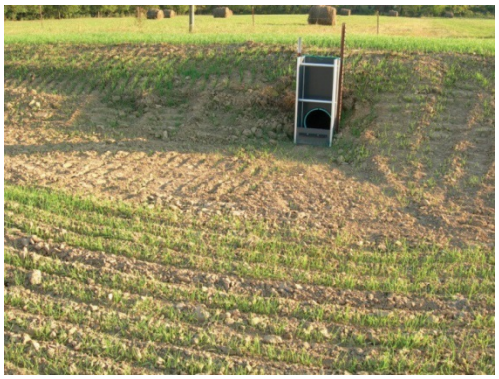


Figure 38. Water control structures allow manipulation of the water level in ponds and areas flooded for wildlife using a dike or levee.

Figure 39. These two Clemson Beaver Pond Levelers were installed by the U.S. Forest Service to improve water flow through culverts and avoid beavers plugging them.

Effect on habitat

- Allows ponds to be drained for managing water quality and control of unwanted fish.
- Allows management of water levels to increase or decrease the amount and type of aquatic vegetation in ponds and wetlands.
- Useful for creating a desirable mix (interspersion) of open water and emergent aquatic vegetation in wetlands.
- Can be used to create shallow water areas.
- Can be used to control water levels in flooded timber, drawing water down to prevent tree mortality.

Water Developments for Wildlife

General description

Water is a critical habitat component. Some wildlife species obtain necessary water from their diet, whereas others require free-standing water for drinking or for aquatic habitat (they live in water). Many species require a water source for obtaining food, reproduction, loafing, or escaping predators. Developing a source of water is a critical consideration for many wildlife species when little or no water is available. There are several ways to make water available to wildlife.

- Small ponds can be created where water is relatively scarce to provide water and habitat for several wildlife species. Small ponds can be created with backhoes or bulldozers. These are usually designed to collect water from runoff and/or precipitation, but may be created where there is an existing spring or seep, which facilitates water collection and helps ensure a reliable water supply. Side slopes for these ponds should be gentle to provide easy access for wildlife. NOTE: these ponds are designed for various wildlife species, not fish.

- **Shallow impoundments** may be created by constructing earthen dikes to retain water (usually run-off water from precipitation) in natural drainage areas. Placement of the dike is critical to avoid damage from floods and to collect sufficient water. When recommending shallow impoundments for waterfowl, bottomland areas (including grain fields and mature bottomland hardwoods) and existing wetlands should be considered for flooding. A water-control device in the dike allows the water level to be manipulated. Water can be removed from the field or woods prior to spring (similar to draining the water out of a bathtub) so the field can be planted again or so the trees will not die. **NOTE**: When this practice is recommended, it is assumed an adequate water control structure will be included and should **not** be an additional recommendation.

- **Guzzlers and windmills** are also used to provide water. Guzzlers are built by covering an area with an apron of fiberglass or some other material that sheds rain. Water is collected in a storage tank and slowly released into a trough from which wildlife can drink.

- **Small backyard ponds** can be constructed in suburban backyards to provide water for a variety of wildlife. **Birdbaths** are also useful for providing water in Urban settings.

NOTE: ***Water Developments for Wildlife*** can be recommended when an additional water source is needed or when an existing water development for wildlife is essentially not functioning because it is in need of repair.

Figure 40. Though different in size and structure, these two shallow impoundments can provide excellent habitat for many wildlife species, including migrating and wintering waterfowl.

Effect on habitat

- Can provide drinking water and wetland habitat.
- Grain fields or mature bottomland hardwoods flooded in fall/winter can provide important migrating and wintering areas with abundant food resources for waterfowl.
- Temporary flooding can improve existing open wetlands for nesting and brooding for some waterfowl, such as blue-winged teal and northern pintail.
- Temporary flooding can improve wooded and brushy areas for nesting and brooding wood ducks.
- Can provide a source of prey for many predators.

Figure 41. Windmills are often used in the western U.S., and sometimes in Arkansas, to provide a water source for livestock and many wildlife species.

Population Management Practices

Decrease Harvest

General description

Regulated hunting, trapping and fishing regulations are primary tools used to manage many wildlife and fish species. State and federal wildlife agencies set regulations for hunting, trapping, and fishing seasons and bag and creel limits. Landowners can choose to take the maximum allowed or less than that, depending on local populations and personal management objectives.

Game birds and mammals

Decreasing harvest may be necessary when harvest data or observation data indicate populations are declining, especially in areas with good habitat. Harvest through hunting and trapping are seldom the reason for declining wildlife populations.

- Habitat quality is usually the reason for low or declining populations. If food, cover, water, or space is limiting, populations may remain low or decline. Appropriate habitat management practices should enhance habitat and allow populations to stabilize or increase.
- Disease and, less often, unsustainable mortality from predation are other reasons for low or declining populations. If populations are low or declining because of predation, it is likely related to habitat (poor-quality cover) or possibly an abnormally high predator population. In this scenario, habitat management and possibly a reduction in the predator population can address low or declining game bird or mammal populations. Possible examples, though relatively rare, include abnormally high predation rates on deer fawns by coyotes or abnormally high predation rates on wild turkey eggs and poults from raccoons.

NOTE: ***Decrease Harvest*** is not an option for migratory species, such as waterfowl and mourning dove, because bag limits are set by the U.S. Fish and Wildlife Service and individual landowners cannot influence population levels of migratory species.

Largemouth bass/bluegill

Balanced Bass/Bluegill Populations

Documented via Seine Sampling: Young largemouth bass present. Many newly-hatched bluegills and some intermediate (3-5 inches) bluegill present.

Documented via Angler Sampling: Percentage Size Distributions (PSDs) – Between 40 percent and 70 percent of 8 inch or larger largemouth bass caught are also at least 12 inches long and 40 percent to 60 percent of 3 inch or larger bluegill caught are also at least 6 inches long.

Decrease Bass Harvest When:
Seine sampling reveals young bass may or may not be present, many intermediate bluegills in poor condition but no recent hatch of bluegills. If angling reveals few bass present but > 60 percent of the bass caught are at least 12 inches long while < 50 percent of bluegill are at least 6 inches long, return all bass.

Intended Result: The lack of bluegill reproduction and poor condition of intermediate bluegill suggests the bluegill population may be too high and food is a limiting factor. Reduce bass harvest (catch and release is ok) to increase predation pressure on intermediate-sized bluegills.

Decrease Bluegill Harvest When:
Seine sampling reveals no young bass present and many recently hatched bluegills but few intermediate bluegills present. If angling reveals < 20 percent of bass caught are at least 12 inches long and > 80 percent of bluegill are at least 6 inches long, return all bluegill.
Intended Result: Assess if other species of fish (such as green sunfish) may be competing with bluegill and if so, consider draining or renovating pond and restocking.

Increase Harvest

General description

Regulated hunting, trapping and fishing regulations are primary tools used to manage many wildlife and fish species. It is the responsibility of state and federal wildlife agencies to set hunting, trapping, and fishing seasons and bag and creel limits. Landowners can choose to take the maximum allowed or less than that, depending on local populations and personal management objectives.

Game birds and mammals
Increased harvest of game birds and mammals may be needed when animals show signs of stress and overpopulation, such as destruction of habitat by overgrazing or overbrowsing, poor body condition and weight loss, low reproductive rate, and increase in prevalence of parasites and diseases.

- Regulated hunting and trapping is the most effective and efficient practice to remove surplus animals and keep wildlife populations in balance with available habitat. When scientific data indicate animals are above carrying capacity, it is often necessary to increase harvest.
- Increased harvest through regulated hunting or trapping also can be used to reduce numbers of a particular game species if that species is causing damage to another species. Examples may include increased harvest of raccoon if they are limiting wild turkey recruitment, increased harvest of coyotes if they are limiting white-tailed deer recruitment, or increased harvest of white-tailed deer if they are degrading habitat for various forest songbirds. See **NOTE** under ***Wildlife Damage Management Techniques***

for discussion on determining whether to recommend ***Increase Harvest*** or ***Wildlife Damage Management Techniques***.

NOTE: ***Increase Harvest*** is not an option for migratory species, such as waterfowl and mourning dove, because bag limits are set by the U.S. Fish and Wildlife Service and individual landowners cannot influence population levels of migratory species.

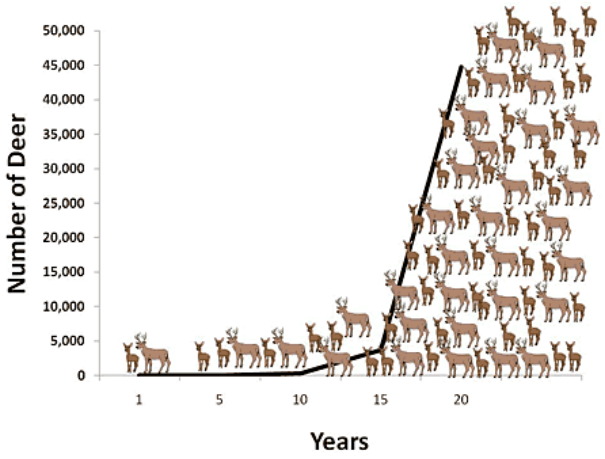


Figure 42. Increased harvest may be necessary where populations approach or exceed carrying capacity of the area being managed. When population reduction for white-tailed deer is necessary, the harvest should concentrate on females which will reduce animal numbers and can adjust the sex ratio.

Largemouth bass/bluegill

Balanced Bass/Bluegill Populations
Documented via Seine Sampling: Young largemouth bass present. Many newly-hatched bluegills and some intermediate (3-5 inches) bluegill present.
Documented via Angler Sampling: Percentage Size Distributions (PSDs) – Between 40 percent and 70 percent of 8 inch or larger largemouth bass caught are also at least 12 inches long and 40 percent to 60 percent of 3 inch or larger bluegill caught are also at least 6 inches long.

Increase bass harvest when:
Seine sampling reveals young bass may or may not be present while there are many recently hatched bluegills but few or no intermediate bluegills. If angling reveals < 20 percent of the bass caught are at least 12 inches long and in poor condition while > 50 percent of bluegill are at least 6 inches long, increase harvest of bass < 12 inches beginning with 10-20 per surface acre per year).

Intended result: The increase in bass harvest will reduce competition for food among small bass and allow the remaining small bass to grow more quickly making more of the forage resource available to them (bass can only swallow bluegill about one-third of their length, for example, a 12-inch-long bass can only consume bluegill < 4 inches long). **NOTE**: This existing pond scenario is desirable if the pond owner is willing to sacrifice bass size for a primary goal of producing large bluegill.

Increase bluegill harvest when:
Seine sampling reveals no recently hatched bluegills but many intermediate bluegills in poor condition present. If angling reveals 20 percent to 60 percent of bass caught are at least 12 inches long but < 50 percent of bluegill are at least 6 inches long, increase intermediate bluegill harvest by angling, seining and/or shoreline rotenone application.

Intended Result: Increased bluegill harvest should decrease competition for food among intermediate bluegill. Make sure excessive turbidity (visibility <15 inches) or weed growth (> 50 percent coverage of the pond) is not limiting largemouth bass access to bluegill.

Wildlife or Fish Survey

General description

Wildlife surveys

Monitoring trends of wildlife populations and physical attributes (such as body weight) is important for wildlife managers. Data on various species are routinely collected by wildlife biologists using observation counts, roadside counts, call counts, point counts, check-in stations, infrared-triggered cameras, transects, questionnaires, and other techniques. These data are used to prescribe future harvest or land management strategies.

Wildlife Survey Techniques

- ***Observation counts*****:** species and number of animals are recorded as they are seen. Counts may be made while conducting other activities or during official observations, such as counting ducks on a wetland
- ***Roadside counts*****:** usually involve driving a predetermined route and counting the number of individuals of a species while driving the route
- ***Call counts*****:** recording the number of individuals or groups (such as a northern bobwhite covey) of a species while waiting and listening at a specific location
- ***Point counts*****:** recording the numbers of a species observed or heard at specific, predetermined points along a transect
- ***Check-in station*****:** data are collected from game animals when hunters bring the animals to an official check-in station, which may be at various places, such as a Wildlife Management Area or local country store
- ***Infrared-triggered cameras*****:** "trail" cameras are placed in areas where animals frequent and the pictures are used to estimate population density, sex ratio, age structure, etc.
- ***Transects*****:** predetermined routes are used to collect observation data, point counts, dropping ("pellet") counts, call counts, etc.
- ***Questionnaires*****:** groups of people, such as hunters or school bus drivers, are asked about their observations of animals

Fish surveys

Pond balance should be checked during early summer by seining at intervals around the pond. Balance is determined by comparing age groups, condition, and numbers of bass and bluegill caught in the seine during the summer months, and from year-round angler catch records.

- Recent young-of-the-year fingerlings of both bass and bluegill collected in the seine indicate the fish population is balanced (see ***Decrease Harvest*** and ***Increase Harvest*** sections for more information).
- Angler catch records should be used to record the numbers, total lengths, and weights (fish caught in the fall only) of all bass and bluegill harvested. Fish caught by hook-and-line can be evaluated on body condition or Relative Weight (fat, skinny, size of head in relation to body) and population size structures based on Percentage Size Distributions.
- Unwanted species (such as bullheads) also may be caught in the seine or when fishing, indicating the fish population may be killed (with Rotenone) or drained.

Seining is usually not effective for collecting fish in streams. Fish in streams are usually collected by electro-shocking or by fishing. Electro-shocking involves running a small electrical current between two conducting rods, which are moved up and down the stream. Stunned fish float to the surface and the age, condition, and numbers are recorded to determine stream balance. The fish are then returned to the stream.

NOTE: Although information from wildlife and fish surveys is always important, surveys should not be recommended if information is provided by contest organizers that indicate a survey has been completed recently.

Figure 43. Infrared-triggered cameras are a tool to survey populations of several wildlife species.

Wildlife Damage Management Techniques

General description

Wildlife managers often have to manage wildlife to control damage. Wildlife damage management is most common in urban and suburban areas where wildlife and humans frequently interact. Examples of wildlife damage include:

- woodpeckers hammering on the side of the house;
- bats or squirrels in the attic;
- snakes in the house;
- deer eating ornamental plants in the yard or depredating soybean crops;
- bobcats, coyotes, and owls preying on livestock or pets;
- rabbits and raccoons eating vegetable gardens;
- beavers killing trees or flooding crops and roads;
- bird strikes at airports;
- rock pigeons defecating on buildings;
- starlings roosting in urban trees and defecating on sidewalks; and
- Canada geese loitering (and defecating) on lawns and golf courses.

Wildlife managers use both lethal and nonlethal methods to control these problems. Fencing and other exclusion devices, habitat modifications, harassment techniques, scare tactics (such as propane cannons, dogs), and taste and odor repellents are examples of nonlethal methods.

Changing human activity also can be effective. For example, removing the dog food or bird feeder from the deck is the easiest way to keep raccoons, rodents, and other wildlife off the deck.

Often, nonlethal methods do not work and lethal methods are required. Lethal methods are intended to kill wildlife quickly without suffering and may include body-gripping traps, trap-and-euthanize (put to death without pain or suffering), shooting, and poisoning. There are advantages and disadvantages to both lethal and nonlethal management methods.

One advantage of lethal methods is they can immediately decrease the numbers of animals in a population that are causing damage or health hazards, thereby immediately reducing the damage or hazard. In some cases, only one or a few animals are causing the problem, and lethal methods can then eliminate the damage once the individual(s) causing the damage is eliminated.

Nonlethal methods typically cause the animals causing the problem to move to another location. Although nonlethal methods may reduce or eliminate the problem at one location, the animal(s) causing the problem may relocate and cause the same problem at a different location. An advantage of nonlethal methods is they are generally accepted by the public better than lethal methods and they can be more easily used in areas with high human density. Education can help the public understand the efficacy and sensibility of many lethal methods.

Regardless of the method used, there are some general guidelines that can increase the success of a wildlife damage management program. It is important to identify the species causing the damage. An integrated wildlife damage management program that 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).

NOTE: For the purposes of this contest, it sometimes can be confusing when deciding whether to recommend ***Increase Harvest*** or ***Wildlife Damage Management Techniques***.

- If the problem is related to an overabundant population of a game bird or mammal and hunting or trapping is allowed on the property, ***Increased Harvest*** should be recommended.
- If the problem is related to a nongame animal, or if regulated hunting or trapping is not allowed on the property, or if control is necessary outside the regulated hunting and trapping seasons, or if the problem is related to one or a few individual animals (whether game or nongame), then ***Wildlife Damage Management Techniques*** would be the appropriate practice to recommend. For example, if cottontails are causing problems in a garden, control would be necessary outside the regulated hunting or trapping season (fall and winter). ***Wildlife Damage Management Techniques*** could be recommended during spring or summer when the problem is occurring.

Wildlife Damage Management Techniques should be used to control nongame and nonnative species for which there is no hunting or trapping season, such as woodpeckers damaging a building or house sparrows outcompeting bluebirds.

Although not common, ***Wildlife Damage Management Techniques*** could also be required if increased harvest has not been effective. Situations can occur where local regulated hunting and trapping pressure is not able to effectively lower a population and professional wildlife damage management specialists are needed to address the situation. Examples may include population reduction for white-tailed deer, raccoon, coyote, and American beaver. The person in charge of the contest will give you clues as to which wildlife management practice (***Increase Harvest*** or ***Wildlife Damage Management Techniques***) would be most appropriate.

Figure 44. House sparrows often displace bluebirds from nest boxes constructed for bluebirds. This invasive nonnative species should be removed whenever possible.

Figure 45. Netting can be used to protect crops, such as grapes and blueberries, from birds and other wildlife.

Figure 46. Coyotes play an important role as a predator. However, they can be problematic in various situations. Problems associated with livestock depredation are often a result of one or a few local individuals. Problems associated with limiting recruitment of other wildlife species, such as white-tailed deer, are more often a result of a dense coyote population. Sustained ***Increased Harvest*** can help lower coyote populations. ***Wildlife Damage Management Techniques*** are employed to target problem individuals. Regardless, trapping is usually the recommended technique for controlling coyotes.

Fish Pond and Stream Management Practices

NOTE: Although many wildlife species may use ponds and fish habitat for various reasons, practices included in this section are intended primarily for fish. 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.

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.

This practice should be recommended when creating new fish ponds with relatively permanent water. When constructing ponds, artificial reefs can be included for additional cover. These structures are usually constructed of rock piles, sections of plastic or cement pipe (a minimum of 6 inches in diameter and 18 inches long), and brush piles. Artificial reefs are normally recommended only for ponds larger than 10 surface acres.

NOTE: ***Restock Fish Pond*** should not be selected when ***Construct Fish Pond*** is recommended.

Effect on Habitat

- Ponds provide habitat for some fish and wildlife species.

Control Aquatic Vegetation

General description

Aquatic vegetation should be controlled when it begins to limit use of a fish pond for recreation or interferes with access. As surface area coverage by vegetation exceeds 33-50 percent, the ability of predator species (such as largemouth bass) to access forage species (such as bluegill) may become reduced and therefore negatively impact the balance of the fish populations.

Prevention of rooted aquatic vegetation growth can be accomplished two ways:

1. Deepening the edges of the pond to a minimum of two to three feet with steep side slopes, which minimizes shallow water areas exposed to sunlight. Pond edges can be deepened in drained ponds with a bulldozer or tractor with rear blade or in existing ponds with a backhoe. The soil removed can be piled on the bank or levee and smoothed for planting with native grasses and forbs.

2. Initiating a spring-through-fall fertility program, which reduces light transmission and prevents rooted submerged plants from becoming established (see **Fertilize/Lime Fish Pond** for more information).

Existing aquatic vegetation can be controlled chemically, biologically, or mechanically.

- Chemical control is accomplished by applying a labeled aquatic herbicide following identification of the targeted plant species.
- Biological control is also plant species specific. Potential biological control agents for aquatic vegetation include fish species (such as white amur/grass carp, tilapia) and insects (such as salvinia weevil). Regulations as to which biological control agents may be used vary from state to state.
- Mechanical control includes physically removing existing vegetation by seining, dragging with chains or ropes, cutting, and raking.

Figure 47. Filamentous algae and cattails must be controlled in this pond before fertilization is possible. Dense cattails can provide cover for many small fish and lead to an imbalanced fish pond.

Effect on habitat

- Reduces rooted 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, preventing an algae bloom. If ponds are not fished sufficiently, the fish population will become out of balance and growth will become stunted.

Fertilization is needed in fish ponds with water clear enough that you can see clearly to 18 inches below the water surface.

- Total alkalinity (the measured of total bases expressed as carbonates) and pH of the pond water should be tested before beginning a fertilization program.
- Total alkalinity should be at least 20 parts per million (ppm) with a pH of 6.5 to 9.0.
- Total alkalinity and pH can be assessed by collecting water samples; pH can also be measured by collecting samples of the pond bottom (substrate) and having them tested.

Agricultural limestone (calcium carbonate) should be applied evenly over the pond surface area per recommended rate.

Fish ponds should be fertilized in the spring when the water temperature reaches 60 F.

- For ponds with moderate hardness (50 mg/l to 100 mg/l calcium hardness), apply 15 pounds of 12-52-4 (or its equivalent) powder, or one gallon of 11-37-0 liquid fertilizer, or 15 pounds of granular 0-46-0 per acre at two-week intervals, or until a good green color (phytoplankton bloom) develops in the pond.
- Make additional fertilizer applications (at the same rate per surface acre) every three to four weeks, or when the water clears (becomes less green).

Fertilization may be continued until water temperatures drop below 60 F in the fall.

Methods for applying fertilizer vary with the type of fertilizer used. Granular fertilizer must be distributed from a fertilizer platform. Liquid fertilizer should be mixed with pond water and broadcast from a boat for large ponds or from the bank of small ponds. Water soluble powdered fertilizers can be broadcast from a boat or from the bank.

Effect on habitat

- Pond fertilization stimulates phytoplankton production, which is the first step in the food chainof a fish pond.

Reduce Turbidity in Fish Pond

General description

Turbid or muddy water limits fish production because natural food organisms need sunlight to grow. Turbidity can be caused by sediment being washed in from the pond banks or watershed, cattle using the pond, feeding activities of bottom-dwelling fish, such as carp or buffalo fish, or negatively charged clay particles suspended in the water column.

Turbidity is most often caused by sedimentation (erosion) from the watershed or the pond bottom (cattle or fish) and will usually clear in a relatively short period of time. Reducing erosion in the watershed is best accomplished by reseeding relatively large bare areas of soil around the pond where there is evidence of erosion. Turbidity from pond sediments can be controlled by restricting cattle to a small area of the pond and eliminating bottom-dwelling fish.

Turbidity from suspension of negatively charged clay particles is a more difficult problem. The addition of positively charged compounds, such as limestone, gypsum, or alum crystals, can cause the clay particles to settle.

Effect on habitat

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

Restock Fish Pond

General description

Restocking a pond is a drastic measure and should only be considered after other management approaches have been attempted.

- Ponds containing wild fish species, such as carp, shad, green sunfish or bullhead catfish, should be restocked with a balanced predator-prey combination.
- Restocking should be done only after all fish in the pond have been removed, either by draining or applying a fish toxicant.

In warm-water ponds, bluegill fingerlings should be stocked in late fall and bass fingerlings are stocked the following June. Although various states have different stocking recommendations, typical stocking rates are 1,000 bluegill and 100 bass per surface acre if the pond is to be fertilized, or 500 bluegill and 50 bass per surface acre if the pond will not be fertilized.

Effect on habitat

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

Photo Acknowledgments

Figure 1. John Gruchy
Figure 2. Becky McPeake, University of Arkansas
Figure 3. Blake Brown, University of Tennessee
Figure 4. Dot Paul, NRCS Photo Gallery
Figure 5. Craig Harper, University of Tennessee
Figure 6. Craig Harper, University of Tennessee
Figure 7. Craig Harper, University of Tennessee
Figure 8. Dwayne Elmore, Oklahoma State University
Figure 9. Craig Harper, University of Tennessee
Figure 10. Craig Harper, University of Tennessee
Figure 11. Craig Harper, University of Tennessee
Figure 12. Craig Harper, University of Tennessee
Figure 13. Craig Harper, University of Tennessee
Figure 14. Craig Harper, University of Tennessee
Figure 15. Craig Harper, University of Tennessee
Figure 16. University of Arkansas
Figure 17. U.S. Fish and Wildlife Service
Figure 18. Becky McPeake, University of Arkansas
Figure 19. Craig Harper, University of Tennessee
Figure 20. Craig Harper, University of Tennessee
Figure 21. Craig Harper, University of Tennessee
Figure 22. Craig Harper, University of Tennessee
Figure 23. Craig Harper, University of Tennessee
Figure 24. David Mercker, University of Tennessee
Figure 25. David Mercker, University of Tennessee
Figure 26. David Mercker, University of Tennessee
Figure 27. Craig Harper, University of Tennessee
Figure 28. Billy Higginbotham, Texas AgriLife
Figure 29. Jon Barry, University of Arkansas
Figure 30. U.S. National Park Service
Figure 31. Craig Harper, University of Tennessee
Figure 32. Craig Harper, University of Tennessee
Figure 33. Craig Harper, University of Tennessee
Figure 34. Marc Bartoskewitz, King Ranch, Texas
Figure 35. Craig Harper, University of Tennessee
Figure 36. Craig Harper, University of Tennessee
Figure 37. Craig Harper, University of Tennessee
Figure 38. Craig Harper, University of Tennessee
Figure 39. U.S. Forest Service
Figure 40. Craig Harper, University of Tennessee
Figure 41. Craig Harper, University of Tennessee

Figure 42. Mississippi State University
Figure 43. Becky McPeake and Jon Barry, University of Arkansas
Figure 44. Craig Harper, University of Tennessee
Figure 45. Dwayne Elmore, Oklahoma State University
Figure 46. Terry Spivey, USDA Forest Service, Bugwood.org
Figure 47. Billy Higginbotham, Texas AgriLife
Figure 48. Craig Harper, University of Tennessee

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

Southeast Mixed and Outer Coastal Plain Forest								
Habitat Management Practices								
Conservation Easement								
Control Nonnative Invasive Vegetation								
Create Snags								
Delay Crop Harvest								
Edge Feathering								
Field Borders								
Forest Management								
Leave Crop Unharvested								
Livestock Management								
Nesting Structures								
Plant Food Plots								
Plant Native Grasses and Forbs								
Plant Shrubs								
Plant Trees								
Repair Spillway/Levee								
Set-back Succession								
Tillage Management								
Water Control Structures								
Water Developments for Wildlife								
Population Management Practices								
Decrease Harvest								
Increase Harvest								
Wildlife Damage Management								
Wildlife or Fish Survey								
Fish Pond/Stream Management Practices								
Construct Fish Pond								
Control Aquatic Vegetation								
Fertilize/Lime Fish Pond								
Reduce Turbidity in Fish Pond								
Restock Fish Pond								
Streams: Create Pools								
Streams: Remove Fish Barriers								

Wildlife Management Plan

Objectives
Referring to an identified area, Senior teams make written recommendations based on landowner objectives as stated on a Field Condition Sheet (scenario), which is provided to each team. A satellite image of the identified area may (or may not) be provided.

Overview
From the Field Condition Sheet, each team interprets the landowners objectives, identifies the focal species, recommends wildlife management practices and their intended impact, and states how the plan will be evaluated. The Judges' Scoring Sheet details how plans are judged. All plans must be written using paragraph format. Follow the format outlined in the study guide.

Contest Rules
1. Each Senior contestant needs to bring pencils and a clipboard. The clipboard may be labeled for identification purposes, but no other writing is allowed.
2. This is a team event, so talking with your teammates is allowed.
3. Each team will be provided a Field Condition Sheet (scenario) and possibly a satellite image of the identified area (optional). Each team will also receive three blank sheets of unlined paper for the wildlife management plan, and additional blank pages for the team to use for brainstorming ideas and drafting the plan.
4. Teams may use **one side** each of three pieces of paper provided for writing their management plan.
   - Two sheets are for writing the narrative.
   - One sheet is for a sketch map illustrating where practices are implemented.
5. Only write the plan or sketch map on one side of each sheet of paper. The other side of the paper should be blank. (The blank side is where you will write the names and ID numbers of the team members.) Plans not written in the proper format or correctly identified will be deducted points or not be judged at all, at the discretion of the judges. For example, if a plan is written on two sides of one sheet of paper, only one side may be judged and receive points.
6. Participants are **required** to draw a sketch and locate where recommended practices will be implemented. (Sketch maps are NOT optional.)
7. The name and id of each team member **must** be written on the blank back side of each sheet.
8. Teams will have 1 ½ hours to complete this event, including preparation for Oral Reasons.

Scoring
This event is worth 250 points maximum based on an evaluation of the plan by one or more wildlife biologists serving as judges. This score is combined with the top three scores for Oral Defense of the Written Plan (50 points maximum per team member) for a total team score of 400 points maximum. Top scores from individual events (except Oral Reasons) are combined with the team score to determine the overall team score.

Wildlife Management Plan - Study Guide

A wildlife management plan for the 4-H Wildlife Habitat Education Program follows a specific format. This format needs to be adhered to (i.e., memorized and used) when writing the plan. The plan consists of two parts:

- written narrative of two pages, and
- sketch map illustrating where practices are to be implemented.

The narrative portion consists of four main sections that must be written in paragraph format. Memorize these four main sections and use them as headings in your wildlife management plan. Writing should be concise and use wildlife concepts and terms.

The narrative portion of the wildlife management plan consists of four parts:

- **Plan Background** (20 Points)
  - *What are the species to be managed? (10 points)*
  - *State the management objectives (10 points)*
- **Plan Development** (80 Points)
  - *Demonstrated understanding of the habitat needs of each species (40 points)*
  - *Accurately evaluated the area as habitat for each species (what is present and what is lacking) and the management objectives (40 points)*
- **Plan Implementation** (80 Points)
  - *Included the appropriate management practices and where they should be implemented (20 points)*
  - *Demonstrated knowledge of the effect of various management practices on the habitat and/or the species (20 points)*
  - *Used the appropriate native plant species or recognized nonnative invasive species (20 points)*
  - *Recognized the management compromises necessary to meet the needs of each species and showed understanding of the mutual benefits of implementing certain practices (20 points)*
- **Plan Evaluation** (30 Points)
  - Presented realistic methods for monitoring success of the recommendations (30 points)
- **Format and drawing of sketch map** (40 Points)
  - *Presented in the appropriate narrative format (20 points)*
  - *Included a drawing or sketch of the area, reflecting the recommended management practices (20 points)*

Sketch Map

The sketch map should be legible and easy for judges to interpret. The ability of judges to understand where practices will be implemented affects your score. Consider the following when preparing a sketch map:

- *Clarity*. Prepare a legend for the map explaining symbols or figures used to represent grasses, shrubs, trees, fencerows, ponds, streams or other map features. Orient the map either with a directional symbol for north, placement of a road or other feature, or other clue to assist judges with map orientation and clarity.

- *Features are accurate*. Existing structures, such as a barn or pond, should be present on the map and their positions should be spatially correct. Figures or symbols should reflect the size and proportion of the feature. For example, a hummingbird feeder should not exceed the size of a shed.

- *Features are logical*.
  - The presence and arrangement of management practices should be realistic and maximize wildlife benefits. For example, do not place a bird feeder on top of a shed where, logically, it would be difficult to refill a feeder. Another example is planting water-intolerant trees in a wetland.

  - Match the management practice to the needs of the wildlife species. For example, do not build brushpiles if no species listed on the Field Condition Sheet will benefit from brushpiles. (An exception is if you team indicates habitat for prey species such as cottontails will be developed; however this must be indicated in the plan.)

  - Pay attention to where planned management practices are placed in relation other practices or features (arrangement and interspersion). For example, constructing a brushpile in the middle of a 20-acre field does not benefit cottontails or bobwhites without shrubby corridors or escape cover nearby. Another example is of burning an entire field, consider partitioning a field into sections and burn on a three to five year schedule to increase plant diversity and provide suitable alternative habitat for nesting or cover.

- *Consistency.*
  - *All management practices are present on the map*. Any management practice listed in the written narrative should be found on the map. Any management practice found on the map should be listed in the written narrative.

Example of Written Wildlife Management Plan

The samples below are intended to help you learn the correct format for writing management plans. At a contest, you will be given three or more blank pieces of paper, two of which are for writing your plan. Write on your paper the heading "Plan Background" and in narrative format, provide information addressing this section. Do the same for "Plan Development," "Plan Implementation," and "Plan Evaluation" sections. Use one sheet of paper for the sketch map.

You can use only one side of each of three sheets of paper. Write neatly, using small print and short concise sentences. For the total score, a maximum of 20 points will be given for use of the correct format and inclusion of an accurate sketch of the site.

2013 National WHEP Written Plan Scenario
Atterbury Fish and Wildlife Area, Trafalgar, Indiana

The Atterbury Fish and Wildlife Area (AFWA) is 6,500 acres and was historically owned by the Department of Defense (DoD, Camp Atterbury) and is now managed by the Indiana Department of Natural Resources (IDNR). Historically, DoD leased fields to local producers for row-cropping, but there were no efforts to manage the area for wildlife. The IDNR has decided to manage particular sections of the property, including the one you are on, for species that use early successional stages, such as eastern cottontail and brown thrasher. The northern bobwhite has been identified as the focal species because bobwhite populations in the ecoregion have declined sharply over the past few decades; therefore, quail hunting has been suspended.

Funding for land management is a limitation. Thus, the IDNR has decided to continue to lease fields for row-cropping, specifically corn, soybeans, and wheat. The IDNR has calculated at least 50 percent of the area must be leased to provide sufficient income for management activities. AFWA is open for hunting. The IDNR foresees hunting opportunities for mourning dove and eastern cottontail, which are relatively common in the area.

The area you are considering is approximately 115 acres and includes 60 acres of soybeans. This section is bordered on the north side by a firebreak and a treeline, on the east side by a firebreak, on the south side by the road, and on the west side by a firebreak and woods.

Your task is to prepare a management plan that provides information and recommendations to meet IDNR's objectives and property limitations. You have 1 1/2 hours to complete your plan. This is a team activity. Prepare your plan on 2 sheets of paper, but write only on one side of each sheet. Sketch a map of the area including placement of your management recommendations on the third sheet. Include your **team ID number** on the back of each sheet. Do not write your name or the name of your state on the sheet. Good luck and have fun coming up with your recommendations!

Plan Background

The species to be managed include northern bobwhite, eastern cottontail, and brown thrasher. The management objectives are to manage the area for wildlife species that use early successional stages, particularly those listed above, and provide hunting opportunities.

Plan Development

Species Habitat Requirements

Northern bobwhite use scattered patches of shrubby cover, well interspersed with native grasses, forbs, and bare ground. Areas dominated by forbs are commonly used for brooding cover. A variety of seeds, leaves, and insects are eaten.

Eastern cottontails require brushy cover interspersed with herbaceous openings. They eat forbs and grasses, bark of shrubs and young trees, buds, and browse.

Brown thrashers are found in shrub and bramble thickets, brushy hedgerows, young forests, and forest edges. They eat invertebrates and various seed found on the ground among the leaf litter. They usually nest in shrubs up to 10 feet aboveground.

Mourning dove use areas with annual and perennial grasses and forbs with considerable bare ground for feeding. They nest in shrubs and trees or on the ground. They commonly use agricultural fields for foraging. They require free-standing water daily.

Habitat Assessment

The area under consideration is 115 acres and includes 2 fields of soybeans that have been planted via no-till agriculture that encompass 60 acres. There are field borders surrounding some portions of the soybean fields. There are 2 small woodlots with an open canopy of scattered trees and a dense brushy understory. The remainder of the area contains dense grass (tall fescue) with scattered forbs, brambles, and tree saplings. Brooding cover for northern bobwhite is limited because of a lack of mobility in the thick grass. Brushy cover used for escape and winter loafing by bobwhite is limiting. Cover for brown thrasher only exists in the 2 small woodlots. Cover for eastern cottontail is largely limited to the small woodlots. The tall fescue does not provide overhead cover. Winter cover will be severely limiting for all species after the soybeans are harvested. There is no free-standing water available.

Plan Implementation

Control Nonnative Invasive Species to reduce coverage of tall fescue and allow the seedbank to germinate, which will provide more food and better cover for all 4 species.
Field Borders should be established around portions of the soybean fields where there are none. This will increase usable space for northern bobwhite and eastern cottontail.
Leave Crop Unharvested will provide soybeans for northern bobwhite, mourning dove, and eastern cottontail into winter.
Plant Shrubs between sections of soybean fields that will be retained to provide a corridor

connecting the two woodlots. This will increase usable space for northern bobwhite, eastern cottontail, and brown thrasher, and increase loafing and nesting cover for mourning dove.
Set-back Succession: Prescribed Fire will set-back and rejuvenate the understory in the woodlots and provide more forage for eastern cottontail and northern bobwhite.
Water Development for Wildlife (small pond) should be established to provide free-standing water for mourning doves.
Wildlife Survey should be conducted to monitor populations of all 4 species. Point counts may be used for mourning dove and brown thrasher, covey counts may be used for northern bobwhite, and observation counts and hunter harvest data can be used for eastern cottontail.

Plan Evaluation

Wildlife survey data will be evaluated annually and tracked over time to estimate population trends.

Hunter success and satisfaction will be accessed through surveys. Vegetation surveys will determine if additional treatment is needed to reduce tall fescue, evaluate success of shrub plantings, and evaluate habitat quality for all species.

Additional Samples of Field Condition Sheets

2012 Arkansas State Contest
Petit Jean Mountain

The Winrock Farms board of directors is interested in developing a small demonstration area to determine whether they want to place more emphasis on wildlife in connection with their cattle operations. The demonstration area is strategically located near the Winthrop Rockefeller Institute to provide visitors with visual enhancement. They would like to provide visitors the opportunity to see wildflowers and butterflies, and hear a variety of birdsongs, to demonstrate the compatibility of livestock production with wildlife.

The boundaries of the demonstration area are the same as described for the wildlife practices scenario. The land area to be judged is outlined on the aerial photo. DO NOT GO INSIDE FENCE. Remain outside the fence to view the land area. If you have questions about the boundary, ask the station monitor.

The species which Winrock Farms wants visitors to see or hear in the demonstration area are:

- Northern bobwhite
- Dickcissel
- Northern harrier

The chair of the board is particularly concerned about the decline of spotted skunks in the state and has approached the Arkansas Game & Fish Commission about relocating some to the farm. Your plan should include habitat for spotted skunks. There is no hunting or shooting on the demonstration area because it is too close to where visitors frequent. The Board of Directors is

concerned about safety and liability issues. Winrock Farms will continue their cattle operations on the demonstration area. The Board of Directors specifically asked for recommendations concerning cattle on the demonstration area.

The stakes are high. If your team's plan and demonstration area is successful, it could result in about one thousand acres of additional wildlife habitat on Petit Jean Mountain.

INSTRUCTIONS: You have 1 ½ hours to complete this team activity. Write your management plan on one side of each of two pieces of paper (two pages maximum). You can use one side of one additional piece of paper to draw a map. Write the names of team members and ID codes on the back of each answer page. Use the remaining time to prepare for oral defense.

National Invitational in Utah

The Three Peaks area has long been favored by outdoor enthusiasts. The area is owned by the Bureau of Land Management (BLM). Managing the area for multiple user groups is often difficult. Users at Three Peaks include hunters, recreational shooters, hikers, bird watchers, ATV riders and remote control airplane fanatics. BLM requests your assistance in developing a management plan for wildlife on the 4,000 acre tract. The area marked by flags is a representative sample of the vegetation and topography on the 4,000-acre area.

Sage grouse are not hunted on Three Peaks. University researchers have surveyed the area and determined sage grouse populations are very low. Early indicators suggest a lack of brood rearing cover and nest disturbance by recreational users may be to blame.

Bird watchers and hikers on the area occasionally observe red-tailed hawks pursuing desert cottontails and kangaroo rats. BLM would like to see an increase in the red-tailed hawk population. Some bird watchers have also reported seeing sage thrashers.

Constructing Interstate 15 directly through the mule deer winter migration corridor leading to Three Peaks has had a negative impact on the herd. Biologists have determined this hunted mule deer population is negatively impacted by deer/car collisions and have determined mule deer here have relatively low body weights.

The presence of cheat grass on Three Peaks is a major concern because it is invasive and does not provide adequate cover or forage. Fire is not the preferred method of disturbance on this site because it allows cheat to dominate. If disturbance occurs naturally or by recommendation, efforts should be made to establish native grasses and forbs to avoid this problem.
Prepare a plan to meet BLM's objectives for mule deer, sage grouse, red-tailed hawk and sage thrasher.

This is a team activity. Use only one side of each of two (2) pages to write your plan. Use an additional third page to write your sketch map. You have 1 ½ hours to complete this activity. Good Luck!

Contestant ID Numbers:_____

Judges' Scoring Sheet – Written Management Plan

Part I: Plan background (0 - 20 points maximum) **_____points**

- Accurately identified the wildlife species to be managed and accurately identified the management objectives (20 points)

Part II: Plan development (0 - 80 points maximum) **_____points**

- Demonstrated understanding of the habitat needs of each species (40 points)
- Accurately evaluated the area as habitat for each species (what is present and what is lacking) and the management objectives (40 points)

Part III: Plan implementation (0 - 80 points maximum) **_____points**

- Included the appropriate management practices and where they should be implemented (20 points)
- Demonstrated knowledge of the effect of various management practices on the habitat and/or the species (20 points)
- Used the appropriate native plant species or recognized nonnative invasive species (20 points)
- Recognized the management compromises necessary to meet the needs of each species and showed understanding of the mutual benefits of implementing certain practices (20 points)

Part IV: Plan evaluation (0 - 30 points maximum) **_____points**

- Presented realistic methods for monitoring success of the recommendations (30 points)

Part V: Format and drawing (0 - 40 points maximum) **_____points**

- Presented in the appropriate narrative format (20 points)
- Included a drawing or sketch of the area, reflecting the recommended management practices (20 points)

Total points (250 maximum) **_____points**

Judge's Helpful Hints for Improvement *(written on back)*

Oral Defense of Written Plan

Senior Event

Objectives

Each contestant will demonstrate his/her understanding of wildlife management individually by responding to questions about the team's written wildlife management plan.

Overview

In this event, each contestant appears before one or two judges and answers questions about the team's wildlife management plan. To be successful and score well in the Oral Defense of Written Plan, it is important that each and every team member actively participates in developing the wildlife management plan. Each team member is expected to demonstrate his or her understanding of the plan in this event.

Contest Rules

1. Contestants are to prepare for the oral defense during time allotted for writing the wildlife management plan.
2. Team members are called individually to face a panel of one or two judges and answer a series of questions related to their written plan.

Scoring Oral Defense of Written Plan

Each team member will be scored individually. Judges use a score sheet with specific criteria to evaluate responses. Practice for this event using the score sheet by judging yourself and your teammates. Offer one or two areas of improvement to each person. Notice that the majority of points on the scorecard are awarded to knowledge of the subject matter. The remaining points focus on your presentation style.

The top three scores will be added together to contribute to your team's score. If four persons are on a team, the lowest score will be dropped. If only three persons are on a team, all three scores will be used.

Note: Scores for Oral Defense of Written Plan are not included in determining high individual scores.

Oral Defense of Written Plan - Study Guide

After completing the written plan, each team member will be expected to demonstrate their understanding of the plan. It is important that each team member actively participates in preparing the written plan. Comprehensive knowledge of the written plan is necessary to successfully respond to judges questions about the team's plan.

Team members are called individually to an area, such as a picnic table or a room, with one or two judges where they are asked a series of questions to test the individual's knowledge of the team's plan.

Each team member may be asked to explain a certain part of the plan such as the background or the implementation; or they may be asked to further explain certain management practices recommended within the plan. They may be asked to explain the habitat needs of the focal species. Questions can cover anything related to the plan, the focal species and/or management practices recommended. When responding, assume judges have not read your team plan.

Sample questions and requests:

- Explain the wildlife management practices your team implemented for Eastern cottontail.
- Two of the four species in your plan had very different habitat requirements. Identify those species and explain the compromises you made to accommodate those species.
- The Eastern bluebird requires early successional vegetation. Explain the techniques your team chose to manage disturbance and why they were recommended.
- In assessing habitat on this site, what do you consider the most limiting factor for thegrasshopper sparrow?
- Explain two methods you would use to determine the effectiveness of your team's plan.

Comprehensive knowledge of the written plan is necessary to successfully respond to judges' questions about the team's plan. Each team member must understand the habitat needs of each species considered and be able to discuss why any wildlife management practice should or should not be implemented.

Scoring Oral Defense of Written Plan

Each team member will be scored individually. Judges use a score sheet with specific criteria to evaluate responses. The contestants' oral reasons are judged based on their understanding of the subject matter (80%) and presentation skills (20%).

Subject matter (80%)

- Understanding of species biology and management
- Understanding of species habitat requirements

- Understanding of wildlife management practices and implementation
- Knowledge of concepts and terms

Contestant (20%)

- Logic, reasoning, and organization
- Poise, voice, and body language

When responding to questions, contestants should:

- remove headgear (e.g., hats)
- not chew gum
- identify themselves by first name and team number
- make eye contact with each judge, smile, and be enthusiastic
- stand or sit straight and not cross legs
- respond in terms of wildlife concepts, successional stages, and/or habitat requirements of the wildlife species of interest

Getting nervous is typical when participating in this event. Practice is usually the best antidote for reducing nervousness. Some nervousness may also help improve your responses. Keep in mind even professional actors, singers and athletes report being nervous before a performance. Consider mentally-rehearsing for your oral defense to focus more on the topic and less on your nerves prior to the event. A suggestion is when asked a question by the judges, rephrase the question as part of your response. This can help clarify the question in your mind and provide a more focused response to the judges. For example, if asked "explain the wildlife management practices your team implemented for Eastern cottontail," a good response might be:

> "The wildlife management practices that my team implemented for the Eastern cottontail were planting shrubs and clover, and building brushpiles every thirty feet along the field border. We will construct our brushpiles using some of the timber that we are thinning from the nearby woodland. We are going to place the larger trunks on the bottom in a criss-cross fashion to allow rabbits space underneath, then stack the brushpile with the smaller pieces. Between brushpiles, we plan to establish clover. We will plant shrubs across the field in strips at least 10 feet wide to give cottontails access to more field edges."

Typically judges are requested to limit each presentation to five minutes. Answers should be concise yet detailed enough to demonstrate your knowledge.

Contestants should never respond, "I don't know" and nothing more, as this provides no response for judges to score. Instead, tell judges what you do know about the topic. Judges may ask follow-up questions to assist contestants if responses are unclear, and help you find the answer.

Contestant Number:_____

Judge's Initials: _____

Judges' Scoring Sheet - Oral Reasons

Part 1: Subject matter (80 points maximum)
Scale for scoring: 0 = very poor, no points; 20 = outstanding, maximum points

- Understanding of species biology and management (20 points) **_____points**
- Understanding of species habitat requirements (20 points) **_____points**
- Understanding of wildlife management practices and implementation (20 points) **_____points**
- Knowledge of concepts and terms (20 points) **_____points**

Part 2: Contestant (20 points maximum)
Scale for scoring: 0 = very poor, no points; 10 = outstanding, maximum points

- Logic, reasoning, and organization (10 points) **_____points**
- Poise, voice, and body language (10 points) **_____points**

Total points: _____

Judge's Helpful Hints for Improvement: