4-H Wildlife Habitat Education Program
Contest Handbook
Web Version

July 2012

The Division of Agriculture offers its programs to all eligible persons regardless of race, color, national origin, religion, gender, age, disability, marital or veteran status, or any other legally protected status, and is an Affirmative Action/Equal Opportunity Employer.
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<th>Junior</th>
<th>Junior</th>
<th>Junior</th>
<th>Junior</th>
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<td>Junior</td>
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General Rules and Regulations

Contestants and Eligibility

A. A county Junior or Senior 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. 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 are encouraged to compete in WHEP. (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 attending WHEP.

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. The WHEP Coordinator will make team assignments by supplying a random number to single individuals and match them to a mixed county team to avoid creating a deliberate advantage to any team or individual.
   2. Mixed county teams comprised of 3 or 4 individuals will be formed.
   3. Individuals may be assigned to county teams already having three contestants if necessary. The team(s) receiving the extra member will be selected using a random number generator.
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 do not need 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.
   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 $10 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 in 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 writing 15 or more days before the contest. No switching of team members is allowed less than 15 days prior to 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 team with fewer than three members on contest day, those remaining must participate in team events and will compete for individual awards.

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 or the Arkansas 4-H Foundation, Inc. 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.

General Contest Rules

A. Cloverbuds, siblings, and 4-H Junior/Senior contestants, after completing contest, must be accompanied by an adult at all times.

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 prepare them 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, Wildlife Foods and Concepts, and Interpreting Wildlife Habitat from Aerial Photos. No talking is allowed.
2. a team on Wildlife Management Practices and will be allowed to talk with team members.

E. Senior contestants compete as:
2. a team 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.

**Summary of Arkansas WHEP Activities by 4-H Level**

<table>
<thead>
<tr>
<th>WHEP Event</th>
<th>Activity Type</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wildlife Identification</td>
<td>With assistance</td>
<td>Cloverbud</td>
</tr>
<tr>
<td></td>
<td>Individual</td>
<td>Junior</td>
</tr>
<tr>
<td></td>
<td>Individual</td>
<td>Senior</td>
</tr>
<tr>
<td>Wildlife Foods &amp; Concepts</td>
<td>Individual</td>
<td>Junior</td>
</tr>
<tr>
<td></td>
<td>Individual</td>
<td>Senior</td>
</tr>
<tr>
<td>Aerial Photo Interpretation</td>
<td>Individual</td>
<td>Junior</td>
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<tr>
<td></td>
<td>Individual</td>
<td>Senior</td>
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<tr>
<td>Wildlife Management Practices</td>
<td>Team</td>
<td>Junior (chart only)</td>
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<tr>
<td></td>
<td>Individual</td>
<td>Senior (land judging)</td>
</tr>
<tr>
<td>Wildlife Management Plan</td>
<td>Team</td>
<td>Senior</td>
</tr>
<tr>
<td></td>
<td>Individual</td>
<td>Senior</td>
</tr>
<tr>
<td>Oral Defense of Wildlife Management Plan</td>
<td>Individual</td>
<td>Senior</td>
</tr>
</tbody>
</table>

F. The Arkansas 4-H Wildlife Committee plans and implements 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, the committee selects a region for the contest. Regions found in Arkansas are eastern deciduous forest, southeast mixed and outer coastal plain forest, wetlands, grasslands, and urban. Only those species which occur within the selected region are used in the contest. An exception is species listed for the urban region which are always included in Wildlife Identification.

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.

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, Wildlife Foods and Concepts, Interpretation of Aerial Photos are recognized. First, second, third, fourth, and fifth places will be awarded.
   2. Senior individuals achieving the highest accumulative score for Wildlife Identification, Wildlife Foods and Concepts, Interpretation of Aerial Photos, and Wildlife Management Practices are recognized. First, second, third, fourth, and fifth places will be awarded.
   3. 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 Interpretation of Aerial Photos 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.

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, Wildlife Foods and Concepts, Interpretation of Aerial Photos) 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, Wildlife Foods and Concepts, Interpretation of Aerial Photos, Wildlife Management Practices) plus the lowest Oral Reasons score will be dropped.

4. In case of a tie, the team with the highest score in 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 Interpretation of Aerial Photos will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Oral Reasons 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 Assistant 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 Evaluation Invitational is held.
   c. All contestants must be members of Arkansas 4-H during the year in which the National 4-H Wildlife Habitat Evaluation Invitational is held.
   d. The contestant, his or her county 4-H staff member, and the Assistant 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 Evaluation contest cannot re-enter the Arkansas state contest again. However, such state winners can continue to participate in Arkansas WHEP as teen WHEP 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 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 Evaluation 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.
   c. The team coach and a member of the Arkansas 4-H Wildlife Habitat Education Program Committee will accompany the winning senior team to the Invitational, unless the committee forfeits this option. In that instance, the team coach selects an assistant coach who will attend the contest.
   d. Coaches and assistant coaches must either be an employee of the 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 costs, including all meals and lodging 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.
   c. Many “fun-day” activities associated with the contest are part of the registration fee, but some activities (e.g., whitewater rafting) may require an extra charge. The Arkansas 4-H Wildlife Habitat Education Program reserves the right not to pay extra activity fees.

Rules for the Contest Day

A. Each contestant must provide his or her own pencils and clipboard. The clipboard should be clean without any writing.
B. Senior contestants are encouraged to wear field clothing and close-toed shoes to WHEP events.

C. No electronic devices of any kind are allowed at the contest site. This includes, but is not limited to, cell phones, iPads, iPods, calculators, etc. Such devices should be left with coaches or chaperones during the contest.

D. 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 at all times 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.

E. Absolutely no talking by contestants will be allowed during the contest, except when working on designated team activities.

F. Anyone caught cheating will be disqualified.

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

H. 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.

I. An official committee will score the contest and announce results. Their decision is final.
WHEP Contest Scoring Guide
Junior and Senior Events

This guide 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 (20 points maximum):** The total number of correct responses is added together for this score.
- **Foods and Concepts (20 points maximum):** The total number of correct responses is added together for this score.
- **Interpreting Wildlife Habitat from Aerial Photographs (20 points maximum):** The total number of correct responses is added together for this score.

**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 Interpretation of Aerial Photos 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
Junior 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 Habitat Practices. If a team has a fourth member, the lowest individual score for each event (i.e., Wildlife Identification, Wildlife Foods and Concepts, Interpretation of Aerial Photos) will be dropped.

**Wildlife Habitat 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.

All boxes are counted in the scoring. For example, for eastern deciduous forest, there are 200 possible correct answers because there are 25 wildlife management practices × 8 possible species on an answer sheet. The practices are worth 100 points maximum, therefore a conversion factor will be used to make the score equivalent to a 100 point scale.
**Tie breaker:** In case of a tie, the team with the highest score in Wildlife Habitat 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 Interpretation of Aerial Photos 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 Junior Individual and Team Scores**

<table>
<thead>
<tr>
<th>4-H WHEP Team</th>
<th>Individual Scores (maximum score)</th>
<th>Team</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wildlife ID (20)</td>
<td>Foods &amp; Concepts (20)</td>
</tr>
<tr>
<td>John Doe</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Jane Doe</td>
<td>15</td>
<td>11 (drop)</td>
</tr>
<tr>
<td>Janie Rainy</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>Johnny B. Good</td>
<td>12 (drop)</td>
<td>17</td>
</tr>
<tr>
<td><strong>Team scores</strong></td>
<td><strong>45</strong></td>
<td><strong>48</strong></td>
</tr>
</tbody>
</table>

**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 (20 points maximum):** The total number of correct responses is added together for this score.
- **Foods and Concepts (20 points maximum):** The total number of correct responses is added together for this score.
- **Interpreting Wildlife Habitat from Aerial Photographs (20 points maximum):** The total number of correct responses is added together for this score.
- **On Site Recommendation of Wildlife Habitat Practices (30 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.

  **Total Score = (total correct boxes / total possible correct answers) × 30**

  All boxes are counted in the scoring. For example, for eastern deciduous forest, there are 200 possible correct answers because there are 25 wildlife management practices × 8 possible species on an answer sheet.

**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...
Interpretation of Aerial Photos 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 the 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, Interpretation of Aerial Photos, Wildlife Management Practices) plus the lowest Oral Reasons score will be dropped.

- **Wildlife Management Plan (140 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 (20 maximum individual points; 60 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 5 to convert the score to a 20-point scale.

Tie breaker: In case of a tie, the team with the highest score in 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 Interpretation of Aerial Photos will be declared the winner. If a tie remains, the team with the highest accumulative individual scores in Oral Reasons 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

<table>
<thead>
<tr>
<th>4-H WHEP Team</th>
<th>Individual Scores (maximum score)</th>
<th>Team Scores (maximum score)</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Jane Doe</td>
<td>15</td>
<td>11 (drop)</td>
</tr>
<tr>
<td>Janie Rainy</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>J. B. Good</td>
<td>12 (drop)</td>
<td>17</td>
</tr>
<tr>
<td>Team scores</td>
<td>45</td>
<td>48</td>
</tr>
</tbody>
</table>
Preparing for Wildlife Contests

This website is a tool for learning about wildlife 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. Only a portion of the study guides are used each year. Knowledge gained from each event builds upon the next.

A study region is announced each year, typically in August. Each region has a limited number of wildlife species to study for the contest. The state 4-H WHEP contest takes place in April and the 4-H Wildlife O-Rama in June and July. The state WHEP contest moves to different locations each year to broaden contestants’ understanding of the different regions. A practice session is held in February to help prepare for these events.

Summary of Arkansas 4-H Wildlife Education Competitive Events

<table>
<thead>
<tr>
<th>WHEP Event</th>
<th>Activity Type</th>
<th>Level</th>
<th>Wildlife O-Rama</th>
<th>Level</th>
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<tbody>
<tr>
<td>Wildlife Identification</td>
<td>Individual</td>
<td>Cloverbud</td>
<td>Wildlife Identification</td>
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<td>Individual</td>
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<tr>
<td></td>
<td>Individual</td>
<td>Senior</td>
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<td>Senior</td>
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<td>Individual</td>
<td>Junior</td>
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<td>Individual</td>
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<td>Wildlife Management Practices</td>
<td>Team</td>
<td>Junior (chart only)</td>
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<tr>
<td></td>
<td>Individual</td>
<td>Senior (land judging)</td>
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<td>Wildlife Management Plan</td>
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<tr>
<td>Oral Defense of Wildlife Management Plan</td>
<td>Individual</td>
<td>Senior</td>
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The **Wildlife Identification** event uses species from the urban region and the announced region, which is about 30 to 40 species. The remainder of the contest focuses on species within the announced region, typically less than 20 species.

For **Wildlife Foods and Concepts**, participants match wildlife with the foods they consume. They must also answer questions about key wildlife management concepts and terms. Additionally, Senior contestants must also know the habitat needs of the wildlife species in the region, and general knowledge about implementing wildlife management practices.

**Interpreting Wildlife Habitat from Aerial Photos** is important for understanding when and where certain wildlife habitat practices need to be implemented. Being able to read an aerial photo is a first step. Contestants also 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.

The **Wildlife Management Practices** event is where contestants match the species with the practices. For example, increase/decrease harvest is an appropriate practice for the wild turkey but not the ovenbird. Seniors judge a piece of land and determine whether a practice is needed, such as leaving snags and downed wood for red-tailed hawks.

These events are building blocks for preparing a **Wildlife Management Plan**. For Senior 4-H members, preparing the plan this is the culminating activity. They work as a team to write the plan based on a scenario having up to six wildlife species 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.

Following is a list of web sites having e-mail, snail mail, and telephone information on agency personnel who work with wildlife on private lands and education programs. 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 say something that differs from the study materials, especially if they are not familiar with the contest or its content. Regardless, 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](#)
<table>
<thead>
<tr>
<th>Species</th>
<th>Eastern Deciduous Forest</th>
<th>Grasslands – Tallgrass/ Mixed Prairie</th>
<th>SE Mixed &amp; Coastal Plain Forest</th>
<th>Urban</th>
<th>Wetlands</th>
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<td>American kestrel</td>
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<tr>
<td>American robin</td>
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<tr>
<td>Big brown bat</td>
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<tr>
<td>Black bear</td>
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<td>Canada goose</td>
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<td>Common nighthawk</td>
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<tr>
<td>Northern bobwhite</td>
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## Wildlife Species by Region for the 4-H WHEP and Wildlife O-Rama Contests

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<th>Species</th>
<th>Eastern Deciduous Forest</th>
<th>Grasslands – Tallgrass/ Mixed Prairie</th>
<th>SE Mixed &amp; Coastal Plain Forest</th>
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<th>Wetlands</th>
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<tr>
<td>Opossum</td>
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<td>Ovenbird</td>
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<td>Wood duck</td>
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Total: 20 17 21 19 18
Wildlife Identification
4-H WHEP and Wildlife O-Rama

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. One of these regions will always be wildlife species from the urban region. The other region 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 region 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 bird songs.
- Identify the male, female, juvenile and adult of a species.
- Know the unique life histories and behaviors of these wildlife species.

Contest Rules
1. Each Cloverbud and Junior/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 non-competitive activity for Cloverbuds. Cloverbuds can complete the scorecard individually, or with assistance from an adult or teen leader. Talking is allowed.
3. Junior and Senior contestants will complete the scorecard individually. This is not a team event, thus no talking is allowed.
4. Contestants are required to identify wildlife species from the official species list from the announced region and the urban region. The urban region will always be one of two regions selected for the contest.
5. A list of wildlife species with a corresponding letter will appear on the scorecard. The correct letter of the species must be written legibly on the scorecard to receive credit.
6. The same species may be written more than once on the scorecard. (For example, both an antler and track of a white-tailed deer may appear on the contest.)
7. Junior and Senior contestants will be given 30 minutes to answer questions and record information on the scorecard.
8. This event is worth one point for each correct answer. Wildlife Identification at the WHEP state contest will be 20 questions (20 points maximum). The Wildlife O-Rama will be 30 questions (30 points maximum).
Wildlife Identification Scorecard
Eastern Deciduous & Urban

Directions: Identify the wildlife species represented by the numbered item on the table and write the letter of the wildlife species in the blank. Answers can be repeated. Turn in your completed scorecard to the station monitor.

1. __________   11. __________   A. American robin
2. __________   12. __________   B. Big brown bat
3. __________   13. __________   C. Black bear
4. __________   14. __________   D. Bluegill
5. __________   15. __________   E. Bobcat
6. __________   16. __________   F. Box turtle
7. __________   17. __________   G. Brown thrasher
8. __________   18. __________   H. Central newt
9. __________   19. __________   I. Common nighthawk
10. __________  20. __________   J. Coyote

K. Eastern bluebird
L. Eastern cottontail
M. Eastern fox squirrel
N. Eastern gray squirrel
O. Elk
P. European starling
Q. Gray fox
R. Great horned owl
S. House finch
T. House sparrow
U. House wren
V. Largemouth bass
W. Mourning dove
X. Northern bobwhite
Y. Northern flicker
Z. Northern raccoon
AA. Opossum
BB. Ovenbird
CC. Rainbow trout
DD. Red fox
EE. Rock pigeon
FF. Ruby-throated hummingbird
GG. Song sparrow
HH. White-tailed deer
II. Wild turkey
JJ. Wood duck

Total Correct:____________
Wildlife Identification Scorecard
Grasslands – Tallgrass/Mixed Prairie & Urban

Directions: Identify the wildlife species represented by the numbered item on the table and write the letter of the wildlife species in the blank. Answers can be repeated. Turn in your completed scorecard to the station monitor.

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<td>12.</td>
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<td>B. Big brown bat</td>
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<tr>
<td>13.</td>
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<td>C. Bluegill</td>
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<td>14.</td>
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<td>D. Blue-winged teal</td>
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<tr>
<td>15.</td>
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<td>E. Box turtle</td>
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<td>16.</td>
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<td>K. Eastern fox squirrel</td>
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<td>L. Eastern hognose snake</td>
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<td></td>
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<td>M. European starling</td>
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<tr>
<td></td>
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<td>N. Grasshopper sparrow</td>
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<td></td>
<td></td>
<td>O. Hispid cotton rat</td>
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<tr>
<td></td>
<td></td>
<td>P. House finch</td>
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<td>Q. House sparrow</td>
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<td>Y. Opossum</td>
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<td>AA. Red fox</td>
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<td>BB. Rock pigeon</td>
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<td>FF. White-tailed deer</td>
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<tr>
<td></td>
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<td>GG. Wild turkey</td>
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</tbody>
</table>

Total Correct: ___________
Contestant Name: ___________________________________________  ID Code: __________

Print Clearly

Circle one:

- Junior
- Senior

Wildlife Identification Scorecard
Southeast Mixed and Outer Coastal Plain Forest

Directions: Identify the wildlife species represented by the numbered item on the table and write the letter of the wildlife species in the blank. Answers can be repeated. Turn in your completed scorecard to the station monitor.

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<tr>
<th>1.</th>
<th>11.</th>
<th>A. American kestrel</th>
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<td>2.</td>
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<td>3.</td>
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<td>5.</td>
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<td>6.</td>
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<td>9.</td>
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<td>10.</td>
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<td>J. Eastern fox squirrel</td>
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<td></td>
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<td>K. Eastern gray squirrel</td>
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<td>M. European starling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N. Great horned owl</td>
</tr>
<tr>
<td></td>
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<td>Z. Prothonotary warbler</td>
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<td>AA. Red-eyed vireo</td>
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<td>BB. Red fox</td>
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<td>CC. Red-tailed hawk</td>
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<td>EE. Ruby-throated hummingbird</td>
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<td>HH. Wild turkey</td>
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<td>II. Wood duck</td>
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Total Correct: __________
Wildlife Identification Scorecard  
Wetlands & Urban

Directions: Identify the wildlife species represented by the numbered item on the table and write the letter of the wildlife species in the blank. Answers can be repeated. Turn in your completed scorecard to the station monitor.

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<td>12.</td>
<td>C. American robin</td>
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<td>13.</td>
<td>E. Black bear</td>
<td>F. Bluegill</td>
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<td>I. Canada goose</td>
<td>J. Central newt</td>
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<td>K. Common muskrat</td>
<td>L. Common nighthawk</td>
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Total Correct: ____________
Wildlife Species
Study Guide

This section contains information on species featured in each of the five regions. Species are listed alphabetically. Each species has specific information on habitat requirements, including diet, water, and cover. Key wildlife management practices used in some regions also are discussed. Wildlife management practices for species vary from region to region, and not all the wildlife management practices listed for a species will be applicable in all regions. Refer to charts within a particular region to determine which practices and foods are appropriate for that region.

The information in this section is the basis for the test at the Arkansas state contest and the National Invitational. It is critical that participants have the background that mastery of this section will provide. Without knowing specific details of each of the featured species, it will be difficult, if not impossible, to succeed in the other portions of the test.

The species descriptions contain all the information you need about the habitat needs for a particular species in the WHEP contest. However, additional reading and research can add depth to your understanding and help you give detail to your plans and oral presentations. Field guides to North American birds and mammals are good sources for information and pictures of the species listed. There also are many good web sites available for further study. These are listed in the Resources section.

Special Notes about Some Wildlife Management Practices

Controlling Non-Native Invasive Vegetation: While not listed under the species descriptions, controlling non-native invasive vegetation should be an important consideration for all species in all regions. Non-native invasive plants can have a detrimental impact on our native wildlife populations. Non-native invasive plants outcompete and overtake areas occupied by native plants, and thereby reduce plant diversity and seasonal foods available to wildlife. For example, white-tailed deer consume the growing tips of kudzu in the spring and summer, but kudzu grows faster than deer can consume it. Kudzu vines overtake forests and prevent regeneration of native plants such as oak trees. Oaks produce acorns which deer rely on as a food source in the fall and winter when kudzu is not palatable. So although deer consume kudzu, an area invaded by kudzu is poor quality for deer.

Fish or Wildlife Survey: The category of Fish and Wildlife Survey is an important consideration for all species in all regions. Seniors - While fish or wildlife surveys are always important for every species, they should not be recommended if it is stated or the field condition sheet indicates a survey has recently been completed for a particular species.
American alligator

General Habitat Preference
American alligators are found in 45 Arkansas counties. They live in rivers, swamps, marshes, oxbows and lakes with habitat along the bank in Stages 2 and 3 of plant succession.

Habitat Requirements
*Diet* - Hatchling alligators feed mostly on small insects and small vertebrates like fish and frogs. Later, crawfish, birds and larger fish are added to this diet. A full grown alligator eats anything of suitable size it can catch, including rough fish, turtles, snakes, birds & mammals.

*Water* - Alligators live in flooded wetlands, permanent wetlands, rivers and reservoirs.

*Cover* - Nesting females and hatchlings require shallow, vegetation-choked freshwater. Males use large bodies of open water more often than females. Cold weather drives alligators to winter dens dug under a bank. The entrances are usually underwater.

Management Practices

*Create Snags:* This will provide habitat for prey species as well as cover for hatchlings.

*Decrease Harvest:* may be necessary where an increased alligator population is desired and hunting has limited growth

*Establish Native Grasses and Forbs:* Females use grasses to construct nests. The decomposing nest materials produce heat and the nest becomes a self-sustaining incubator. Maintain native grasses, forbs and aquatic plants along banks of watercourses.

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

*Manage Disturbance:* grazing management should protect grasses, shrubs and trees along riparian areas; this may include developing livestock watering facilities to discourage congregation in riparian areas

*Water Control Structures:* Where flooding is an issue, controlling water levels can help improve nesting success. Avoid flooding banks from late spring through summer when eggs are incubated.

*Water Developments for Wildlife:* Constructing a water development may provide marginal habitat, but is not recommended if other water sources such as natural wetlands, streams or rivers are available.

*Wildlife Damage Management:* Alligators are not normally aggressive towards humans, but can be of concern in ponds and lakes near high-density housing, waterways at golf courses, or other locations where alligators can become accustomed to living near people. Alligators that have been fed and become habituated to people lose their fear and can be dangerous to unsuspecting humans, especially children. In those cases, the individual alligator is removed by the Arkansas Game & Fish Commission. Typically biologists use traps or snares to capture them. Where alligators pose little risk to people, alter their habitat such as eliminating emergent vegetation along banks. However, eliminating or modifying wetlands may be unlawful and would adversely affect other wildlife. Avoid swimming or water activities in areas with large alligators. Alligators can surge at least 5 feet onto the shore, so stay back from the water’s edge. Do not feed alligators or attempt to capture young (< 2 feet) alligators.
American beaver

General information
Beavers occur throughout most of North America. They are found in riparian areas in Stages 4 and 5 and in 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 a plethora of birds, mammals, reptiles, amphibians, fishes 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 extinction in many parts of their former range. Today, beavers have rebounded with help from wildlife agency regulations and a lack of a viable fur market. In some areas, beavers have become a nuisance as they cut down trees, dam ditches and streams in undesirable places. This causes cropland flooding, destabilization of road edges, and damaged timber when stands are flooded for extended periods. 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) with a constant level
Cover: bottomland riparian areas that can be dammed to provide still water with sufficient depth

Wildlife management practices
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
Manage Disturbance: grazing management should protect shrubs and trees along riparian areas; this may include developing livestock watering facilities in upland areas to discourage congregation in riparian areas
Plant Shrubs: where beavers are desired, but not present, deciduous shrubs may be planted along riparian areas where there are few trees 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 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
Wildlife Damage Management: should be implemented where beavers are causing problems for landowners such as flooding timber, crops, roads and other areas
American kestrel

General information
American kestrels are found year-round throughout the U.S. Kestrels use Stages 2 and 3 for feeding, and Stages 4, 5 and 6 for roosting and nesting. Kestrels use both natural and artificial cavities for nesting. They eat small mammals, other birds and insects.

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

Wildlife management practices
*Create Snags*: for perches, nest cavities and a food source (insects)
*Establish Field Buffers*: to increase cover for prey around row crop fields
*Establish Native Grasses and Forbs*: where necessary to provide increased early successional habitat for prey;
  Stages 2 and 3 should be interspersed with Stages 5 and 6
*Forest Management Techniques*: forest regeneration will provide open areas for hunting for a couple of years
*Manage Disturbance*: prescribed fire, chaining and herbicide applications are recommended to maintain Stage 4 and stimulate Stages 2 and 3; grazing management should leave enough herbaceous canopy to support insects and small rodents; grazing management should maintain trees in riparian areas
*Nesting Structures*: where adequate nesting cavities are lacking; boxes can be placed on fence posts in open areas
*Plant Shrubs*: in large open areas on idle lands for cover for hunting prey
*Plant Trees*: for future perching sites and cavities for nesting
*Tillage Management*: will facilitate hunting prey when waste grain is available
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 in warm seasons; 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, even yard irrigation 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
Mowing: can be used to maintain suitable structure for robins in urban areas
Nesting Structures: a platform or shelf can be constructed where nesting habitat is lacking
Plant Shrub: for soft mast; examples might include dogwoods, hollies, golden currant and winterberry
Plant Trees: both deciduous and evergreen; where nesting sites may be limiting
Water Developments for Wildlife: birdbaths or small backyard ponds can be constructed in urban environments; gradual or shallow depth near edges (< 1 inch) is necessary for songbirds to utilize
**Big brown bat**

**General information**
Big brown bats are one of 46 bat species in North America. They inhabit nearly all of the U.S., except for south Florida and south-central Texas, and 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. It is recommended that more than 50 percent of their habitat be maintained in open areas for foraging. 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 with all other bat species, are nocturnal and are the only mammals capable of flying. Big brown bats will drink “on-the-wing” by dipping their lower jaw into a water source.

Big brown bats hibernate in the winter in northern latitudes, therefore, do not actively feed during winter months, but instead rely on stored fat reserves.

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

**Wildlife management practices**
*Create Snags*: to provide roost sites; only in areas where they pose no danger to human structures or health when they fall
*Nesting Structures*: may provide additional roost or maternity sites
*Plant Trees*: where few trees are present to promote future old trees that may provide roost sites
*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
Black bear

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

Habitat requirements
Diet: spring food sources are typically scarce and consist of early developing plants such as skunk cabbage, squaw root, grasses and insects; occasionally, small to medium-sized mammals such as deer fawns and young livestock (calves and lambs) are preyed upon; during summer and early fall, a variety of soft mast such as blackberry, blueberry, serviceberry, black cherry and pokeweed are important; during late fall, acorns, beechnuts, hickory nuts and other hard mast, as well as field corn and soybeans, help bears prepare for hibernation; when natural foods are scarce, bears may wander near human residences and feed on bird seed, dog/cat food and other food scraps
Water: free-standing water is used for drinking; spring seeps and other shallow water sources are used to cool off and get away from biting insects; water is seldom a limiting factor since black bears have such a large home range
Cover: mature hardwood or mixed hardwood/conifer forests for foraging; brushy areas and young regenerating forest for loafing and escape; early successional openings primarily for foraging, usually for soft mast; rock crevices, excavations, hollow trees, dense mountain laurel/rhododendron thickets for hibernation

Wildlife management practices
Create Snags: den and take refuge from floodwaters in the hollow of old growth trees in bottomland hardwood forests (wetlands region only)
Decrease Harvest: may be necessary when additional bears are desired and hunting pressure may be limiting growth
Forest Management Techniques: forest regeneration, especially clearcut and shelterwood methods, creates dense escape and loafing cover for bears; an abundance of soft mast (pokeweed, blackberry, huckleberry, blueberry) is usually available in recently regenerated stands; timber stand improvement practices can lead to increased hard mast production if quality trees are retained in the stand, and can stimulate groundcover, which usually increases soft mast production
Increase Harvest: where populations can sustain additional hunting pressure for recreation and/or where populations need to be lowered
Leave Grain Unharvested: strips of corn, grain sorghum or soybeans should be left standing, especially where adjacent to escape cover, to provide food close to cover
Manage Disturbance: Prescribed fire can stimulate groundcover and soft mast and maintain Stages 3 and 4

Plant/Manage Food Plots: where available food may be limiting, forage and grain plots may be planted to provide additional nutrition

Plant Shrubs: crabapple, high-bush blueberry, hawthorn, wild plum and elderberry can be planted within forest openings where soft mast is lacking; this can also help maintain Stage 4

Plant Trees: apple, pear, cherry, persimmon and dogwood are suitable choices to provide additional soft mast

Tillage Management: eliminate tillage in the fall to provide additional waste grain during winter, especially when adjacent to Stages 4 through 6

Wildlife Damage Management: may be needed if bear-human conflicts occur in agricultural or urban settings. When destroying bee hives is an issue, electric fencing may be an option. In urban areas or campgrounds, bear-proof garbage containers may be installed.
Bluegill

General information
The bluegill is one of the most abundant bream 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 (used for food) 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 the summer (one foot below surface in the shade)

Wildlife management practices
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest
Manage Disturbance: grazing management should maintain thick herbaceous vegetation surrounding the pond and in the watershed that drains into the pond; livestock watering facilities should be developed away from pond or allow access to only a small part of the pond
Ponds: Construction: where no suitable water source is present and/or where an existing pond needs extensive repair, especially to the dike or dam, including significant tree removal on the dike or dam
Ponds: Deepen Edges: where pond edges are not at least 2 feet deep to discourage rooted aquatic vegetation
Ponds: Fertilize/Lime: 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
Ponds: Reduce Turbidity: reseed the watershed where soil is eroding into the pond and causing muddy water
Ponds: Repair Spillway/Levee: if not functioning properly, e.g., pond not holding water and seepage is evident
Ponds: Restock: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present
Water Control Structures: should be installed if none are present so water depth can be controlled
Blue-winged teal

General information
Blue-winged teal prefer calm water in association with ephemeral wetlands, inland marshes, lakes and ponds. They inhabit shorelines more than open water and primarily nest within a few hundred feet of wetlands in the prairie pothole region of the Northern Great Plains. Nests are found primarily in dense grassland cover. Hayfields will sometimes be used for nesting, assuming adequate grass stubble remains. Blue-winged teal are surface feeders and prefer to feed on mud flats or shallow water where floating and shallowly submerged vegetation is available, along with abundant small aquatic animal life. Shallow wetlands with both emergent vegetation and open water are required for brood habitat. During spring and fall migration, shallow wetlands and flooded fields are used for loafing and feeding. These ducks are the first in North America to begin fall migration on their way to Central and South America.

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

Wildlife management practices
Decrease Harvest: may be selected when wanting to attract more blue-winged teal to a particular area; can assign waterfowl resting area with no hunting or human disturbance to portion of area
Establish Native Grasses and Forbs: for nesting cover where suitable cover is lacking
Increase Harvest: can increase harvest only if current bag limit is below that of waterfowl hunting regulations
Leave Grain Unharvested: can be beneficial if field of soybeans, rice, millet, etc. is flooded
Manage Disturbance: prescribed fire, diskng and herbicide applications can be used to keep wetlands in the desired structure; grazing management should prevent livestock access to vegetation adjacent to wetlands
Plant/Manage Food Plots: planting native wetland food plants and some agricultural crops can provide additional food resources during migration and winter if the area is shallowly flooded when the ducks arrive
Tillage Management: flood crop fields in fall to provide standing stubble and aquatic invertebrate habitat when ducks arrive
Water Control Structures: allow managers to manipulate water levels to enhance habitat
Water Developments for Wildlife: flooded fields provide important areas for teal during migration; constructing small dikes for temporary flooding provides shallow sheet water teal prefer for feeding and loafing
Bobcat

General information
Bobcats occur throughout the U.S., except for some areas in the northern midwestern states where intensive agriculture occurs or in areas lacking rugged or rocky mountainous terrain or extensive bogs and swamps. Bobcats are carnivorous predators and are seldom active during the day. Bobcats have been found to be a significant cause of mortality to wild turkeys but are not considered a major source of mortality for deer. They are classified as a furbearer game species in many states.

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

Wildlife management practices
Decrease Harvest: may be necessary when additional bobcats are desired and hunting or trapping efforts may be limiting growth
Forest Management Techniques: forest regeneration will provide increased dense cover for additional prey; timber stand improvement can provide enhanced understory development that can lead to increased prey populations; down woody debris (logs) can provide denning sites
Increase Harvest: where populations can sustain additional hunting/trapping pressure for recreation and/or where populations need to be lowered
Manage Disturbance: prescribed fire, chaining and herbicide application are recommended to maintain and rejuvenate Stage 4 when habitat quality begins to decline for desired prey; grazing management should prevent overgrazing in Stages 4 through 6 that would degrade habitat quality for rabbits, rodents and other prey
Plant Shrubs: in areas where additional Stage 4 is needed to attract prey and provide security cover
Plant Trees: In areas where additional Stage 5 is needed to attract prey and provide security cover
Wildlife Damage Management: may be necessary if poultry or other livestock depredation is a problem
Box turtle

General information
Found in forests and grasslands throughout most of the eastern and central portions of the U.S. Box turtles are omnivores with a highly diverse diet.

Habitat requirements
Diet: insects, soft mast, mushrooms, various vegetation and carrion
Water: often found near water, but most likely obtains necessary water from diet
Cover: forests with a diverse understory and early successional cover with native grasses and forbs; constructs nests in open areas (Stages 2 and 3) that are warmer because of increased sunlight

Wildlife management practices
Establish Field Buffers: to increase usable space around row crop fields
Establish Native Grass and Forbs: where early successional cover is lacking
Forest Management Techniques: forest regeneration and timber stand improvement can increase herbaceous vegetation for forage
Manage Disturbance: prescribed fire is recommended to maintain a dense herbaceous understory; grazing management should prevent livestock from forests and maintain adequate herbaceous vegetation in open areas
Brown thrasher

General information
Brown thrashers occur in the eastern two-thirds of the country. They require Stages 3 and 4 and are normally found in shrub thickets, hedgerows, shelterbelts, young forests, forest edges and brushy riparian areas. Brown thrashers forage primarily on the ground, using their beaks to turn over leaves and debris looking for food. More food is available when there is substantial ground litter (leaves and debris). Nests are usually found in bushes or small trees 1 foot to 10 feet above the ground.

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

Wildlife management practices
Forest Management Techniques: forest regeneration will improve vegetation structure for nesting and foraging and stimulate additional Stage 4; timber stand improvement in Stages 5 and 6 can improve habitat by stimulating understory development
Manage Disturbance: prescribed fire, chaining and/or herbicide applications can be used to maintain and rejuvenate Stage 4 when habitat quality begins to decline; grazing management should exclude livestock from riparian areas and other woody areas to allow shrubs and trees to regenerate
Plant Shrubs: to promote Stage 4 and create additional cover for nesting/foraging
Bullfrog

General information
The bullfrog’s native range extends from the Atlantic Coast to eastern Colorado and eastern Mexico and from southern Colorado to northeastern Mexico. Bullfrogs are not native west of the Rocky Mountains but have been successfully introduced in many areas. Bullfrogs inhabit permanent bodies of standing or slow-moving water. Bullfrog tadpoles require two years to metamorphose. They prefer shorelines with dense vegetation (Stages 3 and 4 of wetland succession), adjacent to shallow open water (Stage 2) dominated by floating and submerged aquatic vegetation. All habitat requirements are often found in and around a single pond.

Habitat requirements
**Diet**: insects, aquatic invertebrates, earthworms, crayfish, minnows, small fish, other frogs and their eggs  
**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
**Decrease Harvest**: if hunting pressure is limiting population growth where an increase is desired  
**Increase Harvest**: where populations can sustain additional harvest pressure for hunting recreation  
**Manage Disturbance**: grazing management should maintain thick herbaceous vegetation surrounding the pond and in the watershed that drains into the pond; livestock watering facilities should be developed away from pond or allow access to only a small part of the pond  
**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, water developments such as small ponds and shallow impoundments can be provided
Canada goose

General information
The breeding range of the Canada goose extends across the northern half of the U.S. across Canada and Alaska. Although an increasing number of Canada geese choose to winter in Canada, the majority fly south to southern areas of the U.S. and Mexico. Many southern areas of the U.S. have year-round resident populations of Canada goose. 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, seeds 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 water’s edge

Wildlife management practices
Decrease Harvest: may be selected when wanting to attract more Canada geese to a particular area; can assign waterfowl resting area with no hunting or human disturbance to portion of area
Establish Native Grasses and Forbs: where forage for geese is lacking
Increase Harvest: can increase harvest only if current bag limit is below that of waterfowl hunting regulations
Leave Grain Unharvested: can be beneficial if wheat or other preferred crop left in field
Manage Disturbance: prescribed fire sets back succession in cattail-choked wetlands and stimulates lush green vegetation in uplands where geese may feed; grazing management can maintain lush vegetation for feeding
Nesting Structures: in some areas or regions, elevated artificial nesting platforms may be established, preferably on islands and/or peninsulas surrounded by open water, to help increase nesting success
Water Control Structures: can be used to manipulate water levels and 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
Central newt

General information
The adult central newt is a small rough-skinned, slender aquatic salamander. It is the second most widespread salamander in the United States. This species is mostly statewide in Arkansas in appropriate habitats consisting of Stages 5 and 6 with available water. Central newts prefer ditches and backwater areas of small streams, swamps and farm ponds, providing they do not have large numbers of fishes and possess submerged vegetation. Unlike many salamanders, central newts are active by day and night, and throughout the year. They have been observed swimming under ice during winter.

Their life history is quite complex. Most populations have four life-history stages: the egg, the aquatic larva, the terrestrial stage and the aquatic adult stage. From 200 -375 eggs are laid singly on stems and leaves of submerged aquatic vegetation during the early summer. Hatching occurs 3 – 5 weeks later. The gilled larvae may remain in the water until the end of summer. An immature terrestrial stage, called eft, typically lasts from 4 – 5 years, whereupon maturing individuals migrate to breeding habitats. Terrestrial efts are usually found in forested areas in the vicinity of breeding ponds, taking refuge under rotting logs, boards, rocks, and other natural and unnatural objects. Efts can withstand drier habitats than other woodland salamanders but are most active on the forest floor during and after rain.

All life stages of central newts have toxic skin secretions that protect them to varying degree from predators. These toxic skin secretions are harmless to humans (except when mishandled or somehow ingested). Terrestrial efts possess the greatest concentration of poison glands. When attached by a predator, usually a bird or mammal, an eft may flex its mid-trunk so that the head and tail are raised and curled toward one another over the back and become immobile. Aquatic adults are considerably less toxic than the terrestrial efts. However, this toxin does not provide total immunity from predation. Northern raccoons have been found to consume efts without apparent toxicity. Toxicity of larval newts appears to be mild and not a deterrent to some predators.

Habitat requirements
Diet: small aquatic invertebrates including various worms, small mollusks, crayfish and insects. Adults feed on dragonfly nymphs, mosquito and midge larvae, fingernail clams and snails, eggs and larvae of other amphibians such as tadpoles. Larval newts feed on similar but smaller invertebrates. Terrestrial efts forage on moist forest floors where they seek out insects, worms, snails and other small animals of the leaf litter. A hungry eft can consume 2000 springtails.

Water: ditches and backwater areas of small streams, swamps and farm ponds with submerged vegetation and without fish; also upland bogs. Adults prefer small, permanent ponds in woodland openings or in meadows with dense aquatic vegetation, although may also be found in temporary ponds, the shallows of large lakes, quiet portions of streams, or other permanent or semi-permanent bodies of unpolluted water.

Cover: shallow water with aquatic vegetation or submerged woody debris is needed for attachment of eggs; downed logs, rocks, bark and leaf litter are necessary for adult escape cover.

Wildlife management practices
Create Snags: to provide cover for efts and food/cover resources for prey species
Forest Management Techniques: forest regeneration and timber stand improvement can enhance conditions for increased cover; forest regeneration necessary to continue Stages 5 and 6 for future generations of newts.
Manage Disturbance: grazing management should maintain thick herbaceous vegetation surrounding the pond and in the watershed that drains into the pond; livestock watering facilities should be developed away from pond or allow access to only a small part of the pond.

Plant Trees: in areas where additional Stage 5 or 6 is needed to provide security cover for efts.

Water Control Structures: should be installed if none are present so water depth can be controlled; periodic fish removal through draining water and allowing pool to dry up.

Water Developments for Wildlife: fishless ephemeral pools can be constructed in areas lacking breeding habitat; dugouts or shallow impoundments without fish can be constructed for adults where lacking.
Common muskrat

General information
Muskrats are found throughout the U.S., especially in shallow marches 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. During summer, they prefer water 1 foot to 2 feet deep, 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; some forbs
Water: necessary water obtained from diet
Cover: primarily Stage 2 wetlands; den in lodges built from cattails and bulrushes, which are usually in dense patches of cattails and bulrushes; loaf on floating logs or tops of lodges

Wildlife management practices
Decrease Harvest: where trapping efforts have reduced population below desirable levels
Increase Harvest: where populations can sustain additional trapping and/or where populations need to be lowered
Manage Disturbance: prescribed fire is recommended to rejuvenate old, decadent wetland vegetation; grazing management should restrict livestock 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
Water Control Structures: are necessary to control water levels so that approximately 80 percent of the wetland has water less than two feet deep so cattails and bulrushes can grow
Water Developments for Wildlife: small impoundments can be built in low-lying areas to provide additional wetland habitat
Wildlife Damage Management: may be necessary to ameliorate damage to dikes in agricultural areas and waterfowl management areas; populations can be reduced by managing against preferred habitat conditions or by additional harvest
**Common nighthawk**

**General information**
Common nighthawks use bare ground (Stage 1) for nesting, while Stages 2 and 3 are used for foraging. Common nighthawks are found throughout the U.S. during the breeding season, but migrate to South America during winter. Common nighthawks are common visitors to 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 the ground on gravel and bare soil areas common in fields or on rooftops. They are nocturnal and feed “on-the-wing” on flying insects. They have a tiny beak with a large gape, surrounded by stiff feathers called rectal bristles, which help the bird catch its aerial prey.

**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**

*Mowing*: can be used to maintain open areas in urban environments

*Special*: protect open gravel areas where nighthawks nest from human disturbance. Free-ranging domestic or feral cats may be an issue in some 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, shrub land and farmland provide optimal habitat for coyotes, but they also use Stages 5 and 6. Coyotes den in a variety of places, including brush-covered slopes, steep banks, rock ledges, thickets and hollow logs. Coyotes are most active at night, during early morning and around sunset, but they may be active throughout the day. Coyotes live in packs, alone or in mated pairs, depending on the time of year. Coyotes have an extremely varied diet that fluctuates with the seasons.

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

Wildlife management practices
**Decrease Harvest:** may be necessary when additional coyotes are desired and hunting or trapping efforts may be limiting growth; realistically, because of a high reproduction rate and extreme survival abilities, this practice would most likely never be recommended for coyotes
**Establish Field Buffers:** to increase usable space around row crop fields
**Establish Native Grasses and Forbs:** where additional high-quality early successional habitat is needed for prey
**Forest Management Techniques:** forest regeneration and timber stand improvement can enhance conditions for increased prey
**Increase Harvest:** where populations can sustain additional hunting/trapping pressure for recreation and/or where populations need to be lowered
**Manage Disturbance:** prescribed fire, disk ing, chaining and herbicide applications are recommended to maintain Stage 3; grazing management should maintain adequate cover for prey
**Plant Shrubs:** in areas where additional Stage 4 is needed to attract prey and provide security cover
**Wildlife Damage Management:** may be necessary where livestock depredation is a problem
Dickcissel

General information
Dickcissels occur primarily in native grasslands and savannah in the central one-third of the U.S. Stages 2, 3 and 4 are used by diskcissels for nesting. Dickcissels use agricultural areas heavily during winter in Central America.

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

Wildlife management practices
Delay Crop Harvest: delayed hay harvest in areas with insufficient native grassland will allow nests to hatch and hatchlings to leave nests prior to harvest
Establish Field Buffers: to increase usable space around row crop fields
Establish Native Grasses and Forbs: where early successional habitat is limiting; forb component is important
Leave Grain Unharvested: will provide additional food during migration
Manage Disturbance: prescribed fire and herbicide applications should be used to manage early successional habitat
Tillage Management: may provide additional food during migration
Eastern bluebird

General information
Bluebirds are found in early successional habitat (Stages 2 and 3) interspersed with woods and shrubs (Stages 4, 5 and 6), which are used for perching and nesting (where cavities are available). Large open areas without interspersion of hedgerows, fencerows and woodlots 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.

Habitat requirements
Diet: insects, spiders and small amounts of soft mast
Water: obtain necessary water from diet but may use other water sources when available
Cover: nest in cavities of trees and fence posts; old woodpecker cavities are especially important; readily nest in nesting boxes, which have had a major impact in restoring bluebird populations in some areas.

Wildlife management practices
Create Snags: to provide potential nest sites and perching sites in open areas
Establish Field Buffers: to increase usable space around row crop fields
Establish Native Grasses and Forbs: when less than 75 percent of the area is composed of Stages 2 or 3
Forest Management Techniques: in large areas of Stage 6 where regeneration is needed, forest regeneration will create foraging habitat 1 year to 3 years postharvest; retaining some mature trees and snags may provide cavities for bluebirds
Manage Disturbance: prescribed fire, disking, herbicide application, mowing, chaining and roller beating can be used to maintain and rejuvenate areas of Stages 2 through 4 when habitat quality begins to decline; grazing management should prevent livestock from damaging trees and shrubs planted to benefit bluebirds
Mowing: can be used to maintain open areas in urban environments
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 Shrubs: where needed to provide perches; hedgerows may be established across open fields larger than four acres
Plant Trees: to create potential nest sites where young trees are lacking
Water Developments for Wildlife: birdbaths or small backyard ponds can be constructed in urban environments; gradual or shallow depth near edges (< 1 inch) is necessary for songbirds to utilize
Special: European starlings often take over eastern bluebird or flicker nest cavities for their own nests. Appropriate action should be taken to prevent starlings from occupying nesting cavities of other cavity-nesting wildlife. Appropriate actions may include installing nest boxes with entry holes of a size to exclude starlings, or checking nests and removing those from starlings.
**Eastern cottontail**

**General information**
Eastern cottontails occur in the eastern half of the country. They prefer brushy cover (Stage 4) interspersed with perennial grasses (Stage 3). Ideally, habitat components are one-third grassland, one-third cropland, and one-third shrub cover. Eastern cottontails are also found in suburban areas, parks, golf courses and stream corridors. Eastern cottontails represent prey for the majority of carnivorous predators within its range. They are prolific breeders, however, as female may have 7 litters per year, with 3 to 6 young per litter. This is required to perpetuate populations as 70 percent to 80 percent of all rabbits die each year.

**Habitat requirements**

*Diet:* forbs and grasses (Stages 2 and 3), 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, brush piles, native perennial warm-season grasses and forbs (Stage 3) for loafing and escape cover; burrows are also used for denning and escape

**Wildlife management practices**

*Decrease Harvest:* may be necessary when additional rabbits are desired and hunting and/or trapping efforts are limiting growth; low rabbit populations are almost always a result of inadequate habitat, not harvest levels  
*Establish Field Buffers:* to increase usable space around row crop fields  
*Establish Native Grasses and Forbs:* where high-quality early successional habitat is limiting  
*Forest Management Techniques:* forest regeneration, especially clearcutting, provides optimal brushy cover for a few years  
*Increase Harvest:* where populations can sustain additional hunting/trapping pressure for recreation and/or where populations need to be lowered  
*Leave Grain Unharvested:* to provide additional food, especially corn  
*Manage Disturbance:* prescribed fire, disking, chaining, and herbicide applications are recommended to maintain or rejuvenate Stages 3 and 4; grazing management should keep livestock out of food plots and leave ample amounts of herbaceous vegetation in other areas used by cottontails for food and cover; mowing can be used to maintain open areas in urban environments  
*Mowing:* can be used to maintain open areas in urban environments  
*Plant/Manage Food Plots:* where additional forage or grain is needed; one one-quarter-acre plot per 10 acres to 15 acres should be sufficient  
*Plant Shrubs:* in large areas of Stages 2 and 3 and in agricultural areas with few shrubs; field borders, fence rows and other idle land areas are good places to plant; this is also appropriate for open areas in urban settings  
*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  
*Wildlife Damage Management:* may be necessary to control damage to ornamental/landscaping and garden plants
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 Stage 6 forest interspersed small openings (Stages 2 and 3), 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 above the ground, 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*: Stage 6 hardwood and pine forest, woodland and savannas; nest in tree cavities or build a nest of twigs and leaves; where den sites are scarce, may use nest boxes

Wildlife management practices
*Artificial Feeders*: in urban areas, corn or sunflower seeds spilled from feeders onto the ground may be eaten  
*Nesting Structures*: 3 to 4 cavities per acre are desirable; where cavities are limiting, nest boxes may be beneficial  
*Plant Shrubs*: shrubs can be planted across large backyards, parks and fields, and undeveloped areas in urban environments  
*Plant Trees*: in large areas of Stages 2, 3 and 4; along fence rows, adjacent to streams and grain fields, and other idle land areas are suitable sites  
*Water Developments for Wildlife*: in urban areas, a pool or pan of water may be used if water is not available  
*Wildlife Damage Management*: exclusion from buildings or removal may be necessary if damage is occurring
Eastern gray squirrel

General information
The Eastern gray squirrel lives primarily in Stage 6 deciduous forests and woodlands. They also forage along the edge of crop fields, especially harvested cornfields. These 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 above ground. Eastern gray squirrels will use nest boxes, but they are not necessary since nests are built in the absence of cavities; thus, available cavities are not a limiting factor for population growth.

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: Stage 6 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
Decrease Harvest: may be necessary when additional gray squirrels are desired, and hunting pressure is limiting growth
Forest Management Techniques: 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
Increase Harvest: where populations can sustain additional hunting pressure for recreation and/or where populations need to be lowered
Manage Disturbance: grazing management should protect trees and shrubs planted for squirrels and protect woods from overgrazing
Nesting Structures: 3 to 4 cavities per acre are desirable; where cavities are limiting, nest boxes may be beneficial
Plant Shrubs: shrubs can be planted across large fields and in “odd areas” of crop fields not planted to crops
Plant Trees: plant mast trees where Stage 5 and 6 represent less than 50 percent of the area considered and where Stages 5 and 6 forest contain few or no mast-producing trees
Wildlife Damage Management: may be required if squirrels become a nuisance around houses
Eastern hognose snake

General information
Eastern hognose snakes live in a variety of terrestrial habitats, but prefer stage 6 of mixed deciduous/pine forests or pine woods and are especially drawn to wet areas or amphibian breeding sites. They can also be found in stages 2 and 3 of prairies and grasslands. In the southern coastal plains, eastern hognose snakes can be found in pine flat woods, mature pine/oak forests and cultivated fields. They can be found in damp situations as they feed heavily on amphibians. Eastern hognose snakes use burrows such as of moles and other animals for overwintering.

These snakes have several adaptations for their primary food source – toads. Their upturned snout is suited for digging up a buried toad. Their large mouth allows room for a puffed-up toad (fills with air as a predator defense) or one that is swallowed sideways. Once a ballooned toad is far enough down, two larger teeth in the back of the mouth will pop it. Toads are unpalatable to many animals due to poisonous secretions in their skin. Hog-nosed snakes, however, chemically tolerate such a diet, allowing them access to a relatively abundant food source.

Hognose snakes are unique in the manner they defend themselves by a behavior called death feigning. They flatten their head and neck followed by rolling over on the back, writhing, gaping their mouth, and extending their tongue. They may also regurgitate their stomach contents and eliminate feces. It is believed that such behaviors confuse a predator and therefore their ability to survive.

Habitat requirements
Diet: almost exclusively toads, sometimes salamanders
Cover: use burrows of other animals; hide under logs, rocks, or leaf litter; use shrub cover in grassy areas
Water: necessary water obtained from diet

Wildlife management practices
Create Snags: where logs and downed woody material not present
Forest Management Techniques: forest regeneration will provide increased dense cover for additional prey;
timber stand improvement can provide enhanced understory development that can lead to increased prey populations; down woody debris (logs) can provide winter denning sites
Manage Disturbance: prescribed fire and chaining are recommended to reduce woody vegetation where needed and maintain native short grass prairie (grasslands – tallgrass mixed prairie region only); grazing management should leave adequate herbaceous cover and ungrazed, protected damp areas for prey populations
Plant Trees: along riparian areas or other locations where trees are lacking
Water Control Structures: should be installed if none are present so water depth can be controlled; tool for periodic fish removal through draining water and allowing pool to dry up
Water Developments for Wildlife: where water is lacking, construct dugouts, shallow impoundments or ephemeral pools to create breeding habitat for prey species
Elk

**General information**

Elk occur throughout the western U.S. and populations have recently re-established in some eastern states. Elk are present in portions of northern Arkansas along the Buffalo River and surrounding counties. Elk require a mix of Stages 2 and 3 for food, as well as Stages 5 and 6 for cover. Elk form herds that may migrate to different areas depending on weather and food resources. Elk are primarily grazers and eat a variety of herbaceous vegetation, mainly grasses and forbs, but will eat browse as well. For optimum elk habitat, 25 percent to 50 percent of the landscape should be in Stages 2 and 3, well interspersed with Stages 4 through 6.

**Habitat requirements**

*Diet:* predominantly grasses and forbs but also browse, especially when palatable grass and forbs are not available

*Water:* free-standing water used regularly in summer; water should be within one-half mile

*Cover:* Stage 2 and 3 for foraging; Stage 4 through 6 for loafing and calving

**Wildlife management practices**

*Decrease Harvest:* may be necessary when hunting pressure is limiting growth of elk population where an increase is desired

*Establish Field Buffers:* provides additional forage around crop fields

*Establish Native Grasses and Forbs:* provides additional forage where early successional habitat is limiting

*Forest Management Techniques:* forest regeneration, especially clearcutting, will provide additional forage for a few years; timber stand improvement can improve forage availability and stimulate improved understory/midstory cover

*Increase Harvest:* where populations can sustain additional hunting pressure for recreation and/or where populations need to be lowered; where populations need to be lowered because of habitat considerations, harvest should concentrate on females

*Manage Disturbance:* prescribed fire is recommended to maintain early successional cover and stimulate additional herbaceous forage in Stage 4; grazing management should leave ample forage available for elk; areas recently grazed by livestock are often favored by elk

*Plant/Manage Food Plots:* where and when naturally occurring food sources are limited, food plots may provide additional nutrition, particularly during late summer and winter in some areas

*Plant Trees:* where additional forest cover is needed

*Water Developments for Wildlife:* water developments such as dugouts may be useful if water is not available within one-half mile

*Wildlife Damage Management:* necessary when elk begin to damage hay and crop fields, or when they become a nuisance in suburban areas; both lethal and nonlethal practices can be effective
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.

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

Wildlife management practices
Habitat management: to attract or benefit starlings should not occur in any situation.
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

Special: European starlings often take over eastern bluebird or flicker nest cavities for their own nests. Appropriate action should be taken to prevent starlings from occupying nesting cavities of other cavity-nesting wildlife. Appropriate actions may include installing nest boxes with entry holes of a size to exclude starlings, or checking nests and removing those from starlings.
Grasshopper sparrow

General information
In the grasslands of the Great Plains, the grasshopper sparrow prefers open grasslands with some shrubs (Stage 4) and bare ground (Stage 1) interspersed throughout the area. Areas with greater than 35 percent shrubby cover constitute poor habitat for grasshopper sparrows. Native bunchgrasses are important for nesting structure.

Habitat requirements
Diet: primarily insects and seeds, but diet shifts dramatically through the year; in spring and summer (breeding season), grasshopper sparrows rely heavily on insects, comprising 60 percent of the diet; not surprisingly, given the bird’s name, grasshoppers can account for 30 percent to 40 percent of the diet during this time; during fall and winter, diet shifts to 70 percent seeds.
Water: water requirements are unknown but probably obtained through diet
Cover: Stage 3 for escape and nesting cover; nest on the ground, usually in overhanging native warm-season grasses

Wildlife management practices
Delay Crop Harvest: delay mowing/harvesting hay in spring to ensure successful nesting
Establish Native Grasses and Forbs: where quality nesting habitat is limited
Manage Disturbance: prescribed fire can enhance habitat by rejuvenating grasslands, controlling shrubs, and creating patches of bare ground; grazing management is crucial to protect grassland habitat from livestock
Plant Shrubs: provide escape and nesting cover in areas with < 35 percent shrubby cover
Gray Fox

General Habitat Preference
The gray fox inhabits hardwood forests, wooded bottomlands and farmlands that are interspersed fields, woods and brushy fencerows. Rocky wooded areas with dense underbrush are preferred. Therefore, gray foxes prefer the majority of habitat in Stages 5 and 6 interspersed with stages 2 and 3. The gray fox is an adept climber, and it not only climbs leaning trees but also ascends vertical trunks with catlike ease. When pursued, it will often jump from branch to branch. It is primarily nocturnal and spends the day holed up in a hollow tree or log, a natural rock crevice or in a brush pile. Gray foxes tend to avoid open fields. They have few predators besides human, dogs and possibly coyotes.

Habitat Requirements
Diet: opportunists, feeding mostly on rabbits, mice, bird eggs, insects, and native fruits. Cottontail rabbits comprise nearly one-half of the gray fox’s diet. Cotton rats are another important food item, followed by white-footed mice and voles. Gray foxes consume more plant foods (such as persimmons, mulberries, and other soft mast and corn) than either the red fox or coyote. They may feed on carrion at times. Water: den along wooded rivers and streams, though nearby water isn’t a requirement. Cover: den in hollow trees or logs, rock crevices, brush piles and occasionally in a ground burrow. Their den is sometimes located in a hollow tree 16 to 30 feet above ground.

Wildlife Management Practices
Create Snags: where lacking, create cover and den locations in mature trees. Decrease Harvest: may be necessary when hunting and/or trapping efforts are limiting growth; low fox populations are almost always a result of inadequate habitat, not harvest levels. Establish Field Buffers: to increase usable space around row crop fields. Establish Native Grasses and Forbs: where high-quality early successional habitat is limiting; establish where exotic grasses are present in small forest openings; create habitat for prey. Forest Management Techniques: forest regeneration, especially clearcutting, provides optimal brushy cover for a few years, but should be done in moderation; majority of area should be mature forest; timber stand improvement can stimulate improved understory/midstory cover. Increase Harvest: where populations can sustain additional hunting/trapping pressure for recreation and/or where populations need to be lowered. Leave Grain Unharvested: to provide additional food, especially corn. Manage Disturbance: prescribed fire grazing management should keep livestock out of forested areas and leave ample amounts of herbaceous vegetation in other areas used by cottontails for food and cover. Plant Shrubs: in large areas of Stages 2 and 3 and in agricultural areas with few shrubs; field borders, fence rows and other idle land areas are good places to plant. Plant Trees: when necessary to create cover in large expanses of open areas. 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. Wildlife Damage Management – gray foxes are seldom a major predator of poultry, but on occasion will take unpenned chickens, ducks and young turkeys.
Great blue heron

General information
Great Blue Herons are the largest heron in North America. Birds can reach 38 to 54 inches in height, with a wingspan of 66 to 79 inches. However, they only weigh 5 or 6 pounds due in part to their hollow bones – a feature all birds share.

Great Blue Herons typically forage alone by wading slowly or standing stock still and peering into slow-moving or calm water for prey. Herons defend feeding territories from other herons with dramatic displays in which birds approach intruders with their head thrown back, wings outstretched, and bill pointed skyward. Other birds and even humans may also be a target of this defensive maneuver. They can hunt day or night because of their special night vision.

They are found in a wide variety of habitats, typically feeding in Stages 2 and 3 of wetland plant succession (Stage 2 — shallow water dominated by submerged and floating aquatic vegetation, Stage 3 — very shallow water or wet ground dominated by any variety of emergent aquatic vegetation). Typically they nest in Stage 6 of forest plant succession. Most nesting colonies are located within 2 to 4 miles of feeding areas, often in isolated swamps or on islands, and near lakes and ponds bordered by forests. Herons will abandon nesting locations if disturbed by humans in isolated areas.

Habitat requirements
*Diet:* fish, amphibians, reptiles, small mammals, invertebrates and other birds  
*Water:* obtain water where they feed  
*Cover:* nest mainly in trees in colonies consisting of a few to several hundred individual nests built 100 feet or more off the ground. Nest can range from a simple platform measuring 20 inches across to more elaborate structures used over multiple years, reaching 4 feet across and nearly 3.5 feet deep.

Wildlife management practices
*Create Snags:* standing dead trees used as nesting sites; create snags where limited  
*Forest Management Techniques:* timber stand improvement in riparian areas and bottomland hardwoods that can be flooded; woody stem density should increase following timber stand improvement (e.g., thinning) and improve cover in stands that can be flooded  
*Manage Disturbance:* grazing management should provide areas with tall, healthy, herbaceous vegetation that are not disturbed near wetlands, ponds, streams and other water sources.  
*Plant Shrubs:* where there is a lack of emergent woody vegetation in open areas that can be flooded  
*Plant Trees:* trees planted near isolated wetland or riparian areas may be suitable for future nesting colonies  
*Water Developments for Wildlife:* construct where wetlands, ponds, or streams are lacking; shallow impoundments or gradual banks are needed for wading  
*Wildlife Damage Management:* may congregate at fish hatcheries, creating potential problems for fish farmers. Some fish farmers use netting or strategically placed wires over fish ponds to keep herons and other birds from landing. Pyrotechnic cannons which periodically produce a loud booming noise or shell crackers can be effective until birds become habituated to them. Trained dogs have been used to chase birds away from ponds with some success.
Great horned owl

General information
The great horned owl is found throughout North America in a wide variety of vegetation types including open Stage 6, interspersed with areas of Stages 2, 3 and 4, including orchards, farm woodlots and city parks. They also are occasionally found in rocky canyons away from forest cover. The great horned owl is nocturnal and roosts during the day in trees or on sheltered rocky ledges.

Habitat requirements
Diet: great horned owls forage at night; the diet is extremely varied but commonly includes small- to medium-sized mammals including rabbits, skunks, squirrels and others, as well as reptiles, amphibians, large insects and fish
Water: water obtained from diet
Cover: nest in abandoned nests of hawks, crows or herons, and in large tree cavities, crotches, stumps, caves and ledges

Wildlife management practices
Create Snags: where perching sites are limited
Establish Field Buffers: to increase usable space around row crop fields
Establish Native Grasses and Forbs: when less than 25 percent of the area is comprised of early successional habitat (Stages 2 through 4)
Forest Management Techniques: forest regeneration in large areas of Stage 6 may provide additional cover for a variety of prey species; timber stand improvement will encourage understory development and enhance habitat for a variety of prey species
Manage Disturbance: mowing, chaining, roller beating, controlled burning, disking, herbicide application and grazing should be used to maintain and rejuvenate areas of Stages 2 through 4 when habitat quality begins to decline for a number of prey species
Plant Shrubs: where needed to enhance habitat for rabbits and other prey
Plant Trees: where perching sites are limited and where nesting cover does not exist
Tillage Management: will facilitate hunting prey when waste grain is available
Wildlife Damage Management: may be necessary where an owl is killing poultry
Hairy Woodpecker

General information
Stages 4, 5 and 6 provide primary habitat for hairy woodpeckers. They forage on a variety of places such as tree trunks, stumps, snags, downed logs and the ground. Where adequate cover exists, food is usually not a limiting factor. They will forage in Stage 3 if areas with mature trees are nearby. They readily use wooded urban and riparian areas.

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

Wildlife management practices
*Create Snags*: for a food source and potential nest cavities
*Manage Disturbance*: grazing management should maintain trees in riparian areas; grazing when woody vegetation is not growing rapidly (fall and winter) usually does less damage to woody vegetation than at other times of the year
*Plant Trees*: especially softwood deciduous trees where trees are lacking for potential nesting cavities
*Wildlife Damage Management*: when woodpeckers are causing damage to wooden structures
Hispid Cotton Rat

General information
The cotton rat occurs statewide and is a very common small mammal in Arkansas wherever suitable cover is present. Cotton rats are quite common in fields of broom sedge and other grasses where there is a heavy mat of dead vegetation that provides a protective canopy against hawks and other aerial predators. Predators such as foxes, coyotes, bobcats, owls, and hawks consume large numbers of cotton rats. Cotton rats inhabit uncultivated fields, grassy roadside ditches, brushy fencerows, and railroad right-of-ways. They are seldom found in forested areas, but can be found near the forest edge.

Their nest is a crude mass of grasses and plant fibers placed in a shallow surface depression among clumps of coarse grasses or underground. From the nest, runways radiate outward to feeding areas beneath the mat of dead grasses and forbs. Shallow burrows may be constructed where vegetation is light. The runways and burrows of cotton rats are used extensively by other small mammals including shrews, voles, deer mice, harvest mice and house mice.

Habitat requirements
Diet: forbs, grasses, rice and other grain, insects, crayfish, and eggs of ground-nesting birds.
Water: necessary water is obtained through the diet.
Cover: tall grasses, and thick, heavy mat of vegetation.

Wildlife management practices
Establish Native Grasses and Forbs: provide grasses and forbs for food and cover
Leave Grain Unharvested: particularly near grassy field edges where likely to inhabit
Manage Disturbance: prescribed burning, chaining, roller beating and/or brush chopping to keep out invading woody vegetation from open fields and prairies; livestock grazing management should leave adequate herbaceous vegetation
Wildlife Damage Management: damages truck crops; when present in large numbers, can damage cotton, sugar cane, squash and sweet potatoes; destructive to eggs of Northern bobwhites; also competes with bobwhites for food.
House finch

General information
House finches are native to the western U.S., but are an introduced species in the eastern U.S. Their current range is the entire U.S. They are found in a wide variety of urban, suburban, and agricultural areas that have trees (Stages 5 and 6), shrubs (Stage 4), and some open areas (Stages 2 and 3). 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. Finches eat a variety of seeds, soft mast, and buds from both 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 above the ground 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
Artificial feeders: may be used to attract finches in urban areas; millet and sunflower seeds are favorites
Establish Native Grasses and Forbs: to provide forb seed in rural areas where early successional habitat is limited
Mowing: can be used to maintain open areas in urban environments
Plant Shrubs: adjacent to open areas for nesting and hiding cover
Plant Trees: in areas where trees are lacking nesting cover
Water Developments for Wildlife: bird baths or small backyard ponds can be constructed in urban environments; gradual or shallow depth near edges (< 1 inch) is necessary for songbirds to utilize
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 in throughout urban areas. House sparrows are also very common in and around agricultural buildings. They are usually a nuisance, and management objectives are often needed to reduce the quality and quantity of available habitat. 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 above the ground 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.

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.

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 above the ground, and on any projection or ledge they can find on buildings or other structures

Wildlife management practices
*Habitat management*: to attract or benefit house sparrows should **not** occur in any situation.
*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
House wren

General information
House wrens are found throughout the U.S. during the breeding season, and migrate to the deep southern U.S. during winter months. In urban settings, house wrens prefer older residential areas with large shrubs (Stage 4) and trees (Stages 5 and 6). Wrens also use forested (Stages 5 and 6) and open areas (Stages 2 and 3) at higher elevations, as well as stands of aspen (Stages 5 and 6). House wrens nest in a variety of elevated cavities, as high as 30 feet above the ground. They forage both on the ground and above the ground.

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
Create Snags: when none are present
*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 keep out house sparrows, starlings and other birds
*Plant Shrub:* where lacking for cover while feeding and for nesting
*Plant Trees:* where trees are lacking for cover and nesting
Largemouth bass

General information
Largemouth bass are not really bass but members of the sunfish family. Largemouth bass are an extremely 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
Decrease Harvest: refer to the wildlife management practices for specifics on fish harvest
Increase Harvest: refer to the wildlife management practices for specifics on fish harvest
Manage Disturbance: grazing management should maintain thick herbaceous vegetation surrounding the pond and in the watershed that drains into the pond; livestock watering facilities should be developed away from ponds or allow access to only a small part of the pond
Ponds: Construction: where no stream or pond is present and/or where an existing pond needs extensive repair, especially to the dike or dam, including significant tree removal on the dike or dam
Ponds: Deepen Edges: where pond edges are not at least two feet deep to discourage rooted aquatic vegetation
Ponds: Fertilize/Lime: 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
Ponds: Reduce Turbidity: by reseeding the watershed where soil is eroding into the pond and causing muddy water
Ponds: Repair Spillway/Levee: if not functioning properly
Ponds: Restock: if the population is too far out of balance to correct via seining or fishing or if undesirable species are present
Water Control Structures: should be installed if none are present so water depth can be controlled
**Mallard**

**General information**
The mallard has 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. As migratory waterfowl, they winter south of Canada, throughout the U.S. and south to Central America. Mallards are dabbling ducks that nest in tall grasses and forbs or in shrubby cover. They need open water (Stage 2 of wetland succession) with associated emergent aquatic vegetation (Stage 3) to raise young. Mallards prefer to spend the winter in wetlands that contain all 4 wetland stages, including Stage 1 (open water) and Stage 4 (harvested grain crops). In addition, riparian areas with open water may be used. These birds 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.

**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; most food is associated with wetlands, but mallards will readily dry-feed in agricultural fields during winter
*Water:* see cover requirements below
*Cover:* nest in grass and forb vegetation (sometimes they nest under shrubs) preferably within one-half mile of a wetland that provides open water with some adjacent emergent aquatic vegetation; brooding cover is open water with considerable emergent aquatic vegetation for protection from predators; ideally, wetlands have a minimum of 50 percent open water and 10 percent to 20 percent emergent vegetation; in wintering areas, mallards rest on open water bodies, such as streams, rivers and warm-water sloughs

**Wildlife management practices**
*Decrease Harvest:* may be selected when wanting to attract more mallards to a particular area; can assign waterfowl resting area with no hunting or human disturbance to portion of area
*Forest Management Techniques:* can be used to increase mast production for mallard
*Increase Harvest:* can increase harvest only if current bag limit is below that of waterfowl hunting regulations
*Leave Grain Unharvested:* to provide a winter food source
*Manage Disturbance:* prescribed fire is recommended to rejuvenate dense vegetation in nesting areas and to increase or maintain proper water and vegetation interspersion in wetlands; grazing management should provide areas with tall, healthy, herbaceous vegetation that are not disturbed during the nesting season
*Plant/Manage Food Plots:* shallowly flooded grain plots can provide beneficial food source for migrating and wintering mallards
*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 and dugouts can be important for migrating and wintering mallards; flooding grain fields, planted food plots, and oak woodlands in winter makes food more available and provides a feeding area with more protection from predators.
Mink

General information
Mink are found in Alaska, Canada and across most of the U.S. They are mainly nocturnal and prefer habitat associated with stream banks, river banks and the shores of a variety of wetlands. Mink are strictly carnivorous. Most food 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 many 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: closely associated with water; necessary water probably obtained through diet
Cover: wetland edges, riparian areas, dens under log jams and tree roots, old muskrat burrows and rock piles

Wildlife management practices
Decrease Harvest: may be necessary when trapping pressure is limiting population
Increase Harvest: where populations can sustain additional trapping pressure, and when mink have been identified limiting upland nesting waterfowl or game birds
Manage Disturbance: prescribed fire is recommended to rejuvenate old decadent wetland vegetation that can improve habitat for prey; grazing management should prevent livestock from damaging vegetation and structure along banks of streams, rivers and other wetlands; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
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 available habitat where appropriate
Mourning dove

General information
Mourning doves may be found throughout much of the lower 48 states. They prefer Stages 2 and 3 for feeding with some shrubs and trees nearby for nesting and roosting. 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. Small areas of bare ground are beneficial for doves to obtain grit (small gravel) to help in digesting food. Mourning doves prefer shorelines without vegetation when 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
Create Snags: for perching/loafing sites in open areas
Decrease Harvest: may be selected when wanting to attract more mourning doves to a particular area; can assign no hunting or human disturbance to portion of area to attract doves
Delay Crop Harvest: (in Grassland/Tallgrass Prairie region only) in spring to avoid nest destruction
Establish Native Grasses and Forbs: to provide forb seeds for food
Increase Harvest: can increase harvest only if current bag limit is below that of mourning dove hunting regulations
Leave Grain Unharvested: for a variety of small grain crops such as wheat, barley, millet, milo or oats to provide additional food resource
Manage Disturbance: disking and herbicide applications will provide bare ground; prescribed burning will maintain Stage 3 and expose seed for feeding; chaining will reduce shrub cover; chainsawing/feller bunching may be used to open forest and allow sunlight to reach the forest floor
Plant/Manage Food Plots: in areas lacking grain
Plant Shrubs: for nesting and roosting in areas where shrub/tree cover is limiting; fence rows, field borders and other idle land area are good sites
Plant Trees: for nesting and roosting in areas where shrub/tree cover is absent; fence rows, field borders, and other idle land area are good sites
Tillage Management: tilling cropland may be delayed in spring to allow nesting in standing stubble; tillage may be eliminated in the fall to allow wildlife access to waste grain
Water Developments for Wildlife: where water is limited or absent, development of water sources is desirable; examples include dugouts, guzzlers and shallow impoundments
Northern bobwhite

General information
Bobwhites require Stages 2, 3 and 4, well interspersed. Ideally, habitat is composed of scattered patches of shrubby cover with a diversity of native grasses and forbs. Native grasses, such as bluestems, are used for nesting cover, while more recently disturbed sites rich in forbs and insects are used for brood rearing. In some parts of the country, savannas provide excellent habitat. Savannas have very few trees with an understory of grass, forbs and shrubs maintained by frequent fire (2 years to 4 years). Savannahs may be pine (as in southeast mixed and outer coastal plain forest) or oak (as in cross timbers portion of the Great Plains and eastern deciduous forest). Some agricultural crops can provide seasonal food for bobwhites, but they are not a substitute for diverse native plant communities.

Habitat requirements
Diet: young quail eat insects; adult quail eat a variety of seeds, green vegetation (mostly forbs), insects, small grains and hard mast
Water: necessary water is obtained through the diet
Cover: shrubs for escape and thermoregulatory cover throughout the year; perennial native grasses for nesting; native forbs for brood rearing

Wildlife management practices
Decrease Harvest: may be necessary if populations are declining in suitable habitat where hunting pressure has been excessive
Establish Field Buffers: to increase usable space around row crop fields
Establish Native Grasses and Forbs: where suitable nesting and brood cover is limited
Forest Management Techniques: forest regeneration will enhance habitat for a few years in stands ready for harvest
Increase Harvest: can increase harvest only if current bag limit is below that of Northern bobwhite hunting regulations
Leave Grain Unharvested: to provide additional food through fall and winter
Manage Disturbance:
Prescribed fire is the most important tool for quail management and should be used if possible; burn small areas in large expanses of Stages 3 and 4; burning every 1 year to 2 years in Stages 5 and 6 forest may, over time, create a woodland or savannah; disking small areas in large expanses of Stages 3 and 4 will encourage annual forbs and grasses, but disking should be avoided in native rangelands; fire will encourage similar plant communities without soil disturbance and at a lower cost; chaining small areas in large expanses of Stage 4 vegetation may increase Stages 2 and 3;
Grazing management should keep livestock from grazing food plots and should leave ample herbaceous vegetation for cover and food; grazing management may revert or maintain Stage 3; grazing management should be used to discourage a uniform structure of plants across the landscape; uniform clipping of vegetation by cattle across large areas leaves no nesting cover and does not encourage annual forb production; cattle grazing in combination with prescribed burning is an excellent quail management strategy that mimics historic natural disturbance events; grazing management should maintain dense shrub and herbaceous cover in some areas; however, up to one-third of an area can be grazed more intensively to encourage annual forb production for brood habitat, assuming the same areas are not repeatedly grazed the same way;
Chainsawing/feller bunchering may be used to open forest and allow sunlight to reach the forest floor; herbicides may also be used to remove undesirable plants or to reduce woody plants when overly abundant

**Plant/Manage Food Plots:** relatively small linear food plots (one-fourth acre) may be established adjacent to suitable cover where food may be limiting

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

**Tillage Management:** eliminate fall tillage to provide waste grain
Northern flicker

General information
Northern flickers occupy all of North America, and inhabit most of the U.S. year-round. Flickers use open areas in Stages 2 and 3 interspersed with areas of Stages 5 and 6. Northern flickers are often found in riparian and urban areas. They prefer older urban residential areas with large trees, golf courses and parks. Flickers create cavities in trees for nesting and will occasionally use nest boxes. 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.

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 dying or rotting 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
Artificial feeders: may be used to attract flickers in urban areas; suet is preferred
Create Snags: if none present for nesting cover
Mowing: can be used to maintain open areas in urban environments
Nesting Structures: install nest boxes if suitable tree cavities are lacking
Plant Shrubs: several soft mast-bearing shrubs can provide additional food resource
Plant Trees: in large expanses without trees
Wildlife Damage Management: may be necessary to prevent damage from foraging, drumming and excavating wooden buildings; exclusion practices to prevent access to buildings; harassment to repel flickers from an area

Special: European starlings often take over eastern bluebird or flicker nest cavities for their own nests. Appropriate action should be taken to prevent starlings from occupying nesting cavities of other cavity-nesting wildlife. Appropriate actions may include installing nest boxes with entry holes of a size to exclude starlings, or checking nests and removing those from starlings.
Northern harrier

General information
Northern harriers occur in the northern portions of the Great Plains and throughout Canada during the nesting season. They winter throughout much of the country. Stages 2, 3 and 4 are preferred and may include wet meadows, grasslands, pasture and croplands. Harriers typically hunt by flying low to the ground in search of prey. Harriers nest on the ground in Stage 3.

Habitat requirements
*Diet:* small mammals, birds and reptiles
*Water:* necessary water obtained from diet
*Cover:* cover requirements of early successional prey (primarily small rodents) should be considered

Wildlife management practices
*Delay Crop Harvest:* in spring to avoid ground nests
*Establish Native Grasses and Forbs:* where early successional cover is limiting
*Manage Disturbance:* prescribed fire should be used to rejuvenate and maintain early successional habitat; grazing management should maintain a diverse structure of vegetation conducive to prey and the efficiency of hunting for Northern harrier; chainsawing can be used to remove trees and revert an area to an earlier successional stage that is to be maintained in Stages 2 through 4
*Tillage Management:* will facilitate hunting prey when waste grain is available
Northern raccoon

General information
Raccoons are very common throughout most of the U.S., except in certain parts of the Rocky Mountains, Nevada, Utah and Arizona. Raccoons are found in a variety of vegetation types but are usually most abundant near riparian areas and wetlands. They are also found in urban areas. Raccoons den in hollow trees, burrows under stumps or brushpiles, or in chimneys, attics and crawl spaces of houses and buildings. They are omnivorous and eat a wide variety of foods. Raccoons can become pests in urban areas and in wetlands where waterfowl nesting is important. Raccoons have also been identified as major predators on game bird nests and young game birds. In such cases, wildlife damage management or increased harvest may be necessary.

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; also dens in ground burrows under stumps, brush and junk piles, old abandoned buildings and rocky cliffs and ledges

Wildlife management practices
Create Snags: relatively large dead trees with cavities can provide denning sites
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Establish Field Buffers: to increase usable space for prey around row crop fields
Forest Management Techniques: forest regeneration and timber stand improvement can stimulate soft mast production and cover for prey; relatively large snags with cavities should be retained when implementing forest management
Increase Harvest: where populations can sustain additional hunting or trapping pressure for recreation and/or where populations need to be lowered for various reasons
Leave Grain Unharvested: especially cornfields adjacent to bottomland hardwoods and riparian areas
Manage Disturbance: prescribed fire is recommended to rejuvenate old decadent wetland vegetation; prescribed fire and disking can maintain Stages 2 and 3; prescribed fire, herbicide applications and chaining are recommended to revert Stage 4 and Stage 5 to Stages 2 and 3; grazing management should prevent livestock from degrading 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/Manage Food Plots: annual grain food plots, especially corn
Plant Shrubs: where soft mast is lacking and to provide corridors across large areas of Stages 2 and 3
Plant Trees: especially in riparian areas and adjacent to wetlands where few trees are present; maintain approximately 50 percent deciduous forest cover; maintain forested riparian corridors
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 wetland habitat
Wildlife Damage Management: may be necessary if raccoons invade 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
Opossum

General Habitat Preference
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 in Stages 5 and 6. Opossums prefer environments 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
Create Snags: provide nesting and escape cover, & insect habitat
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Increase Harvest: where populations can sustain additional trapping pressure for recreation and/or where populations need to be lowered for various reasons
Leave Grain Unharvested: especially cornfields adjacent to bottomland hardwoods and riparian areas
Manage Disturbance: apply periodic prescribed fire and herbicides to open understory and favor fruit-bearing shrubs and trees; exclude livestock grazing from forest to encourage vegetation
Plant Shrub: provide soft mast; create cover, corridors and riparian buffers in open areas
Plant Trees: fruit trees provide a food source

Water Developments for Wildlife: in areas lacking water, construct a permanent water source from a dugout, shallow impoundment, or small backyard pond

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 are not wary of traps and may be easily caught with cage trap.
Ovenbird

General information
Ovenbirds frequent mature deciduous and mixed forests throughout the eastern third of the country. Ovenbirds require a well-developed herbaceous understory for cover as they forage and nest on the forest floor. They construct a nest of grasses and forbs arched over in the shape of a Dutch oven, hence the name. The nest is usually well hidden in herbaceous vegetation on the forest floor.

Habitat requirements:
Diet: insects and spiders
Water: usually obtain necessary water from diet but will also use other water sources when available
Cover: mature forest with well-developed herbaceous understory

Wildlife management practices
Forest Management Techniques: timber stand improvement will encourage increased groundcover important for nesting and foraging
Manage Disturbance: grazing management should prevent livestock grazing in forested areas
Plant Trees: in areas where less than 75 percent of the area is in Stages 5 or 6 forest
Prairie vole

General information
Prairie voles can be found in the northern tier of counties in the Gulf Coastal Plain in Arkansas. Their habitat ranges from grassy, overgrown areas in grassy fields that aren’t too damp. They prefer pastures, prairies and weedy areas. This includes fencerows, railroad rights-of-ways, and meadows, wherever cover is dense enough to conceal it from predators. They also live in cultivated fields of clover and alfalfa, and near towns they live on golf courses and vacant lots. This animal occurs in grassy areas near the forest edge but does not inhabit woodlands.

Prairie voles have extensive runway systems beneath the grass canopy. They part the grass at ground level to make 2-inch wide runways between the entrances to their burrows, or from the burrows to their food source. Voles clip grass and ground level and consume the most nutritious parts. Runways in active use can be identified by small piles of fresh grass cuttings and brownish black droppings. They also have an underground burrow system with numerous entrances and large mounds. The large mounds often reveal food caches and underground nests. Where the grass is tall, a globular nest is built above ground among grass roots. Nests are comprised of coarse grasses, lined with finer grass or finely shredded vegetation. They are preyed upon by a variety of predators including raptors, owls, snakes, foxes, skunks, and coyotes.

Habitat Requirements
Diet: mostly grasses and forbs, including prairie grasses and mosses. They eat roots and other parts of clovers, dandelions, alfalfa, and goldenrod. Seeds, tubers and plant roots may be cached in underground chambers near nests.
Water: usually obtain necessary water from their diet.
Cover: dense vegetation.

Wildlife Management Practices
Establish Field Buffers: to increase usable space around row crop fields and forest edges
Establish Native Grasses and Forbs: provide food and cover where lacking
Leave Grain Unharvested: particularly near grassy field edges where voles are likely to inhabit
Manage Disturbance: Prescribed burning of small areas (40 acres maximum, 10 to 20 acres preferred) in old decadent stands of Stage 4 – 6 vegetation will promote native grasses and resprouting of shrubs. Chaining, roller beating or brush chopping small areas (40 acres maximum, 10 to 20 acres preferred) in old decadent stands of Stage 4 -6 vegetation will promote native grasses and resprouting of shrubs. Livestock grazing management should leave adequate herbaceous vegetation needed for food.
Wildlife Damage Management: In places near agricultural fields or gardens, prairie voles may become pests. Other than disking and destroying tunnels, there are few options for controlling excessive populations.

Image courtesy of Cr. Thomas Curtis, Florida State University
Prothonotary warbler

General information
The prothonotary warbler nests in hardwood forests (Stage 6) near water, primarily in the southern U.S. They are most often found in forested wetlands such as cypress swamps and other bottomland hardwoods. Prothonotary warblers are cavity nesters, so large overmature trees and standing dead trees are important. Additionally, this warbler feeds primarily on insects in the lower canopy or at ground level; thus, a 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 such as ants, beetles, mayflies, aquatic larvae and snails
Water: necessary water is obtained through the diet
Cover: forested wetlands and other mature bottomland hardwood forests; dead standing timber help ensure presence of cavities

Wildlife management practices
Create Snags: where lacking, provide potential nest sites
Forest Management Techniques: timber stand improvement can stimulate vertical structure where absent
Manage Disturbance: grazing management should prevent livestock from damaging vegetation and structure along banks of streams, rivers and other wetlands; this may include development of livestock watering facilities in uplands to discourage congregation in and overuse of riparian areas
Nesting Structures: nest boxes are readily used and will provide suitable nesting cover where natural cavities are limiting
Plant Trees: in open bottomlands where forest cover is lacking and natural regeneration is not sufficient
Water Developments for Wildlife: shallow impoundments can be established in bottomland hardwoods for habitat enhancement
Rainbow trout

General information
Rainbow trout are native to the U.S. west of the Rocky Mountains. They have been introduced throughout the U.S. including Arkansas as a sport fish. Rainbow trout are cool- to cold-water fish that do best in freshwater systems below 70 F. They are carnivorous and in their native habitat, spawn in areas with a rocky river or lake bottom. In Arkansas, trout are unable to spawn, and therefore are stocked by the Arkansas Game & Fish Commission and the U.S. Fish and Wildlife Service below dams with cold water, in spring-fed streams and other locations.

Habitat requirements
Diet: fish, aquatic insects, crustaceans and mollusks; may also eat terrestrial organisms that fall into the water, but this is not common
Water: streams, lakes and ponds where the water does not rise above 70 F in summer; ideally stream should have 50 percent riffles and 50 percent pools; basic requirements include dissolved oxygen (minimum of six parts per million); pH should range between 6.5 and 9.0
Cover: rocks, as well as debris on the bottom of the river or lake, provide cover for hiding from prey or fishermen

Wildlife management practices
Decrease Harvest: refer to wildlife management practices for specifics on fish harvest
Increase Harvest: refer to wildlife management practices for specifics on fish harvest; managers have begun reducing rainbow trout populations to minimize predation on or competition for resources with native fish species; increasing the harvest can reduce the rainbow trout population
Manage Disturbance: grazing management should maintain thick vegetation on banks and shores; livestock watering facilities should be developed away from streams, rivers, lakes or ponds; fencing along the riparian area or lakeside may also be necessary
Ponds: Construction: where no pond or stream is present and/or where an existing pond needs extensive repair, especially to the dike or dam, including significant tree removal on the dike or dam
Ponds: Deepen Edges: where pond edges are not at least two feet deep to discourage rooted aquatic vegetation
Ponds: Fertilize/Lime: 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
Ponds: Reduce Turbidity: by reseeding the watershed where soil is eroding into the pond and causing muddy water
Ponds: Repair Spillway/Levee: if not functioning properly
Ponds: Restock: if too few are present
Streams: Dams, Boulders Logs: gravel and cobble should be placed in stream to provide structure for insects and locations for spawning; structures should not change currents, which could increase bank erosion; boulders and logs may be placed in the stream or lake to provide cover for trout while hunting, as well as cover for prey species
Water Control Structures: should be installed if none are present so water depth can be controlled
Red-eyed vireo

General information
Red-eyed vireos occur in mature deciduous forests throughout eastern North America and the upper Midwest. They are strongly associated with riparian and wet deciduous forest and shrub habitats. They are usually found foraging in the middle to upper layer of the forest canopy but often nest in the understory or midstory. The nest is usually placed on a horizontal fork of a slender branch.

Habitat requirements
Diet: 85% insects and spiders (one-third of which are caterpillars and moths), 15% soft mast
Water: necessary water is obtained from diet
Cover: midstory and overstory of stage 6 mixed deciduous forest

Wildlife management practices
Forest Management Techniques: single-tree and group-selection methods of forest regeneration are compatible with the habitat requirements of red-eyed vireos; timber stand improvement may stimulate additional understory and midstory development and provide enhanced nesting cover in relatively open woods
Manage Disturbance: grazing management should be excluded from forest to allow seedling regeneration; use herbicides to remove less desirable trees and improve availability of understory or midstory trees for nesting
Plant trees: in large open areas, trees may be planted to provide future habitat
Red Fox

General Habitat Preference
The red fox is adaptable to most habitats within its range, but usually prefers open country with moderate cover. Red foxes prefer upland woods and farmlands with meadows, cultivated fields, pastures and woodlots. Thick cover is usually avoided. Red foxes have demonstrated their adaptability by establishing breeding populations in many urban areas of the United States, Canada, and Europe.

Habitat Requirements
Diet: opportunists, feeding mostly on rabbits, mice, bird eggs, insects, and native fruits; usually prey upon animals smaller than a rabbit, although fawns, pigs, kids, lambs, and poultry are sometimes taken; sometimes kill more than they can eat and bury food in caches for later use; sometimes feed on carrion; soft mast such as persimmons and mulberries eaten when available, but comprise only a small portion of the diet

Water: may den along wooded rivers and streams, though nearby water isn’t a requirement

Cover: dig dens or use abandoned burrows of a woodchuck; same dens may be used for several generations; usually located in a wooded area adjoining a field or along wooded rivers and streams; used mostly for rearing young but may be used to bed down during severe winter weather.

Wildlife Management Practices
Establish Native Grasses and Forbs: establish where exotic grasses are present or in forest openings; create habitat for insects

Mowing: create more open areas for foxes to prey on rodents

Plant Shrubs: create cover in open areas; develop corridors and riparian buffers

Plant Trees: red foxes avoid thick woods; however, tree planting may be necessary to create moderate cover in large expanses of open areas

Wildlife Damage Management: may cause serious problems for poultry producers. Young pigs, lambs, and small pets are also taken by foxes. Damage difficult to detect because prey is usually carried from the kill site to a den site, or uneaten parts are buried. Net wire fences with openings ≤ 3 inches, buried with apron at least 12 inches outward from the bottom. A 3-wire electric fence with wires spaced 6 inches, 12 inches, and 18 inches (15 cm, 31 cm, and 46 cm) above the ground can repel red foxes.
Redhead

General information
Redheads range over the north-western and central U.S. and Mexico. They winter in southern areas of the U.S. into Mexico. Redheads are diving ducks that use Stage 2 wetlands for most activities. They may loaf in Stage 1 wetlands and usually nest in emergent aquatic vegetation associated with Stage 3 wetlands adjacent to Stage 2 wetlands. Nests are built out of emergent vegetation and are usually placed above water or very near the shore in dense vegetation providing concealment.

Habitat requirements
Diet: young redheads primarily eat aquatic invertebrates (mollusks, snails, crustaceans) during late spring and early summer; during the rest of the year, redheads prefer aquatic plants such as pondweeds, muskgrass, bulrush seeds, wild celery, water lily seeds and coontail
Water: see cover requirements below
Cover: during spring and summer, dense emergent vegetation for nesting and wetlands composed of 50 percent Stage 3 interspersed with 50 percent Stage 2 wetland; during fall and winter, Stage 2 wetland; also may use stage 1 wetland during migration and winter

Wildlife management practices
Decrease Harvest: may be selected when wanting to attract more redheads to a particular area; can assign waterfowl resting area with no hunting or human disturbance to portion of area
Increase Harvest: can increase harvest only if current bag limit is below that of waterfowl hunting regulations
Manage Disturbance: use prescribed fire every 3 years to 5 years to rejuvenate deteriorated vegetation; grazing management should maintain tall emergent aquatic vegetation adjacent to water; prolonged protection of nesting areas from disturbances such as fire and grazing, can result in deterioration of the vegetation; intense grazing of nesting areas every 3 years to 5 years (after nesting season) can rejuvenate vegetation; usually only one-third to one-half of the nesting area should be treated during any one year
Water Control Structures: should be installed if not present to promote growth of tall emergent aquatic vegetation (Stage 3 wetland) adjacent to Stage 2 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
Red-tailed hawk

General information
Red-tailed hawks are found throughout the country, in open areas of Stages 2 and 3 of plant succession interspersed with Stages 4, 5 and/or 6. They hunt by soaring over Stages 2, 3 and 4 and eat small mammals, birds and reptiles. Red-tailed hawks nest in trees and cliffs, and often roost in solitary trees in grasslands/savannas.

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

Wildlife management practices
Create Snags: in open areas to facilitate hunting
Establish Field Buffers: to increase usable space around row crop fields
Establish Native Grasses and Forbs: where less than 75 percent of the area is in Stages 2 or 3
Forest Management Techniques: forest regeneration in large expanses of stage 6 will provide open habitat for a few years and facilitate hunting prey
Manage Disturbance: prescribed fire, diskings and grazing management are recommended to rejuvenate and maintain Stage 3; prescribed fire and chaining are recommended to rejuvenate and maintain small areas in large expanses of Stage 4
Plant Shrubs: in large expanses of Stages 2 or 3 where trees and shrubs are not present to create perching and nest sites and provide habitat for prey
Plant Trees: in large expanses of Stages 2 or 3 where trees and shrubs are not present to create perching and nest sites
Tillage Management: will facilitate hunting prey when waste grain is available
**River Otter**

**General Habitat Preference**
River otters live in streams, rivers, oxbows, old river channels, lakes, swamps, sloughs and borrow ditches. Though not abundant, their populations have rebounded successfully in localized areas. River otter populations were depleted in the early 1900s by habitat destruction and unregulated market hunting. River otters are closely associated with beavers, relying on them for dens as well as for areas to hunt for food. They frequent pools created by beavers to hunt for fish, crayfish, and frogs. Because otters do not make their own dens, they typically move into beavers’ (or occasionally muskrats’) abandoned dens and lodges.

**Habitat Requirements**

**Diet:** River otters eat mostly crayfish and fish. They sometimes eat frogs, salamanders, turtles, mussels, snakes, and muskrats. They also prey on migratory waterfowl when abundant.

**Water:** They live in a variety of freshwater and coastal marine habitats. River otters seem to be sensitive to pollution and disappear from areas with polluted waters.

**Cover:** River otters use dens built by beavers and other mammals. Dens are found in natural hollows such as under a log or in river banks. Dens have underwater entrances and a tunnel leading to a nest chamber that is lined with leaves, grass, moss, bark and hair.

**Wildlife Management Practices**

**Decrease Harvest:** may be necessary where an increased otter 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

**Manage Disturbance:** *Livestock grazing management* should exclude grazing near waterways to improve water quality for otters. This may include fencing livestock from waterways and developing livestock watering facilities in upland areas to discourage congregation in and overuse of riparian areas.

**Water Control Structures:** Water levels can be adjusted to optimize prey for river otters. River otters utilize deeper pools where they prey upon fish and shallow areas where crayfish thrive. Occasionally they may prey upon migratory waterfowl attracted to shallow water areas.

**Water Developments for Wildlife:** Wetland construction may be necessary in areas lacking natural wetlands.

**Wildlife Damage Management:** River otters can become too numerous and consume fish used for recreation or commercial purposes. To prevent this, it may be necessary to periodically remove some otters from certain areas. River otters have been accused of competing with recreational anglers and commercial fisheries for game fish. Therefore increasing harvest by trapping may be necessary. Other options are removing beavers and muskrats in the pond or nearby stream and destroying their dens and lodges. In some circumstances, building an electric fence around a pond may work. The 4-strand electric fence should be spaced at 4 to 5 inch intervals from the ground up.
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 like large buildings, parks and open areas. They create a shallow nest of sticks, leaves and other vegetation, and nest above the ground and on or around buildings. Rock pigeons primarily feed on the ground on small grains, seeds, crumbs and garbage.

Habitat requirements
_Diet_: waste grain and weed seeds; in urban areas, rock pigeons live mostly on 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, 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
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 the winter months. Hummingbirds are found in Stages 2 through 6 rich in flowering plants. In urban settings, they prefer areas with large trees and nearby flowering plants. A hummingbird’s nest is a small cup 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
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
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
Rooftop / Balcony Gardens: can provide source of nectar if appropriate flowers are planted

Note: Plant Flowers should not be recommended to plant Rooftop / Balcony Gardens
Song sparrow

General information
Song sparrows inhabit all of America, but will migrate from extreme northern areas during the colder months of the year. Song sparrows occupy shrubby areas interspersed with Stages 2, 3, 5 and 6, especially along riparian areas. Song sparrows often nest along forest edges in a cup nest of grass and leaves on or near the ground. Nest is often placed on the ground under a shrub or in thick herbaceous cover and made of grass and forbs. 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, escape

Wildlife management practices
Artificial Feeders: millets and sunflower seeds are favorites
Establish Native Grasses and Forbs: interspersed with Stage 4 for cover and nesting
Plant Shrubs: plant shrub species that provide soft mast where there is little soft mast available
Water Development for Wildlife: birdbaths and pans of water can provide drinking water
Spotted Skunk

General Habitat Preference
Spotted skunks, sometimes called civet cats, occur in a variety of habitats including open fields, prairies, croplands, fencerows, farmyards, forest edges and woodlands. Wetlands and dense timber stands in Stages 5 or 6 are avoided. Because of low population numbers, the hunting season is closed for spotted skunks in many states.

Habitat Requirements
**Diet:** Spotted skunks are omnivorous and feed upon insects, mice, rats, some birds, and to a lesser extent, upon fruits, corn, nuts, small lizards and snakes.

**Water:** They obtain necessary water requirements from their surroundings.

**Cover:** Spotted skunks are found most commonly in open grasslands, brushy areas and cultivated land. They den below ground in rocky crevices, along fencerows, or deserted woodchuck or armadillo burrows as well as above ground in brush piles, woodpiles, hollow trees or logs, and hay stacks.

Wildlife Management Practices
**Create Snags:** den in hollow trees or logs

**Establish Field Buffers:** to increase usable space around row crop fields and forest edges

**Leave Grain Unharvested:** occasionally consume corn and other grain crops

**Manage Disturbance:** livestock grazing management should be controlled to allow for undisturbed areas of brushy growth to occur; in large areas of Stages 5 and 6, create openings to produce edge habitat by mowing, chaining/roller beating, diskng, or burning. Avoid burning or clearing fencerows, brush piles and downed logs or trees where skunks may be present.

**Plant Shrubs:** In large open areas of Stages 2 or 3, plant multiple rows of fruiting shrubs; encourage shrub growth in fencerows, hedgerows, field/woods borders, and odd areas

**Plant Trees:** in areas of Stages 2, 3, or 4, plant a few mast-producing trees

**Wildlife Damage Management:** occasionally raid poultry houses, consume chickens and eat eggs

**Special:** Due to low numbers, there is no trapping season for spotted skunks in Arkansas at this time.
White-tailed deer

General information
The white-tailed deer is the most important game animal in North America. They 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 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 very 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
Decrease Harvest: if hunting pressure is limiting population growth where an increase is desired
Delay Crop Harvest: hay harvest may be delayed so fawning sites are not disturbed; however, poor-quality hay will result; also, if fawns are found in a hayfield, it is probably symptomatic of poor fawning cover on the property
Establish Field Buffers: to increase fawning cover and forage availability (forbs) around row crop fields
Establish Native Grasses and Forbs: where there is not at least 25 percent of the property in high-quality early successional cover
Forest Management Techniques: forest regeneration 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
Increase Harvest: where populations can sustain additional harvest pressure for hunting recreation and/or where populations need to be lowered because of overpopulation and habitat degradation; in these cases, it is important to concentrate the harvest on females
Leave Grain Unharvested: to provide additional food resource, especially near cover
Manage Disturbance: prescribed fire is recommended to maintain Stages 2 through 4 and to revert Stage 4 to Stage 3; also to stimulate the understory for increased forage and soft mast in Stages 5 and 6 of Eastern Deciduous Forest and Southeast Mixed Forest; mowing and chaining can also maintain Stages 3 and 4; in areas dominated by mesquite, root plowing combined with seeding grasses and legumes may be the best way to maintain small areas in Stage 3; grazing management should maintain forbs, grasses, shrubs and trees available for food and cover—this is particularly important in riparian areas in the Great Plains Grassland Region
Plant/Manage Food Plots: where and when naturally occurring food sources are limited, food plots may provide additional nutrition, particularly in late summer and winter of most regions
Plant Shrubs: where needed to provide additional soft mast, brushy cover, and browse; ravines, field borders, other idle land areas and across large areas of Stages 2 or 3 to provide travel corridors
Plant Trees: where appropriate, to maintain at least 30 percent to 40 percent forest cover; and where mast producers are lacking, particularly oaks
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 an external water source for drinking

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

**General information**
Wild turkeys use a wide variety of vegetation types across the U.S. They are very adaptable and are limited only by tree cover for roosting and by snow depth and persistence for obtaining food. Optimum habitat contains an interspersion of brushy cover for nesting, native forbs and grasses for brooding, and hard- and soft-mast producing trees and shrubs for roosting and food availability. A rule of thumb is one-fourth to one-half in an interspersion of Stages 2, 3 and 4, and one-half to three-fourths in mature woodlands (Stage 6).

**Habitat requirements**

**Diet:** various hard mast including acorns and beechnuts; soft mast including blackberries and black cherry; insects and other invertebrates including spiders and snails; miscellaneous seeds; leaves from forbs and grasses; grain from a variety of agricultural crops; chufa tubers

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

**Cover:** mature forest, regenerating forest, brushy areas and old-fields with rank cover for nesting; nest is a shallow depression on the ground lined with leaves and/or grass and is usually well concealed amongst vegetation or against some object (such as a tree, log or brush); mature forest, Stages 2 and 3 forb cover, and grain fields for feeding; trees or tall shrubs for roosting

**Wildlife management practices**

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

**Delay Crop Harvest:** hay harvest may be delayed so nests not disturbed; however, poor-quality hay will result

**Establish Field Buffers:** to increase usable space around row crop fields

**Establish Native Grasses and Forbs:** where less than one-quarter of the area is composed of Stages 2 and 3

**Forest Management Techniques:** forest regeneration methods can enhance nesting habitat, provide additional brood cover, soft mast, and miscellaneous seed for 2 years to 3 years after harvest; timber stand improvement practices can improve the structure of the understory for nesting and brood rearing, increase production of soft mast and miscellaneous seed, and enable the crowns of desired trees to grow and produce additional mast

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

**Leave Grain Unharvested:** (especially corn and grain sorghum) to provide a high-energy food source during fall and winter; especially important during years of poor acorn production

**Manage Disturbance:** prescribed fire, disking, herbicide application, chaining, roller beating and grazing management can be used to maintain and rejuvenate Stages 2 to 4 when habitat quality begins to decline; grazing management should prevent livestock from degrading habitat by overgrazing and damaging planted trees and shrubs

**Plant/Manage Food Plots:** where grain crops and quality forages such as clovers are lacking to provide a supplemental food source and additional areas for brood rearing

**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

**Tillage Management:** eliminate tillage in the fall to provide additional waste grain during winter, especially when adjacent to Stages 4 through 6

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

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

General information
Wood ducks are primarily found along rivers and large creeks within bottomland hardwood forests, Stage 3 wetlands and swamps with emergent woody vegetation adjacent to Stage 2 wetlands, and shallowly flooded Stages 5 and 6 hardwood forest. Wood ducks nest within cavities. Usually, nest sites are within or adjacent to flooded timber; however, wood ducks have been known to nest up to one mile from water. Cavity availability is critical for a sustainable population. Thus, artificial cavities 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, various 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: obtain water through diet and drink free-standing water regularly
Cover: Stage 3 wetlands and swamps; shallowly flooded bottomland hardwoods; nest in tree cavities in stage 6 hardwoods and artificial cavities

Wildlife management practices
Create Snags: to provide potential cavity nesting sites
Decrease Harvest: may be selected when wanting to attract more wood ducks to a particular area; can assign waterfowl resting area with no hunting or human disturbance to portion of area
Forest Management Techniques: timber stand improvement in bottomland hardwoods that can be flooded can lead to larger crowns of favored trees and increased mast production; woody stem density should increase following TSI and improve cover in stands that can be flooded
Increase Harvest: can increase harvest only if current bag limit is below that of waterfowl hunting regulations
Leave Grain Unharvested: (especially corn) to provide high-energy food source for wood ducks 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
Manage Disturbance: grazing management should prevent livestock from damaging trees and shrubs planted for wood ducks
Nesting Structures: nest boxes should be erected where there is a lack of natural cavities; nest boxes for wood ducks should be at least 100 yards apart and should not be placed within sight of each other if possible
Plant/Manage Food Plots: shallowly flooded grain plots 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
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: specifically, shallow impoundments should be created where topography allows, to create feeding and nesting space for wood ducks
Wildlife Foods and Concepts - Description
4-H WHEP and Wildlife O-Rama

Objectives
Junior and/or Senior contestants demonstrate their knowledge and understanding of foods eaten by wildlife species in the selected region, basic wildlife habitat concepts and habitat practices. Seniors are expected to know more material than Juniors for the contest.

Overview
Junior and Senior contestants answer 30 questions about wildlife foods and concepts for both the 4-H WHEP and Wildlife O-Rama competitions. The format can be multiple-choice, true/false, or matching. Each question is worth one point.

Juniors answer questions about food habits of the announced species and wildlife management concepts. Questions may be taken from the Wildlife Foods Chart for the selected region, Wildlife Concepts and Terms, and the Glossary.

Seniors answer questions about food habits of the announced species and wildlife management concepts. Questions may be taken from the Wildlife Foods Chart for the selected region, Wildlife Concepts and Terms, and the Glossary. In addition, Senior contestants may answer questions about the selected region, Species Habitat Needs, and descriptions of Wildlife Management Practices.

Note: Foods have been placed in groups. Juniors and Seniors should be prepared to indicate which foods are eaten by specific wildlife species, and be familiar with the food group definitions. Foods charts for species are available for each region. Further information on foods can be found in Species and Habitat Needs. If food descriptions in the Species and Habitat Needs differ from the Food Chart, the Food Chart serves as the final source for determining correct answers.

Contest Rules
1. Contestants need to bring pencils and a clipboard for this event. (No extra pencils or pencil sharpeners will be available.)
2. Contestants will complete the scorecard individually. This is not a team event.
3. Question responses can require using a visual item for determining the answer, such as a wildlife food sample, picture or prop.
4. A Foods Chart of wildlife species and their corresponding foods has been developed for each region. The chart serves as a study guide for answering multiple-choice, true/false, or matching questions about wildlife foods.
5. Contestants will be given 30 minutes to answer questions and record information on the score sheet.
6. This event is worth 30 points. One point will be given for each correct answer.

Content Areas
The Wildlife Foods and Concepts event focuses on several key areas. Following is a list of study areas for Juniors and Seniors.
Juniors
1. **Food habits of wildlife species present in the region.** Study the foods chart for 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).

2. **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, Wildlife Foods Chart, Explanation of Food Categories, and Glossary.

Seniors
1. **Food habits of wildlife species present in the region.** Study the foods chart for 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).

2. **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, Wildlife Foods Chart, Explanation of Food Categories, and Glossary.

3. **Description of the region.** Read the description of the region that was selected for the contest. Know the region’s unique features.

4. **Wildlife species and their habitat needs.** Review descriptions of wildlife species. Be able to describe the food, water, cover, and spatial needs for each species in the announced region.

5. **Wildlife habitat practices.** Be able to describe management practices for improving habitat and their application. A question may ask the advantages or disadvantages of a practice, its application to an ecosystem, or improving habitat for a particular wildlife species. For example, what are the benefits of a prescribed fire for wild turkey?
Wildlife Foods & Concepts Scorecard

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

1. ________________ 11. ________________ 21. ________________
2. ________________ 12. ________________ 22. ________________
3. ________________ 13. ________________ 23. ________________
4. ________________ 14. ________________ 24. ________________
5. ________________ 15. ________________ 25. ________________
6. ________________ 16. ________________ 26. ________________
7. ________________ 17. ________________ 27. ________________
8. ________________ 18. ________________ 28. ________________
9. ________________ 19. ________________ 29. ________________
10. ________________ 20. ________________ 30. ________________

Total Correct: ____________________
Region Descriptions: 
Eastern Deciduous Forest

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

Dominant Vegetation
Depending upon site, the final stage of succession is dominated by a variety of deciduous trees. Depending on geographic location, trees such as oaks, hickories, maples, American beech, basswood, buckeye, yellow poplar, walnut and birches can be indicators of climax vegetation. Common evergreen trees on many sites undergoing succession include shortleaf pine and eastern redcedar.

Changes in the composition, structure and function of the Eastern Deciduous Forest have already occurred during the past 100 years with the loss of American chestnut and the near total exclusion of fire. Prior to fire suppression, oak savannas and woodlands were prevalent over much of this region.

Prevalent midstory trees include flowering dogwood, sassafras, sourwood, Eastern redbud, hophornbeam, American hornbeam and striped maple. Common shrubs include arrowwood, black huckleberry, blueberries, hawthorn, pawpaw, spicebush, viburnums and witchhazel. A wide variety of forbs and ferns may be found in the understory.

Well-interspersed with forested areas are fields undergoing succession containing a wide variety of grasses and forbs. Virtually all of these “old fields” have been cropped in the past, and the vast majority has since been planted to non-native grasses. Restoring early successional areas with native grasses and forbs is a major objective concerning wildlife conservation in this region. Native grasses, forbs, shrubs and brambles occurring naturally in openings and savannas include bluestems, panicgrasses, indiangrass, switchgrass, asters, lespedezas, tick trefoils, partridge pea, pokeweed, wild plum, sumacs and blackberry.

Typical invasive plants in the Eastern deciduous forest include tall fescue, orchard grass, timothy, serecia lespedea, Bradford pear, Russian olive, and bicolor lespedeza.

Farming and Ranching
Large areas of Eastern Deciduous Forest have been cleared of native vegetation for crop production and livestock forage. Depending on how croplands and pastures are managed, some wildlife species benefit from

Many species of trees and shrubs are present in this mature Eastern Deciduous Forest and provide well-developed vertical structure. Photo by Craig Harper.
farming. Unfortunately, the vast majority of pasture and hayland are composed of non-native grasses that are not beneficial for wildlife.

**Plant Succession Stage**
Stage 1 — bare ground, Stage 2 — annual forbs and grasses, Stage 3 — perennial forbs and grasses, Stage 4 — brushy cover, Stage 5 — young forest, Stage 6 — mature forest.

Not all wildlife species use mature forest. This young Eastern Deciduous Forest provides necessary habitat components for species such as brown thrasher. *Photo by Craig Harper.*
Region Descriptions:  
Grasslands – Tallgrass/Mixed Prairie

Physical Description
The terrain is characterized by flat to rolling plains. Average annual precipitation ranges from 20 inches to 40 inches. Winters are cold; summers are hot.

The Great Plains region was the largest native grassland encountered by pioneers moving west. Isolated grasslands also exist in parts of Arkansas, but these are less well known than the Great Plains. Plant life in a grassland community is very sensitive to subtle variations in soil moisture, chemistry, and texture, and that accounts for the many different grasses and flowering plants that grow here. An acre of native grassland can be shown to support up to 150 different native plants.

The tallgrass prairies in Arkansas have almost entirely disappeared. Once the prairie sod is plowed, native plants often disappear, and with few exceptions, only land that was set aside for raising hay have retained their original flora and soil structure. Only 1% of the original grasslands remain today in Arkansas, making the tallgrass prairie one of the most rare and threatened ecosystems in the state.

With the loss of habitat came the loss of prairie species such as the greater prairie chicken and the snowy orchid, which are no longer found here. Agriculture, overgrazing and development have reduced the once extensive prairies to small, isolated fragments. One key to prairie restoration includes strategically locating new efforts next to the these remnant areas to allow birds, insects, pollen, and seeds to move between restored sections and remnant lands so they can develop into a functional prairie landscape.

Dominant Vegetation
In undisturbed areas, climax vegetation in the tallgrass prairie is typically tall grasses growing 8 feet or more, such as big bluestem, little bluestem, Indian grass and switchgrass. A variety of forbs are also found such as sunflowers, broomweed, ragweed and lespedezas. Sedges, buttonbush, cottonwood, willow, and other shrubs and trees are often present in drainages, stream courses and other moist areas.

Within the region, there are large areas along rivers and drainages dominated by trees and shrubs such as cottonwood, green ash, red maple, bur oak, American elm, box elder, eastern red cedar and various willows. Because of the abundant vegetation and readily available water, these sites are very attractive to various wildlife species that are adapted to woody vegetation.

In part of the tallgrass prairie, a mixture of woodland dominated by post oak and blackjack oak exists on upland sites. These vegetation types were historically maintained by a combination of grazing and fire. The lack of fire is a major cause of habitat deterioration.

Typical invasive plants include serecia lespedeza, Bermudagrass, musk thistle, and tall fescue.

Management Considerations
Planting trees for wildlife in this region is only recommended in areas where trees would have occurred historically such as in riparian areas or major drainages. The historic occurrence of these trees was influenced by soils, moisture and fire.
Historically, the community was shaped by climate, grazing, and fire. These factors limited the encroachment of trees and shrubs. Fire also increased the productivity of the prairie by returning nutrients to the soil. Some trees and shrubs grow in savannas, which are transition zones between the prairie and surrounding forests. Seasonal wetlands may form in low areas. Blooming forbs add brilliant colors to the landscape. To survive the extreme conditions on the surface, much of the prairie community is underground. Plants have complex root systems reaching as deep as 15 feet.

**Farming and Ranching**

The mixed-prairie area consists of a mix of short, intermediate and tall grasses depending on the site. Tall grasses dominate moist sites with soil depth greater than 20 inches such as flood plains and valleys. Dry sites such as hill tops and south facing slopes are dominated by shortgrass species or glades. Transition sites (between areas) consist of a mixture of tall, mixed and short grasses. Drainages and other moist areas may have shrubs and trees such as native plum, buttonbush and cottonwood.

Cultivated cropland is found in portions of this region. Where precipitation is adequate or irrigation is possible, large areas are planted into agricultural crops such as wheat, millet, oats, corn, sunflowers and alfalfa. In areas where soil is fertile, the main crops are wheat, corn, soybeans, grain sorghum, and alfalfa.

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

Most of the native range is grazed by livestock. Some areas, particularly glade habitats, are being invaded by eastern redcedar because of fire suppression. Fire is a critical component to rangeland and forest health. The current lack of fire is the greatest threat to wildlife in this region.

**Plant Succession Stage**

Stage 1 — bare ground, Stage 2 — annual forbs and grasses, Stage 3 — perennial grasses and forbs, Stage 4 — shrubs occur most frequently on moist sites in mid and eastern areas, also found mixed with Stage 3 in western areas, Stage 5 — young woodland and Stage 6 — mature woodland. Stages 5 and 6 are found along stream and river courses. Stages 3 and/or 4 are commonly the final stage of succession in this region.

![The 71-acre Baker Prairie is all that is left of a once 5,000-acre tallgrass prairie in northwest Arkansas. Photo courtesy of The Nature Conservancy – Arkansas.](image1)

Prairie is not only composed of grasses, but forbs are equally important. This recently burned prairie has abundant forbs and bare ground. *Photo by Dwayne Elmore.*
Region Descriptions: Southeast Mixed and Outer Coastal Plain Forest

Physical Description
The terrain is rolling hills to mostly flat. Marshes, lakes and swamps are numerous along the coastal plain. The average annual precipitation ranges from 40 inches 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 upland sites where prescribed fire is still used, shortleaf pine may be the principal overstory species. Planted loblolly pine is widespread over much of the region, but without fire and judicious thinning, the value of loblolly plantings for wildlife is decreased. Gum and cypress are dominant on moist areas along major river drainages. Midstory trees throughout much of the region include dogwoods, American hornbeam, redbud, sweetbay, and shadbush. Native forbs and grasses commonly found in Stage 2 and Stage 3 include lespedezas, partridge pea, ragweed, pokeweed, bluestems, paspalums, 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 invasive plants in the Southeast Mixed Forest include Japanese climbing fern, privet, cogongrass, bahia grass, Japanese honeysuckle, kudzu, and Chinaberry.

Farming and Ranching
Many wetlands along major rivers have been drained and forests cleared to grow crops such as rice, cotton, soybeans, corn and other grain crops. Large areas of forests have also been cleared and planted to non-native grasses and legumes as forage for livestock. Unfortunately, most of these are not beneficial for wildlife.

“Tree farming” is a big industry in Arkansas and portions of the South. Loblolly pine is the most important timber-producing tree species. Loblolly pine naturally occurs primarily in the coastal plain region of the southern United States. In Arkansas, this region comprises the southwest third of the state. Though loblolly pine is native to the coastal plain region, research has shown that planted stands in north Arkansas can be successful as well.

Loblolly pine is adaptable to a variety of soils; however, it performs best on well-drained soils with adequate moisture, a thick topsoil layer and firm subsoil. The ability of loblolly pine to survive and grow on a variety of soil types, along with consumer demand for its wood, has maintained its popularity as a species to plant for timber production statewide.
In most cases, sawtimber-size loblolly pine trees provide the greatest economic benefit. Unmanaged loblolly pine stands can take up to 50 years to mature into sawtimber-size trees. Managed stands can generate sawtimber-size trees much faster, often within 25 to 40 years depending on the management regime. The difference in rotation length between managed and unmanaged stands can greatly affect the rate of return generated from a stand. Therefore, management of some sort is economically desirable to most landowners. Management provides other benefits as well. Managed stands are less susceptible to adverse weather, insect outbreaks and disease outbreaks. Managed stands can also provide better habitat for wildlife than unmanaged stands.

**Plant Succession Stage**

Stage 1 — bare ground, Stage 2 — annual forbs and grasses, Stage 3 — perennial grasses and forbs, Stage 4 — shrubs, Stage 5 — young forest and Stage 6 — mature forest.

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**Photo by Dwayne Elmore.**

Many species of pine are common across the Southeast. Early successional habitat is provided for a few years until the canopy of the pines closes.

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**Photo by Dwayne Elmore.**

Mature pine stands 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.
Region Descriptions:

Urban

Physical Description
According to the U.S. Census Bureau in 2005, 80 percent of the American population lived in or near an urban area. The Census Bureau defines an urban area as a large central place with a total population of at least 50,000. In addition to a sizeable human population, urban areas are characterized by residential and commercial development connected and crisscrossed by infrastructure such as roads, train tracks, and utilities. Areas such as neighborhood parks offer the best example of contiguous wildlife habitat within an urban environment.

Dominant Vegetation
Because urban areas are found in all regions of the U.S., it is difficult to identify dominant vegetation common across all regions. However, urban regions typically contain Stage 1 in the form of bare ground and paved areas, annual plantings, perennial grasses and forbs, shrubs and young and mature trees. The vegetation is as likely to be an introduced species as it is a native species. Additionally, vegetated areas are typically manipulated in a landscaped manner versus “letting nature take over” as in rural areas. Interspersion is an important concept to understand in urban areas because of the fragmented landscape from residential and commercial development.

As a result of a disturbed and fragmented landscape, combined with the fact that many varieties of non-native ornamentals are planted for aesthetic purposes, urban areas are often dominated by non-native, invasive vegetation. Educating the public about native versus non-native cultivars and monitoring can also be very effective and should be implemented in all urban areas.

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

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

While urban areas provide limited wildlife habitat, open areas with vegetation can allow some wildlife species to survive. This provides a higher quality of life for urban residents. Photo of Little Rock, Arkansas by Michael Baxley.
Region Descriptions: Wetlands

Physical Description
Wetlands can be described as the zone between deep water and upland areas. They are characterized by various amounts of open water, aquatic vegetation and soil that is often wet or covered with shallow water. There are many different types of wetlands including beaver ponds, man-made ponds, small lakes, marshes, rivers, streams and swamps.

Dominant Vegetation
To describe wetland vegetation, aquatic vegetation must be distinguished from upland vegetation. Aquatic vegetation can survive in the water or on lands flooded or saturated with water for extended lengths of time. Upland vegetation cannot tolerate areas saturated or flooded with water for long periods. The vegetation found in association with wetlands varies with permanence of the water, depth of water, salinity and substrate (bottom). Wetlands with deep, permanent water typically have less emergent (above the water surface) aquatic vegetation and more floating or submerged (below the water surface) aquatic vegetation. As the water depth decreases, emergent aquatic vegetation becomes more dominant. Less vegetation is found on rock and gravel bottoms than on bottoms that are more characteristic of soil such as the presence of silt, clay and organic (dead plants and animals that are decomposed) matter. Emergent aquatic vegetation includes trees, shrubs, grasses and grass-like plants.

Examples of trees often found in wetlands are willows, cottonwood, oaks, and cypress. Shrubs commonly found in and adjacent to wetlands include willows, alders, pawpaw, swamp privet and buttonbush. Grass and grass-like vegetation such as cattails, bulrushes, cordgrass, sedges, and wild rice are examples of emergent aquatic vegetation found in wetlands. Water lilies, pond weeds, wild celery, and duckweeds are examples of floating and submerged aquatic vegetation.

The amount of open water and vegetation is important in determining how suitable the wetland is for different wildlife species. For instance, young ducks need open water and emergent vegetation for hiding. Floating and submerged vegetation supports large amounts of food high in protein such as snails, mollusks and crustaceans that young ducks need for fast growth. Emergent vegetation may supply nesting areas such as trees for wood ducks, grass for mallards, and cattails for red-winged blackbirds and muskrats.

Wetlands with stable, nonflowing water levels go through successional stage of vegetation development similar to those found on adjacent upland areas. The open-water areas fill with silt and dead vegetation, allowing emergent aquatic vegetation to become dominant. As the wetland continues to fill, it becomes drier, allowing upland vegetation to become dominant. Typical invasive plants found in wetlands include purple loosestrife, reed canarygrass, water hyacinth, and alligator weed.

Plant Succession Stage
Typically succession proceeds in the following order: Stage 1 — deep water with little vegetation, Stage 2 — shallow water dominated by submerged and floating aquatic vegetation, Stage 3 — very shallow water or wet ground dominated by any variety of emergent aquatic vegetation and Stage 4 — ground becomes drier and upland vegetation similar to the surrounding area becomes dominant.
Succession proceeds slowly in wetlands with large amounts of deep water or a rocky bottom. Fluctuations in water levels can cause the final stage of succession to regress to an earlier stage. For example, if a wetland in Stage 3 succession is flooded with deep water for a period of time, the aquatic emergent vegetation may die, leaving a wetland in Stage 1 or Stage 2 succession. The extent of this regression depends on the length of time the wetland is flooded with deep water, how much the water level changes, and the extent (length of time) the present vegetation can survive in the changed water level.

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

Stage 1 wetland— characterized by open water and limited vegetation. *Photo by Dwayne Elmore.*
Stage 2 wetland—This beaver-influenced wetland provides a mosaic of open water with submerged vegetation as well as floating islands of debris and emergent vegetation. *Photo by Craig Harper.*

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

Stage 4 wetland— a riparian area along the Missouri River has recently flooded and sediment is deposited along the river. However, most of the time, this area is relatively dry.
Wildlife Management Concepts and Terms

Before you can evaluate wildlife habitat and make management recommendations, some basic concepts about habitat and how different wildlife species relate to habitat should be understood. In this section, some of the basic concepts are described. Since most of the contest will be based on these concepts, it is important you study and understand them.

**Wildlife management** is both an art and a science that deals with complex interactions in the environment. For the purposes of this program, a number of assumptions and simplifications have been made to make the materials more understandable. In actual management cases, trained, experienced professionals should assist you in making the proper decisions.

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 manual.

**Concepts and Terms**

- Communities and Ecosystems
- Habitat Requirements
- Focal Species
- Species Richness and Diversity
- Plant Succession and Its Effect on Wildlife
- Vertical Structure
- Arrangement and Interspersion
- Edge
- Area Sensitive Species
- Home Range, Movements and Migration
- Carrying Capacity
- Pond Dynamics and Balance and Stream Habitat
- Food Webs
- Invasive Species

**Communities and Ecosystems**

A biotic (living) community includes all the plant and animal populations living in a defined area. The composition of a 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 biotic community and the abiotic environment form as a system, called an **ecosystem**. The size of the area involved when defining communities or ecosystems can vary. For example, there are populations of organisms associated with a decaying log or within an ephemeral pond that form communities. Likewise, this can be expanded to include all the communities associated with a forest.
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 regions of the state reflect different climate and soil conditions, though they may be blurred along boundaries where these regions meet. Within these regions, Wetlands and Urban regions can be found.

### Habitat Requirements

“Habitat” represents the physical and biological resources (food, cover, water, space) required by wildlife for survival and reproduction. Habitat requirements are species specific. That is, not all species require the same resources in the same amount. Differences in habitat requirements among some species are subtle, while differences in habitat requirements among other species are dramatic. For example, habitat requirements for Northern bobwhite and Eastern cottontail are somewhat similar. They both require early successional cover, share some food resources, obtain water from plants and require relatively little area when food and cover resources are abundant. However, habitat requirements for Eastern gray squirrel and mourning dove are dramatically different, as they use different vegetation types and foods and have different space requirements.

It is important not to confuse “habitat” with habitat components. Some of the habitat components among wildlife species may be similar, while other components are not. For example, both Northern bobwhite and American kestrel require early successional cover, but while bobwhites primarily eat various plants, seed, mast and insects, kestrels prey on other animals and insects. Thus, even though they may use the same type of cover, their habitat requirements are different. Another example is from white-tailed deer. Whitetails thrive in areas with considerable interspersion. Thus, habitat for white-tailed deer usually includes several vegetation (or cover) types. These vegetation types might include mature oak-hickory forest, old fields undergoing
succession, regenerating pine forest, brushy thickets and agricultural fields. Although some people may use
the term “habitat type” interchangeably with “vegetation type,” this is confusing and should be avoided.

Habitat requirements for wildlife often change through the year. Food and cover resources needed during one
season 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 poult
are able to fly. During summer, wild turkey broods use early successional areas with abundant forbs where
they feed upon insects and are hidden from overhead predators. As young wild turkeys reach 2 to 3 weeks of
age, they roost in trees and shrubs, and—as mast becomes available in the fall—wild turkeys are frequently
found in mature hardwood forests when available.

A well-developed forest understory provides both cover and
food resources for many species of wildlife.

Focal Species
There are two basic goals in wildlife habitat management. One is to provide the habitat requirements for a
particular, or focal, wildlife species. The other, which is explained later in this manual under Species Richness
and Diversity, is to provide habitat requirements for multiple wildlife species in the same area.

When evaluating habitat, you must first determine the focal species. Landowners or the general public may
have specific objectives or concerns about a particular species. Once the species is decided, determine the
habitat requirements for the focal species and evaluate the capability of the area to provide those
requirements. If one or more habitat requirements is in short supply or lacking, then various habitat wildlife
management practices may be used to improve the area’s ability to supply the needed requirements.
Occasionally, the focal species may be totally incompatible with the available habitat and management goals
must be changed.

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

When determining which wildlife management practices to apply, remember that wildlife management
practices that improve habitat for some wildlife species may be detrimental to other wildlife species. It is
impossible to manage an area for any one species or group of species that require similar habitat without
influencing other species in some manner. For example, if you plan a clearcut in a deciduous forest to benefit
ruffed grouse, you may also benefit wild turkey, white-tailed deer and Eastern cottontail, while species such as
ovenbird, wood thrush and Eastern gray squirrel, which prefer unbroken mature deciduous forest, will be forced to use another area.

When managing property for wildlife, it is important to identify the focal species for management. Not all species benefit from the same habitat and wildlife management practices.

Species Richness and Diversity
A species is a type of organism whose members can freely interbreed with each other and are genetically very similar. Species richness refers to the number of different species present in an area. Species richness differs from diversity in that diversity involves the number of species present as well as the distribution and abundance of those species. 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. Generally, habitat requirements are provided for more wildlife species when a variety of vegetation types and successional stages are present.

Plant Succession and Its Effect on Wildlife
Plant succession involves an orderly change in the species of plants occurring in a particular area over time. In climates with sufficient rainfall, plant communities dominated with herbaceous species (nonwoody plants such as grasses, forbs and legumes) succeed to woody species. In drier climates, perennial (plants that live more than two growing seasons) grasses and forbs or shrubs may represent the ultimate, or climax, successional stage. In other words, the climax stage is the final stage of a site if no disturbance takes place. Disturbance events, such as fire, grazing, ice and wind storms, lightning and flooding—continually set back succession and the process starts over.

Plant succession involves a change in plant species composition over time. This field represents a relatively early successional stage with blackberry, persimmon, and scattered oak trees pioneering into perennial grasses (switchgrass and broomsedge).
Succession occurs rapidly in areas with warm temperatures and abundant rainfall. For example, in the Eastern Deciduous Forest, grasses and forbs germinate from the seedbank after a field is disked. Within 20 years, without continued disturbance, trees will be growing on the site and a young forest will be established. In other areas of the United States where precipitation is considerably less, succession still occurs but more slowly. Also, the structural change in vegetation through succession is much less than where grasses and forbs give way to shrubs and tall trees. For example, in a glade habitat in the Ozarks, the underlying rock bed and lack of soil may prevent succession from proceeding beyond a few perennial grasses and forbs. Thus, wildlife species found there such as lizards do not require trees.

Plant succession is an important concept for wildlife managers because all wildlife species are associated with one or more successional stage. 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. This highlights the need to manage a particular successional stage for some species, and highlights the importance of having a diversity of vegetation types and successional stages, if a diversity of wildlife species is a goal or consideration.

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

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

Descriptions of a typical successional stage found in different regions of the U.S. can be found in the regions section of this manual. A description of the typical successional stage occurring in relation to water can be found in the wetland region description. Throughout this manual, successional stages have been numbered to help define plant communities and the structure they represent. In general, stages of plant succession that occur on land can be defined as:

| 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 |
Stage 1 – Bare ground.

Stage 2 – Annual grasses and forbs.

Stage 3 – Perennial grasses and forbs.

Stage 4 – Brushy cover, composed primarily of shrubs.

Stage 5 – Young forest.

Stage 6 – Mature forest.
Oak savannas and woodlands represent early successional vegetation with scattered trees. Without continued fire, oak savannas and woodlands would succeed into forests.

Although successional stages have been defined and numbered here for simplicity, successional stage sometimes can be difficult to distinguish. That’s because succession is continual, and one successional stage gradually develops into the next. When using the designations above, consider the dominant plants in the area you are considering. 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.

If tree species dominate, the canopy is beginning to close, and the understory is beginning to open, it is a young forest. The structure is no longer representative of brushy cover. Is it a forest or a woodland? A savanna or grassland? These can be differentiated by tree density.

In general, a forest is defined as an area with more than 60 square feet of **basal area**. Basal area is a forestry term measuring the volume of tree trunks at 4.5 feet above ground in a given area, typically in an acre. A basal area of 60 square feet per acre means that of 43,560 square feet of available space in 1 acre, tree trunks represent 60 square feet of that space 4.5 feet above ground. Having 60 square feet of basal area is a relatively dense stand of trees. A
woodland contains 20 square feet to 60 square feet of basal area (a lot of trees, but widely spaced apart), a savanna contains 5 square feet to 20 square feet of basal area (only a few trees, very widely spaced apart) and a grassland has less than 5 square feet of basal area (very few, if any, trees).

When evaluating a woodland or savanna, do not worry about defining the successional stage. Instead, consider the structure and composition of the plant community and whether it provides habitat for the wildlife species under consideration.

**Vertical Structure**

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, shrubs and young trees.
- The *midstory* is represented primarily by shrubs and trees more than 4.5 feet tall yet below the overhead canopy.
- The *overstory* is made up of those trees in the canopy.

How the different layers of vegetation are arranged in relation to each other is important to many wildlife species. For example, some birds may require a herbaceous understory for feeding but nest in the overstory.

The forest structure may vary dramatically from site to site, even within a given forest type. For example, one mature oak-hickory forest might have a well-developed understory and midstory with visibility of no more than 20 feet, while 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 suitable habitat for the same wildlife species. The structure could be manipulated on these sites depending on the objectives.
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). While some wildlife species obtain all their habitat requirements from only one successional stage, many wildlife species need more than one successional stage to provide all their habitat requirements. For example, wild turkey may forage on acorns in mature mixed-hardwood stands during fall and winter, but nest near forest openings where newly hatched chicks can forage for insects. Likewise, when a field with abundant forb cover is located near a field containing native warm-season grasses, distance from nest sites to brooding areas are reduced for Northern bobwhite. Required successional stages must be close to each other to allow for safe travel to and from those areas.

This is especially true for species with relatively small home ranges, such as bobwhites, cottontails, lizards and frogs. Managing areas of different successional stages within a landscape is called interspersion. Usually, more interspersion supports a greater diversity of wildlife. A way to estimate the amount of interspersion is explained in the activities section. However, increased interspersion is not necessarily beneficial to all species. As interspersion increases, so does the amount of edge.

Types of Vegetation Interspersion

![Types of Vegetation Interspersion](image)

Edge
An edge is formed where two or more vegetation types or successional stages meet. Where a field meets a forest represents where two vegetation types meet. Where a young mixed-hardwood stand meets an older mixed-hardwood stand represents where two successional stages meet. The transition in vegetation types and/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. An example of a gradual change would be where a 30-year-old forest meets a 60-year-old forest, or where an overgrown

The arrangement of vegetation types and successional stages directly influences animal movements and home range size. Here, nesting cover, brooding cover, and escape are all arranged in close proximity (juxtaposed) to favor habitat requirements for Northern bobwhite.
field—with grass, forbs and scattered shrubs—meets a brushy area. Where these communities meet would represent a *soft edge*.

The abrupt change in species composition and structure shown here is typical of a hard edge. *Photo by John Weir.*

Allowing native grasses, forbs, and brambles to grow into the field from a woods edge increases the amount of “usable space” for many wildlife species by providing suitable cover and food resources.

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:

- the types or stages present provide some habitat requirement;
- the arrangement of the types or stages is suitable and within the home range of the focal species; or
- the specific vegetation types and successional stages for the focal species are in proximity.

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

For wildlife considered “edge” species, the location where two vegetation types or successional stages meet may not be as important as the plant structure of the vegetation or successional stages. *Photo by John Gruchy.*

The presence of edge is not always beneficial for any wildlife species. If the vegetation types or successional stages present do not provide any habitat requirement for the species in question, the interspersion and resulting edge is poor quality habitat. Some species often found along an edge have been relegated to use the
edge because the interior of the adjacent vegetation type is unattractive or does not provide any habitat requirement. For example, wild turkey and Northern bobwhite broods might be found along the edge of a field dominated by tall fescue or bermudagrass. Tall fescue and bermudagrass are not suitable habitat for these birds. The structure of the vegetation in the field is so thick at ground level that small chicks cannot walk through it. Ideally the field would contain native grasses intermixed with bare ground to provide more usable space for the birds. The biological carrying capacity of the property would be increased.

**Area Sensitive Species & Fragmentation**

**Fragmentation** is the disruption of vegetation types either man-made or by natural processes. It is the process of dividing large areas of contiguous (similar) habitat into smaller isolated areas. An example is cutting down a forest and leaving only small, isolated patches. Or it could be planting trees and shrubs in a grassland habitat, leaving only small openings among the trees.

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, while others may not respond to fragmentation except under extreme circumstances such as an interstate highway bisecting a forest or prairie.

Some species need large, unfragmented areas in a certain successional stage to provide some or all of their habitat requirements. Such species are referred to as **area sensitive**. For these species, large areas in one successional stage are desirable. Unfragmented habitat of at least 100 acres is considered the minimum requirement for many area sensitive species. Some species, such as the grasshopper sparrow, may require a minimum of 1,000 acres of relatively unfragmented habitat to sustain a viable population. Grasshopper sparrows are rarely found in grasslands smaller than 100 acres. Others, such as the prairie chicken, may require 30,000 acres of relatively unfragmented habitat. However, 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. These species are not considered area sensitive.

**Home Range, Movements and Migration**

A home range is the area in which an animal lives. For every species, 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 obtain habitat requirements are reduced. A seasonal home range can be defined if an animal uses a different area during different seasons. A seasonal movement, or migration, is made when an animal moves from one seasonal home range to another. Migration for many species, such as waterfowl and songbirds, involves movements to and from
wintering and nesting areas, but this is not true for all species. For example, elk in the western United States migrate from high elevations to lower elevations each spring and fall, as food availability varies with the seasons.

Migration distances may be short or very long, depending on the species. Long migrations require available habitat along the route. Thus, wildlife managers must consider this in landscape planning for various species. This means habitat conditions might have to be considered among states, countries, or even continents.

**Corridors and Riparian Buffers**
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.

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. For example, the probability of predation increases by raccoons, skunks, bobcats, and coyotes in narrow corridors.

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.

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.

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.

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.

**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. By increasing the requirement in shortest supply, a manager 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 is when most young are born, which helps ensure adequate nutrition and cover are available for growth and survival. With the coming of winter or summer drought, food and cover gradually diminish.

More animals are produced each year than will survive. Surplus animals are lost to predation, starvation, competition or disease. Young wildlife and animals in poor health experience the highest mortality rates. Hunting and fishing remove some animals and help prevent overpopulation for some species.

In suburban areas, the biological carrying capacity may be able to support a given number of animals. However, humans may demand the density of certain wildlife be lower 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 successfully on ornamental plants. However, homeowners have low tolerance for deer feeding on expensive landscape plants. Thus, the deer population must be reduced to limit damage. In this case, the *cultural carrying capacity* is lower than the biological carrying capacity.
Any area is only able to support a certain number of animals before available food and cover resources are depleted. Here, overabundant white-tailed deer have exceeded the carrying capacity of the area. Chronic overbrowsing has eliminated the forest understory and thus negatively affected many other wildlife species that require understory vegetation for nesting, feeding, roosting, or escape cover.

**Pond Dynamics and Balance**
A properly managed pond can provide excellent fishing and can benefit many species of wildlife. 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.

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. Excessive water exchange through the pond prevents adequate phytoplankton blooms because fertilization is diluted.

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.

**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. Thus, 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.

**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. Photo by Dwayne Elmore.**

**Food Webs**

A food web is a network of interconnected food chains, which are the step-by-step passage of material and energy (food) through an ecosystem.

Plants are primary producers in a food chain because they supply food at the lowest level of the food chain. It takes an enormous number of individual plants to support the other parts of a food web. At the next level of a food chain are primary consumers, plant-eating animals or herbivores.

Primary consumers include rabbits, mice, certain other mammals; some insects and dabbling ducks, geese and certain other

Primary consumers are eaten by secondary consumers, or carnivores (meat-eaters). This includes predators such as birds of prey, foxes, wild cats and people.

Secondary consumers are eaten by tertiary consumers, which may be predators or

**Source: John R Meyer North Carolina State**
scavengers such as turkey vultures, crabs and sometimes people.

Note these categories are very broad and general. Many animals fit into more than one group, and there are more complex levels of the web.

An example of this is an omnivore, which is an animal that eats both plant and animal matter.

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

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

Invasive Species
Many plants and animals have been introduced, either accidentally or intentionally, into the United State from around the world. Some of these species became established and have proven to be persistent and competitive with native plants and animals. Often these species are successful because the climate is similar to that from which they originated and when introduced into a new area they no longer have natural pests and competitors that may have limited them in their original location. These are known as invasive species.

Invasive plant species can contribute to loss of habitat for native wildlife and plant species. Some invasive plants outcompete natives and cause them to decline. This poses a considerable challenge for natural resource managers. Often these invasive plant species are difficult to control or eradicate. Prescribed fire, herbicide, mechanical removal, and other methods are commonly used to limit their impact on native species. In some instances biological control, such as an insect pest, may be used. Not only do 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 exotic species that are likely to become invasive.
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

Sericea lespedeza is no longer recommended as a wildlife planting because its invasive qualities have outpaced its benefits. Photo by James H. Miller, USDA-NRCS PLANTS Database.

Although white-tailed deer consume Japanese honeysuckle, its prolific growth quickly overtakes native plant species and other deer foods. Photo by Chuck Bargeron, University of Georgia, Bugwood.org.

Acknowledgements: All photos are by Craig Harper unless indicated otherwise.
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<th>Bobcat</th>
<th>Box turtle</th>
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<th>Elk</th>
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Definitions of Food Groups


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
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
cacti: plants adapted to dry conditions; often store water in leaves and other parts of the plant; usually have small leaves and thorns.
canopy cover: the amount of ground covered by the branches, leaves and stems of plants; can specify as herbaceous, shrub, tree or all canopy cover; expressed as a percentage
coastal plain: large, nearly level areas of land near ocean shores
conifer: usually refers to needleleaf trees that bear seeds in cones; examples include spruces, pines and firs
cover: vegetation and other land features that provide areas for wildlife to hide, sleep, feed and reproduce
decadent: declining in health and/or productivity
deciduous: plants that shed their leaves annually
decomposition: the natural break-down and decay of dead plant and animal material
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
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
ecosystem: the plant community along with the animal community together with soil, air, water, and sunlight
evergreen: plants that do not lose all their leaves at one time, including some conifers, but also many broadleaf trees and shrubs such as live oak and American holly
excavate: to make a cavity or hole
exclusion: keeping something out of an area
fertile: usually referring to soil high in available nutrients
fingerling: a small fish, especially up to one year of age
fluctuate: to vary, or rise and fall irregularly
forage: n. refers to the vegetation eaten by animals; v. to search for food
forest stand: a contiguous area of trees of similar species composition, age and structure that can managed as a unit
forb: broad-leaved herbaceous plant
fragmentation: the disruption of vegetation types either man-made or by natural processes. It is the process of dividing large areas of contiguous (similar) habitat into smaller isolated areas.
glean: to gather food in a systematic manner
ground litter: dead and decaying organic matter found on the ground such as leaves, branches and dead plants
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
insecticide: chemicals used to control insects
invertebrates: animals lacking a backbone; examples include insects, spiders, mollusks and crustaceans
irrigate: to water through diversion ditches and pipes
keystone species: plant or animal species with a disproportionate influence in its community relative to its abundance
legume: plants that bear seeds in a pod; examples include lespedezas, clovers, soybeans, peas and black locust
native: plant and animal species originating historically or migrating naturally to a particular region
nutrients: chemicals required for plants and animals to grow and exist
omnivore: an animals that eats both plant and animal material
perennial: plant species that grow from a root system that remains alive more than two years
phytoplankton: microscopic floating and suspended aquatic plants
plateau: an elevated, relatively level expanse of land; sometimes called tableland
point count: a census method commonly used to monitor relative abundance of songbirds
population: a group of individuals of the same species living in a given area that interact with each other
regenerate: to replace lost or damaged parts with new tissue
rejuvenate: to stimulate and return to good health and vigor
riparian: the area adjacent to and influenced by a water source such as a creek, stream, river, pond, lake, swamp or other wetland
savannah: 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
sedg: 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
silviculture: the process of tending and managing a forest; the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis.
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 grazeable portion of the year

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

succulent: having thick fleshy leaves that conserve moisture

terrain: referring to topography

thatch: accumulation of dead grass and leaves on the ground

transitional: the process of changing from one form to another

woody: referring to trees and shrubs

zooplankton: microscopic animals that float/swim in water
Interpreting Wildlife Habitat from Satellite Images
Junior and Senior Event

Objectives
Contestants will identify features and judge suitability of wildlife habitat using satellite images.

Overview
Different types of contest questions can be asked using satellite images. Contestants may be asked to identify a feature, such as a creek or power line. Contestants may be asked to identify which habitat is best suited for a particular wildlife species. Eligible wildlife species are those listed in the announced region. Junior contestants compare two satellite images and Senior contestants compare four satellite images to indicate the most suitable habitat for a certain wildlife species.

Features for identification may include: streams, rivers, ponds or lakes, dirt or gravel roads, paved roads, highways, buildings, ballparks, deciduous trees, coniferous trees, gravel or sand bars, row crop fields, rice fields, improved pastures, fence rows, mountains, bluffs, valleys, islands, utility right-of-ways, successional stages, habitat concepts (e.g., soft vs. hard edge), or any other feature found on a satellite image.

Contest Rules
1. Each contestant needs to bring pencils and a clipboard. The clipboard may be labeled for identification purposes, but no other writing is allowed.
2. Contestants will complete the scorecard individually. No talking is allowed.
3. Typically satellite images from the announced region will be judged.
4. Contestants have 30 minutes to answer questions and record information on the score sheet.
5. This event is worth one point for each correct answer (20 points maximum).

Scoring
This event is 20 points maximum.
Interpreting Wildlife Habitat from Satellite Images
SAMPLE JUNIOR SCORECARD
(Southeast Mixed and Coastal Plain Forest Species)

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<td>B. River</td>
<td>12. A B Black Bear</td>
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<tr>
<td>C. Pond or lake</td>
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<tr>
<td>D. Dirt or gravel road</td>
<td>13. A B Eastern Bluebird</td>
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<td>E. Highway</td>
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<td>G. Tree(s)</td>
<td>15. A B Prothonotary Warbler</td>
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<td>H. Gravel or sand bar</td>
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<td>I. Crop field</td>
<td>16. A B Wild Turkey</td>
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<td>J. Pasture (improved)</td>
<td>17. A B Northern Raccoon</td>
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Total Score (20 points maximum):__________
Interpreting Wildlife Habitat from Satellite Images
SAMPLE SENIOR SCORECARD
(Southeast Mixed and Outer Coastal Plain Forest Species)

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Total Score (20 points maximum):_________
**Interpreting Wildlife Habitat from Satellite Images**

*Study Guide*

**Overview**

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.
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** 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>
<thead>
<tr>
<th>Species</th>
<th>Satellite Image #</th>
<th>Best Habitat</th>
<th>Worst Habitat</th>
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<tbody>
<tr>
<td>American Kestrel</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Bluegill</td>
<td>1</td>
<td>4</td>
<td></td>
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<tr>
<td>Brown Thrasher</td>
<td>3</td>
<td>4</td>
<td></td>
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<tr>
<td>Eastern Bluebird</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Eastern Cottontail</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Eastern Gray Squirrel</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Mourning Dove</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Hairy Woodpecker</td>
<td>2</td>
<td>4</td>
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<tr>
<td>Northern Bobwhite</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Northern Raccoon</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Ovenbird</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>White-tailed Deer</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Wild Turkey</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Wood Duck</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
• **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.

- **Northern 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](http://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/).
Wildlife Management Practices
Junior Event

Objectives
Juniors work as a team to identify wildlife management practices which benefit selected wildlife species.

Overview
The team completes a chart (table) which lists regional wildlife management practices in rows and up to eight wildlife species in columns. Eligible wildlife species are from the announced region only. The team places an “X” in each box corresponding to a wildlife management practice for each species. For example, if Bluegill is the selected species, correct practices are: control non-native invasive vegetation, decrease harvest, fish or wildlife survey, increase harvest, manage disturbance, all the ponds practices, and water control structures.

The study guide for wildlife management practices provides descriptions of each practice. Another reference is the Species Descriptions in which beneficial wildlife management practices are listed for each species.

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. Juniors are basically replicating the chart for up to eight species selected by judges.

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. (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.)
7. Contestants will have 30 minutes to complete this event.

Scoring Wildlife Management Practices
All boxes are counted in the scoring. For example, for eastern deciduous forest, there are 200 possible correct answers because there are 25 wildlife management practices × 8 possible species on an answer sheet.

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.

Total Score = (total correct boxes / total possible correct answers) × 30
On-Site Recommendation of Wildlife Management Practices
Senior Event

Objectives
Seniors work individually to evaluate habitat and recommend wildlife management practices for selected wildlife species at a designated management site.

Overview
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 list 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 or written. 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 will 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. 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 one or even zero management practices were necessary for a particular species.

**Scoring Wildlife Management Practices**

**Participants are given credit for:**
- putting an “X” in the appropriate boxes; [**Note:** Keep in mind that during a contest, all “X’s” marked on the wildlife management practice chart may not be used, as the correct answers depend on the field condition sheet and the habitat conditions present on site at the time of the contest.] and
- leaving boxes blank where no “X” is indicated on the wildlife management practice chart. [That is, regardless of field conditions, boxes that are not marked on the wildlife management practice chart should never be marked during a contest because these practices have been determined inappropriate for that species and region.]

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

**Total Score** = \[
\frac{\text{total possible} - \text{total incorrect}}{\text{total possible}} \times 30
\]

All boxes are counted in the scoring. For example, for eastern deciduous forest, there are 200 possible correct answers because there are 25 wildlife management practices × 8 possible species on an answer sheet.
Wildlife Management Practices:
Eastern Deciduous Forest

<table>
<thead>
<tr>
<th>Wildlife Management Practices</th>
<th>Eastern Deciduous Forest Wildlife Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Non-Native Invasive Vegetation</td>
<td></td>
</tr>
<tr>
<td>Create Snags</td>
<td></td>
</tr>
<tr>
<td>Decrease Harvest</td>
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<tr>
<td>Delay Crop Harvest</td>
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<tr>
<td>Establish Field Buffers</td>
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<td>Establish Native Grasses &amp; Forbs</td>
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<tr>
<td>Fish or Wildlife Survey</td>
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<tr>
<td>Forest Management Techniques</td>
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<tr>
<td>Increase Harvest</td>
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<td>Leave Grain Unharvested</td>
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<tr>
<td>Manage Disturbance</td>
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<tr>
<td>Nesting Structures</td>
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<tr>
<td>Plant / Manage Food Plots</td>
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<td>Plant Shrubs</td>
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<td>Plant Trees</td>
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<td>Ponds: Construction</td>
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<td>Ponds: Deepen Edges</td>
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<tr>
<td>Ponds: Fertilize / Lime</td>
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<tr>
<td>Ponds: Reduce Turbidity</td>
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<td>Ponds: Repair Spillway / Levee</td>
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<td>Ponds: Restock</td>
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<td>Streams: Dams, Boulders or Logs</td>
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<td>Tillage Management</td>
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<td>Water Control Structures</td>
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<td>Water Developments for Wildlife</td>
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<td>Wildlife Damage Management</td>
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Number Correct

Total Correct: _________

138

### Wildlife Management Practices

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<td>Control Non-Native Invasive Vegetation</td>
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Wildlife Management Practices
Study Guide

In this section, various practices used to manage wildlife and their habitat are described in further detail. They are listed in alphabetical order. The descriptions are brief and general and are not meant to be comprehensive.

Identify and learn the practices recommended for the species listed in the regions you are studying. When preparing for a competitive event, it is only necessary to learn information pertaining to the wildlife management practices appropriate for the species included in the region that will be used in the event. Several practices are commonly used in certain regions, but not in others. It is always wise to learn as much as possible from other resources to help you better understand these practices and their effect on wildlife and habitat.

- 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. **Landowner objectives should determine which practices you recommend.**

- Some practices may not be applied in all regions, even though you may be dealing with the same species. For example, *Plant Trees* is not appropriate for Northern bobwhite in the Eastern deciduous forest or Grassland: Tallgrass/Mixed Prairie, but it may be in Southeastern Mixed and Outer Coastal Plain where planting oaks along riparian buffers would improve habitat.

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.

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Delay Crop Harvest
Establish Field Buffers
Establish Native Grasses and Forbs
Fish or Wildlife Survey
Forest Management Techniques
Increase Harvest
Leave Grain Unharvested
Manage disturbance
Mowing (Urban Region only)
Nesting Structures
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Plant / Manage Food Plots
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Ponds: Construction
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Watershed
Ponds: Repair Spillway/Levee
Ponds: Restock
Streams: Dams, Boulders or Logs
Tillage Management
Water Control Structures
Water Developments for Wildlife
Wildlife Damage Management
Artificial Feeders

General description
Artificial feeders are used primarily to feed songbirds and butterflies for viewing purposes. A wide variety of feeder designs, methods and foods are available. Most bird species prefer black-oil sunflower seeds and white proso millet. Species such as hairy woodpecker prefer to eat suet (fat) rather than seeds. Some species such as mourning dove and song sparrow, prefer to eat on the ground than on an elevated feeder.

It must be noted that artificial feeders can be hazardous to birds. Because feeders draw birds close together, disease transmission becomes problematic. Salmonellosis, aspergillosis and mycoplasmal conjunctivitis are fatal diseases among songbirds and are readily transmitted at heavily used bird feeders. It is imperative to clean feeders regularly with hot soapy water and a mild bleach solution.

In addition, feeders pose danger via non-native predators, specifically house cats. Although house cats may be fed, they still hunt and kill millions of birds and small mammals each year. It is irresponsible to own a cat and leave it outside because of the unnatural pressure they put on native wildlife. Feral cats should be reported to local animal control officials, removed from the area and euthanized.

Effect of practice
• Provides supplemental food source, primarily for viewing purposes.

Backyards can be arranged in various shapes and with various plantings and nest boxes so that they are more attractive and useful for wildlife. 
*Photo by Craig Harper.*
Control Non-Native Invasive Vegetation

General description
Non-native 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 non-native 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 non-native plants out-compete native species for sunlight and nutrients and exclude them from a particular site or area. This in turn, has been detrimental for several wildlife species. Many non-native 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 non-native invasive species.

Examples of invasive, non-native plant species to control are:
- 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: alligator weed, purple loosestrife, phragmites, hydrilla, water hyacinth, Eurasian watermilfoil, reed canarygrass.

Without management, non-native invasive species continue to spread, limit plant species diversity and degrade wildlife habitat. Most often, herbicide applications are necessary to control non-native invasive species. Some species can be controlled by hand-pulling or mechanical techniques. Of course, non-native invasive species should never be planted.

There are few properties in the country that do not contain any non-native species. When evaluating an area for this contest, consider the impact non-native species are having on the native plant community and associated wildlife.

Note: When recommending this practice specifically to control non-native invasive plant species, Manage Disturbance should not be selected unless succession needs to be altered as well. Then, both practices should be selected.

Effect on habitat
- Killing non-native species (whether trees, shrubs, vines, grasses or forbs) where they limit growth of native species can improve available cover and forage for many wildlife species.
- Controlling non-native invasive species often leads to increased plant species diversity.
- Eliminating non-native 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.
- Killing non-native trees and shrubs can increase space for desirable tree and shrub species, which can lead to increased mast production.
Non-native perennial cool-season grasses, such as this tall fescue, provide little habitat for wildlife. Eradicating these undesirable grasses will help improve early successional habitat more than any other practice. *Photo by John Gruchy.*
Create Snags

General description
Snags are standing dead trees. They provide cavities used by many birds and mammals. In forested areas, snags and down woody material are usually available.

Where snags are not available and when managing for species that use snags and down woody material, it may be desirable to create some snags 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 herbicide to the wound.

Effect on habitat
• Snags provide roosting and perching sites for many bird species.
• Snags provide woodpeckers with sites for cavity construction. Later, other species (such as bluebirds, owls and wood ducks) may use these cavities for nesting and roosting.
• Snags provide foraging sites for many species of wildlife. Insects living in snags and down woody material are a food source for woodpeckers and other wildlife species.

Snags can be created by girdling the tree and spraying the wound with the appropriate herbicide. When trees die, additional sunlight enters the stand and stimulates groundcover. Photo by Dwayne Elmore.
Decrease Harvest

General description
It is the responsibility of state and federal wildlife agencies to set hunting, trapping, and fishing seasons and bag and creel limits. However, landowners can choose to take the maximum allowed or less than that, depending on personal management objectives.

Bass
Needed when seine samples and fishing records of a pond reveal:
• no recent bluegill hatch
• many medium-sized bluegill in poor condition
• bass are few in number, but large and in good condition

Bluegill
Needed when seine samples and fishing records of a pond reveal:
• many recently hatched bluegill
• very few medium-sized bluegill
• bass less than one pound and in poor condition
• no young bass

Trout
Needed when seine and fishing records of a pond reveal:
• fish in good condition
• few medium- and large-sized fish
• many small fish

Game birds and mammals
Regulated hunting and trapping is a primary tool used to keep several game species within the carrying capacity of available habitat. This is obviously true for species that have relatively few natural predators in a given area or region such as white-tailed deer. However, it may be necessary to decrease harvest levels for other species such as Northern bobwhite and greater prairie-chicken, or when harvest data and/or observation data indicate species populations are declining in areas with good habitat and where hunting pressure has been excessive. It is important to realize decreasing regulated hunting and trapping opportunities and harvest levels are seldom the reason for declining wildlife populations. Relatively low or declining wildlife populations are almost always a result of poor habitat, whether as a result of existing site quality or degradation and/or destruction of habitat quality in the surrounding area.
Delay Crop Harvest

General description
When landowners have an interest in wildlife, it may be beneficial to avoid harvesting crops or hay during nesting and fawning seasons to reduce nest destruction and mortality. It is important to note crop yield and quality are often reduced dramatically when harvest is delayed. This is especially true when hay harvest is delayed until seedheads form. A much more important consideration than delaying crop harvest is making sure adequate usable space is available across the property for the focal wildlife species. This may mean reducing the acreage cropped or hayed to increase acreage available for wildlife.

Note: this practice should be recommended only when a hay- or row-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 most songbirds are most vulnerable, can help maintain a sustainable population or population increase.

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 does not appreciably reduce yield. Photo by Blake Brown.
**Establish Field Buffers**

**General description**
Field buffers are strips of grasses and forbs around crop fields. These strips are designed to trap sedimentation and nutrient run-off. They also can provide excellent nesting, brooding and escape cover for many wildlife species. Field buffers should be a minimum of 30 feet wide, but wider is better. Field buffers up to 120 feet wide are highly desirable and recommended to provide adequate usable space for wildlife dependent upon early successional habitat. Where wildlife is considered, field buffers should be composed of native grasses and forbs, which may be planted or allowed to establish naturally from the seedbank. Scattered brambles and shrubs may also be used and are highly beneficial for several wildlife species.

**Note:** *Establish Native Grasses and Forbs and/or Plant Shrubs* should *not* be recommended in order to *Establish Field Buffers*. However, if there are existing field buffers of undesirable non-native species, *Control Non-Native Invasive Vegetation* should be recommended. Only recommend additional field buffers if there are crop fields without buffers or additional buffers are needed around a field. This practice is recommended for row crops only (especially soybeans and grain crops). It should *not* be recommended around hay fields.

**Effect on habitat**
- Can prevent sedimentation and nutrient run-off
- 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

Field buffers around crop fields provide increased usable space for species that require early successional cover. Field buffers don’t have to be planted. Here, broomsedge and blackberry have established from the seedbank. *Photo by Craig Harper.*
Establish Native Grasses and Forbs

General description
Native grasses and forbs are recommended primarily to increase or enhance early successional habitat for a number of wildlife species. Non-native grasses (such as tall fescue and bermudagrass) are not recommended for wildlife because they do not provide suitable habitat structure for most wildlife, and their competitive nature often prevents native grasses and forbs from becoming established. Warm-season grasses and forbs grow primarily during late spring and summer. Cool-season grasses and forbs make primary growth in the spring and fall and often go dormant during the summer depending on weather conditions.

Native grasses and forbs can be planted, or they can be established by killing existing non-native cover with selective herbicides and allowing native seed lying dormant in the seedbank to germinate. Note: If native grasses and forbs are planted, it is imperative to eradicate undesirable non-native grasses and forbs prior to planting. This will require herbicide applications. In this situation, you should also recommend Control Non-native Invasive Vegetation.

Early successional habitat is required by many wildlife species that do not use woods such as Northern bobwhite, grasshopper sparrow and dickcissel. Additional early successional habitat is particularly needed for those species and others in areas that are predominately forested and where the majority of existing early successional habitat is dominated by non-native species. The amount of early successional habitat required is dependent on the focal species. Some species such as Eastern cottontails, will use and thrive in relatively small areas of early successional habitat, while other species such as elk require acres of native grasses and forbs.

Early successional habitat must be maintained. Prescribed fire, diskling and grazing are recommended to prevent deterioration of the vegetative structure through litter buildup and excessive woody plant succession. It is a good idea to burn, disk, or graze a different area each year to provide a diversity of plant structure and composition across the property to serve the different needs of wildlife dependant upon early successional habitat. Usually burning and diskling are conducted just prior to spring green-up or in late summer/early fall, so nests and young wildlife are not disturbed. Ideally, early successional habitat should not be mowed.

Examples of desirable native plants are:
- warm-season grasses: bluestems, switchgrass, sideoats grama, indiangrass
- native cool-season grasses: wildryes, low panicgrasses
- forbs and brambles: ragweed, pokeweed, blackberry, dewberry, native lespedezas, beggar’s-lice, old-field aster, partridge pea, perennial sunflowers and crotons

Examples of undesirable non-native plants are:
- warm-season grasses: bermudagrass, cogongrass, johnsongrass, crabgrass, dallisgrass, goosegrass
- cool-season grasses: tall fescue, bermudagrass, bahiagrass, orchardgrass, and bromegrasses
- forbs and brambles: sericea lespedeza, curly dock, spotted knapweed, sicklepod and cocklebur
Effect on habitat

- Native grasses and forbs provide nesting, bedding, roosting and/or escape cover for several songbird species, bobwhites, wild turkeys, cottontails and other small mammals as well as white-tailed deer. These areas are also important for predators such as hawks, owls, coyotes and others.
- Ground-nesting birds usually build their nests at the base of a native grass bunch/clump.
- Although some wildlife such as elk readily eat native grasses, forbs provide a greater food source for more species. Not only is the foliage of forbs eaten, but the seed produced by many forbs such as native lespedezas, ragweed, sunflowers and pokeweed is a most important food source for many birds and mammals. Forbs also provide optimal cover for brooding quail and wild turkeys.
- Areas burned or disked during the previous year provide an open structure at ground level, which is desirable for young quail and turkeys as they can walk about easily between the bunches of grasses and under the canopy of forbs, eating insects and other invertebrates and gleaning seed of various forbs off the ground.
- Areas burned or disked at least two years previously provide dead, dry vegetative material that birds use for building nests.
- Native grasses and forbs can be used to develop a riparian buffer. Riparian buffers are important for protecting water quality and can provide excellent cover and travel corridors for wildlife as well. The recommended width is 100 feet, but width may vary with size and order of the stream, as well as topography and landowner objectives.

Native grasses and forbs can be promoted for additional early successional habitat. Here, big and little bluestem and Indiangrass complement the blackberry, beggar’s-lice, partridge pea, pokeweed, and various asters growing on the site. *Photo by Craig Harper.*

Ideally, early successional habitat should be managed with prescribed fire. If prescribed fire is not possible, disking and selective herbicides are the best alternatives. Mowing is the least desirable management practice and should be avoided if possible. *Photo by Craig Harper.*
Fish or Wildlife Survey

General description

Fish surveys
Population balance is first established in ponds by stocking the correct number of fish. After the first year, pond balance should be checked during early summer by seining at intervals around the pond. Four to five seine sweeps in an average pond is usually enough. Balance is determined by comparing age groups, condition and numbers of bass and bluegill caught in the seine and from fishing records. Recent reproduction of both bass and bluegill in the seine indicate the fish population is balanced. Fish caught by hook-and-line can be evaluated on body condition (fat, skinny, size of head in relation to body, etc.). Trout do not often reproduce in ponds, so overall health of the fish is used as an indicator of pond balance. Unwanted species (bullheads, crappie, etc.) may also 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 fishing or are electro-shocked. 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.

Wildlife surveys
Monitoring wildlife for trends of increasing or decreasing populations or body weights is important for wildlife managers. Data on bats, white-tailed deer, black bear, wild turkeys, bobwhite quail, mourning doves, and many songbirds are routinely collected by wildlife biologists using infrared cameras, roadside counts, call counts, check stations, transects, capture netting and hunter questionnaires. These data are used to prescribe future harvest or land management strategies.

Note: While fish and wildlife surveys are always important, they should not be recommended if it is stated or the field condition sheet indicates a survey has been completed recently.

Effect on habitat
Understanding the number of wildlife species in an area and consideration of landowner objectives is important for determining which habitat practices to apply and where. For overabundant species, a fish or wildlife survey may indicate the need to increase harvest when exceeding carrying capacity. Habitat typically is poor in areas with overabundant fish or wildlife and can affect other species. For example, if deer consume all plant material within reach, other wildlife species requiring forest understory will be affected. A pond in which most zooplankton is consumed would change the species composition in that closed system. For less common species, a wildlife or fish survey could help identify where these species are thriving, so the manager can avoid applying management practices which may inadvertently lower their populations in these areas.
Placing multiple infrared-triggered cameras along wildlife pathways on a property have been used to roughly estimate populations of several wildlife species. Because of the mobility of some species and lack of distinguishing features, such surveys often do not hold up to scientific standards. However, such surveys may provide a local index of species.

When conducting a survey for white-tailed deer, corn is often used to bait deer in front of cameras in late summer or late winter when the quality or quantity of natural foods is relatively low.

This helps ensure a majority of the deer using the area are photographed and included in the survey. 
*Photo by Craig Harper.*
**Forest Management Techniques**

**General description**

Forests can be managed by harvesting stands and allowing a new stand to develop (regenerating the stand), or by manipulating the existing stand through partial cuts or thinning (timber stand improvement). Managing forests for the appropriate structure and species composition is absolutely crucial when managing wildlife that use forested habitat.

**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. Silviculture is the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis. Pines are often planted after harvest to establish a new stand. Hardwood stands are almost always regenerated naturally and not planted.

Stand age and health, as well as landowner objectives, determine when a stand should be regenerated. Harvesting the trees allows additional sunlight into the forest, which stimulates seedling germination and growth. Thus, a young forest is established. This process changes the structure of the forest and the composition of plants growing in the forest understory. Some wildlife species benefit from these changes, while others do not. For example, rabbits and bobwhites readily use the cover and food resources provided in a recently clearcut stand of mixed hardwoods, while Eastern gray squirrels that were using that stand prior to harvest would have to move to an adjacent 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 that regenerating stands be well dispersed across the area being managed.

**Note:** Forest regeneration should be recommended as a silvicultural tool to regenerate stands and provide young forest cover— not to create “openings” or early successional habitat. Regenerated forests result in new forests, not openings. Where additional early successional habitat is needed, and the area is currently forested, Forest Regeneration should not be recommended automatically. Instead, Manipulation of Succession (chainsawing) and Establish Native Forbs and Grasses should be recommended.

The regeneration method recommended depends upon forest type and composition, site quality, and landowner objectives. Following are types of forest regeneration methods:

- **Clearcut** regeneration method harvests all the trees in the stand. More sunlight is allowed into the forest floor with this method than with any other. Clearcutting generally releases shade intolerant species (such as yellow poplar, black cherry, basswood) when present.

- **Shelterwood** regeneration method removes a pre-determined number of trees from the stand to allow development of seedlings (regeneration) from beneath. Later (usually 6 to 8
years), the remaining overstory (shelterwood) is removed as the regeneration becomes developed.

- **Seed-tree** regeneration method leaves a few good seed-producing stems per acre to regenerate a new stand. This method is often used in pines and other species with lightweight, wind-carried seed. The seed trees are usually harvested after the crop of new trees becomes established.

- **Group selection** regeneration method harvests small groups of trees (no more than 2 acres) within a stand. This method creates more diverse structure within the stand and generally does not allow as much light into the stand, which can allow both shade-tolerant and shade-intolerant trees to regenerate.

- **Single-tree selection** regeneration method harvests only select, individual trees out of the stand, not groups of trees. This method can create a diverse structure with small gaps in the forest canopy. This method generally regenerates shade-tolerant species in closed-canopy forests and is not applicable in all regions.

Regardless of regeneration method used, it is important to make sure food, cover, and water for certain wildlife species are always in close proximity. Typically, regenerated stands should be adjacent to more developed stands to provide travel corridors and space for wildlife that do not use young stands. Also, whenever stands are harvested, it is important to leave standing dead trees (snags) for wildlife that might use them. Where snags are not available and when managing for species that use snags and down woody material, it may be desirable to create some snags when the stand is harvested 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 herbicide to the wound.

**Effect on Habitat**

- Harvesting timber generally sets back succession and produces new forest growth with greater stem density, which provides nesting and escape cover for several wildlife species.
- Clearcut, shelterwood, and seed-tree revert Stage 6 to Stage 5 with an abundance of herbaceous plants persisting until 5 or 6 years post-harvest when they are shaded out by the developing trees. During this time, forage and soft mast may be increased considerably.
- Group selection and single-tree selection maintains the structure of Stage 6, but an increase in understory growth will enhance nesting structure for some species and provide additional forage and soft mast.
- Enhances cover for many prey species, which provides food for predators. Retaining snags and cavity trees when harvesting trees provides nesting, roosting, denning and perching sites.
- The tops and slash of harvested trees remaining on the site provide what is called down 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 critical for ecological function. From a wildlife perspective, several reptiles and amphibians live in and under the decaying logs. Many small mammals also nest and den in and under decaying logs. Birds such as wild turkeys and ruffed grouse commonly nest adjacent to the brushy material and logs left behind, which

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Not all trees are harvested initially when using the shelterwood method. This allows managers to leave trees that might provide an important food source, such as oaks, blackgum, black cherry, persimmon, and others. This is a very important consideration when managing for wildlife that eat acorns and other mast. *Photo by Craig Harper.*

**Clearcutting** removes all the overstory trees in a stand. This allows full sunlight onto the site. Natural regeneration is immediate. This 2-year-old mixed hardwood-pine forest provides food and cover for species such as black bear, bobcat, brown thrasher, Eastern cottontail, great horned owl, white-tailed deer, wild turkey, and others. *Photo by Craig Harper.*

The **seed-tree** method is most often used with pines. Scattered trees are left standing after the initial harvest. Wind scatters seed from these remaining trees across the harvested area and new pines establish naturally. During the process, early successional habitat is provided as the new stand develops. *Photo by Craig Harper.*
Standing dead trees (snags) should be left when practicing forest management to provide cavities and perches for various wildlife species. Where additional snags are needed, Create Snags should be recommended.

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. Photo by Dwayne Elmore.

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.
Timber Stand Improvement (TSI)
TSI may involve any of several techniques used to improve the quality and composition of forest stands by shifting resources (sunlight and nutrients) toward production of desired products, which include timber and/or wildlife. TSI most often involves some type of thinning, which reduces stand density to influence stand growth. Thinnings may be pre-commercial or commercial. Pre-commercial thinnings are conducted before the trees have sale value. Commercial thinnings involve removing at least part of the trees for a useful product. Removing trees increases the amount of sunlight entering the forest canopy and is used to promote increased growth of the remaining trees through changes in stand composition and structure (cover) in the understory and midstory to favor food-producing plants, both woody and herbaceous.

Effect on habitat
• Increased herbaceous growth in the understory enhances brooding cover and provides additional forage, browse and soft mast.
• Increased woody stem density in the midstory improves cover for some species such as ruffed grouse.
• When adjacent competing trees are removed, trees retained following TSI are able to grow larger crowns and produce additional mast.
• Down logs and other woody debris left following TSI provide sites for feeding, denning, drumming, reproducing, hiding and resting for several species.

Timber stand improvement (TSI) can be implemented to remove undesirable tree species and increase growth of selected trees that remain in the stand. By allowing additional sunlight into the stand, groundcover is stimulated, providing additional cover and food resources in the stand which can be maintained with fire. *Photo by Craig Harper.*
Increase Harvest

General description
It is the responsibility of state and federal wildlife agencies to set hunting, trapping, and fishing seasons with bag and creel limits. Within that limit, landowners can choose to take the maximum allowed if necessary to meet management objectives.

Bass
Needed when seine samples and fishing records of pond reveal:
• many recently hatched bluegill
• very few medium-sized bluegill
• bass less than one pound and in poor condition
• few or no young bass; increase bass harvest cautiously; target bass less than one pound and spread the harvest over the summer

Bluegill
Needed when seine samples and fishing records of pond reveal:
• no recent bluegill hatch
• many medium-sized bluegill in poor condition
• bass are few, large and in good condition
• target medium-sized bluegill, using seine harvest or shoreline rotenone

Trout
Needed when seine or fish records reveal:
• many fish, small and in poor condition
• in many areas, extremely cold water reduces trout growth; in these situations, harvesting more may not be beneficial

Game birds and mammals
Increasing harvest is 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 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. Photo by Craig Harper.
Leave Grain Unharvested

**General description**
Strips or blocks of grain or other crops (such as soybeans) can be left unharvested. This is especially valuable if the strips are left adjacent to cover. This practice should be recommended only if there is an unharvested agricultural crop present. It is not applicable to food plots which may have grain plants grown in them.

**Effect on habitat**
Provides additional food resource, which can be particularly important when naturally occurring foods are in low supply and/or in years with poor acorn production.

By leaving strips or blocks of grain unharvested, additional food is available for wildlife. This can be an important consideration, especially in areas where winters are harsh. *Photo by Craig Harper.*
**Manage Disturbance**

**General description**
Succession is the orderly and predictable series of changes in plant species composition through time and occurs in all natural communities. Wildlife habitat is most often managed by setting back succession in an effort to retain the successional stage(s) beneficial for the focal wildlife species. There are essentially four general methods for manipulating succession and by managing disturbance:

(1) mechanical methods, which includes disking, chainsawing/feller-bunchering, chaining/roller beating, and mowing/mulching
(2) fire (prescribed burn)
(3) grazing management
(4) herbicide applications

Each of these may be applicable for manipulating succession in any region for various species, but they may not produce the same effect. One or more may be recommended over another depending on the situation. In some instances, more than one method may be applied.

**Seniors** - for the written and oral segments of the contest, the recommended methods for manipulating succession should be specified and reasons given as to why they are recommended.

**(1) Mechanical methods**

**Disking**
Disking sets back succession by mixing the upper soil layer and incorporating organic material into the soil, facilitating decomposition and stimulating the seedbank. Disking is a relatively inexpensive and effective practice for reducing grass coverage, encouraging germination and growth of forbs and exposing bare ground. Areas in Stages 2, 3 and 4 (depending on size and height of shrub cover) can be disked to maintain/promote growth of annual and perennial forbs and grasses. Disking should be performed on a rotational basis, usually in winter. In planted pines, disking can be used in Stages 5 and 6 to reduce unwanted woody stems and encourage herbaceous growth. Similar to controlled burning, timing of disking and disking intensity influence vegetation composition and structure. Disking should be used instead of mowing when and where possible and should be used where burning is not possible. While disking is often used to create firebreaks to facilitate controlled burning, it should not be recommended in order to burn. Disking should not be prescribed for dominated by perennial non-native grasses (such as tall fescue and bermudagrass). Instead, Control Non-native Invasive Vegetation should be recommended for those areas.

**Effect on habitat**
- In Stages 2 and 3, maintains herbaceous vegetation.
- Promotes fresh herbaceous growth and enhances forage availability for many wildlife species.
- In Stages 3 and 4, reverts succession to Stage 2.
**Disking** sets back succession, facilitates decomposition, provides bare ground, and stimulates the seedbank, encouraging early successional species. *Photo by Craig Harper.*

**Chainsawing / Feller-bunchering**
A chainsaw or feller-buncher may be used to kill and/or remove trees in forests, savannahs and woodlands where trees are not needed or where additional areas of early succession are needed for the focal wildlife species.

**Note:** Implementing this practice implies that once the trees are removed, the area is to be managed in something other than trees such as native forbs and grasses and forbs or food plots. Do not recommend Forest Management to achieve this management goal. If an additional practice is intended, such as Establish Native Grasses and Forbs or Plant/Manage Food Plots, it should be recommended as well.

**Effect on habitat**
- Reduces tree density and encourages early successional plant communities.

Where additional early successional habitat is needed in wooded areas, but forest management is not desired or an option, trees may be cleared using a chainsaw. On this property, trees were cut, not harvested, and the site has been burned every 2 years to maintain early succession. *Photo by Craig Harper.*

**Chaining / Roller Beating**
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. Roller beating (drum-chopping) involves bulldozers pulling a roller with large, sharp metal blades to knock down and chop large shrubs and small trees. Roller beating is an alternative to chaining and has almost
the same effect on vegetation. Both techniques are used where rugged terrain, rocks or large shrubs prevent the use of a mower. This practice is not used to manipulate understory vegetation in woodlands or savannas. Soil compaction is a concern and can be a problem when using bulldozers in certain regions. Prescribed fire is the preferred method to set back succession and maintain the desired vegetative composition and structure.

**Effect on habitat**
- Helps remove competition of some kinds of shrubs, allowing grasses and forbs to grow better. Woody growth however, usually readily resprouts following chaining or roller beating.
- Helps maintain succession in Stage 4; encourages resprouting.
- In Stage 5, reverts succession to Stage 4.

**Mowing / Mulching**
Mowing is most often accomplished with a large rotary mower mounted behind a tractor. Sometimes, a mulching machine is used to mow large shrubs and small trees. To avoid disrupting nesting birds and destroying reproductive cover or winter cover, mowing should not be conducted until late winter/early spring. When used to manage fields or other early succession habitat, mowing should be conducted only when it is apparent that undesirable woody species are encroaching in the field. In other words, mowing grassy fields is unnecessary. Mowing and mulching machines are often not desirable because they create 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 and disking should be implemented instead of mowing or mulching.

**Effect on habitat**
- Helps maintain Stage 3 or 4.
- Helps remove competition from some kinds of shrubs, allowing grasses and forbs to grow better. Maintains low shrub growth with certain species of shrubs by encouraging resprouting.
- In Stage 3 and 4, helps rejuvenate grasses, forbs and shrubs, which improves nesting cover for some bird species.
• Causes thatch build-up, which reduces availability of invertebrates and seed to young quail, grouse, 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.

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. Photo by Todd Black.

(2) Fire (Prescribed Burning)
Prescribed fire can be the most effective and efficient method for managing succession. Prescribed fire is recommended to maintain Stages 2 through 4 and to influence understory composition and structure within Stages 5 and 6. Prescribed fire should be used to manage early successional habitat instead of mowing or mulching wherever burning is possible.

Timing, intensity and frequency of fire strongly influence vegetation composition and structure. Burning in late summer/early fall tends to reduce woody composition more than burning in winter/spring. Low-intensity fire is recommended to prevent damaging trees when burning a forest understory. Like other methods, fire only sets back succession temporarily. With the exception of intense fire, more frequent burning over time, will change vegetation composition more so than less frequent burning. For example, in the south, an area burned every 1 to 2 years will eventually be dominated by annual and perennial herbaceous vegetation. Where there is adequate rainfall, if that same area is burned every 3 to 5 years, considerable woody cover will be present. If burned every 5 to 10 years, the site will be dominated by woody species. Intensity and timing of fire will dictate whether woody species are killed or if only the leaf litter is consumed.

Although a very beneficial practice, prescribed burning may not be 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 prescribed fire.
Effect on Habitat
- Reduces litter layer (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.
- Releases nutrients into the soil.
- Burning during the dormant season does not significantly alter vegetation composition. Small woody stems may be top-killed, but usually resprout.
- Burning during the late growing season more effectively kills woody stems and may reduce density of native warm-season grasses and encourage additional forb cover.

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. While fire intensity and season of burning influence fire effects, fire frequency is the most important consideration. *Photo by Craig Harper.*

(3) Grazing Management
Livestock and wildlife grazing must be managed to enhance wildlife habitat. This practice should be recommended when evidence of livestock is present (e.g., fencing, manure) or information on livestock use is given.

Grazing management may be used to exclude livestock from sensitive areas or to manage disturbance to benefit wildlife by adjusting stocking rate, season of use or grazing system.

Livestock may be used to manipulate the height and structure of native warm-season grasses to enhance wildlife habitat.

Grazing should not be used to manipulate non-native forage pasture (such as tall fescue, orchardgrass, bermudagrass) for wildlife because these grasses are detrimental to wildlife, displacing otherwise suitable habitat.

Livestock distribution can be controlled with fencing, herding or fire. Regardless of pasture type, proper stocking rate must be practiced to prevent improper grazing. The term improper grazing is used to describe livestock grazing that fails to meet land objectives such as soil conservation, plant species diversity, maintenance of wildlife habitat and adequate livestock nutrition.
Effect on habitat
• Stocking rate, which is the amount of land allotted to each animal for the entire grazable portion of the year, is the most important consideration concerning livestock grazing management.
• Proper stocking rate and/or rotational grazing can be used to alter the vegetation structure and composition to favor wildlife.
• Restricting livestock from riparian areas may improve habitat structure and composition for many wildlife species. Fencing can help reduce siltation, turbidity and stream bank erosion, while reducing stream and pond pollution from livestock wastes.

Stocking rate greatly influences the vegetation composition and the resulting structure. The forest on the left was grazed and the forest on the right was ungrazed. Less forbs and other understory plants are available to wildlife where cattle were allowed to graze. Photo courtesy www.forestryimages.org.

(4) Herbicide Applications
Herbicides are often applied to control undesirable vegetation and encourage plants that are more desirable for wildlife.

Effect on habitat
• In some areas, hardwood brush reduces vegetative diversity and limits many plants important for wildlife. Proper herbicide applications control unwanted woody growth and encourage more herbaceous groundcover.
• May be used to revert Stages 4 or 5 to Stages 2 or 3

Herbicide applications can set back succession and are often necessary to control non-native invasive vegetation. Selective herbicide applications, as shown here, can be used instead of mowing and help to transition plant species composition toward more favorable species by killing undesirable species. Photo by Craig Harper.
The “hack and squirt” method is used to remove unwanted woody vegetation. After slicing the trunk, herbicide is applied to the opening. *Photo courtesy of Utah State University, www.forestryimages.com*
Mowing (Urban region only)

General description
Mowing with a push or riding lawnmower can maintain early successional habitat in urban areas. Lawns and park-like settings are the most often mowed areas. Mowing is usually the only practice for managing early successional habitat in urban areas as burning is typically not allowed, and chaining/roller beating, diskimg, and grazing are not practical. Many wildlife species inhabiting urban areas require early successional habitat interspersed with shrub and forest for foraging purposes and travel corridors.

Effect on Habitat
• Mowing keeps succession in Stages 2 or 3.
• Wide expanses of mowed areas may not provide adequate cover for wildlife, therefore it is important to leave some areas unmowed or provide cover using islands of shrubs and flowers.
Nesting Structures

General description
Some species den, nest and/or roost in cavities they don’t excavate themselves (such as bluebirds and wood ducks). If natural cavities are not available, artificial cavities (nest boxes) can be used.

Many species prefer a certain kind of cavity (particular 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.

Birds or mammals which use tree cavities prefer enclosed boxes. Recommended nest/den box dimensions for species in this contest are indicated in the table below. Some birds nest on more open platforms or shelves, such as the American robin. These platforms or shelves have a roof and floor, but are only partially enclosed on the sides. A cone-shaped nest basket can be fashioned from hardware cloth for mourning doves. Canada geese will nest in washtubs or platforms anchored over water.

It is not necessary to memorize these nest dimensions for the competition; however, a general knowledge of their appearance and relative sizes could be helpful when competing in Wildlife Practices, Wildlife Identification and Wildlife Management Plan.

<table>
<thead>
<tr>
<th>Species</th>
<th>Floor space (inches)</th>
<th>Height of box (inches)</th>
<th>Entrance hole diameter (inches)</th>
<th>Hole height above floor (inches)</th>
<th>Mounting height above ground (feet)</th>
<th>Location tips</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Kestrel</td>
<td>8” x 8”</td>
<td>12” – 15”</td>
<td>3”</td>
<td>9” – 12”</td>
<td>10’ – 30’</td>
<td>Open habitats, including meadows, grasslands, parkland, agricultural fields, urban and suburban areas</td>
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<tr>
<td>Big Brown Bat</td>
<td>See <em>Bats In and Around Your Home (FSA9088), University of Arkansas</em></td>
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<tr>
<td>Eastern bluebird</td>
<td>4” x 4” or 5” x 5”</td>
<td>8” – 10”</td>
<td>1 ½”</td>
<td>6” – 9”</td>
<td>5’ – 10’</td>
<td>Open areas in the sun, pastures, fields or golf courses</td>
</tr>
<tr>
<td>Eastern Gray Squirrel</td>
<td>9” x 9”</td>
<td>20”</td>
<td>3” on side of box close to tree trunk</td>
<td>16”</td>
<td>20 – 25’</td>
<td>Young to mature woodlands</td>
</tr>
<tr>
<td>Hairy Woodpecker</td>
<td>6” x 6”</td>
<td>12” – 15”</td>
<td>1 1/2”</td>
<td>9” – 12”</td>
<td>8’ – 20’</td>
<td>Open country, farms and park-like woodlands</td>
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<tr>
<td>Place 1” - 2” Sawdust in bottom of box</td>
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<tr>
<td>House Wren</td>
<td>4” x 4”</td>
<td>6” – 10”</td>
<td>1 1/8” – 1 ¼”</td>
<td>4” – 6”</td>
<td>5’ – 10’</td>
<td>Backyards near buildings</td>
</tr>
<tr>
<td>Species</td>
<td>Floor space (inches)</td>
<td>Height of box (inches)</td>
<td>Entrance hole diameter (inches)</td>
<td>Hole height above floor (inches)</td>
<td>Mounting height above ground (feet)</td>
<td>Location tips</td>
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<tr>
<td>Northern Flicker</td>
<td>7” x 7”</td>
<td>16” – 18”</td>
<td>2 ½”</td>
<td>14” - 19”</td>
<td>6’ – 20’</td>
<td>Open areas with perennial forbs and grasses</td>
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<tr>
<td>Wood Duck</td>
<td>10” x 18” or 10” - 24”</td>
<td>10” - 24”</td>
<td>3” x 4” oval</td>
<td>12” - 18”</td>
<td>3’ - 6’ above water in wooded swamp or 6’ – 30’ elsewhere</td>
<td>Mature woodlands adjacent to flooded woodlands, ponds or open marshlands</td>
</tr>
</tbody>
</table>

Note: Nesting structures for Canada geese are not recommended in areas where resident Canada geese have become too numerous and are a nuisance. This is also true for any other species indicated as being a nuisance at the contest.

Effect on habitat

- In open areas (Stages 2, 3 and 4) 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.
- Near water sources, nesting structures provide secure nesting sites for wood ducks where trees with cavities suitable for nesting are absent. 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.

Nest boxes provide artificial cavities for several species of birds. Nest boxes have been instrumental in helping bluebird and wood duck populations recover from drastic low levels in the early 1900’s. Photo by Craig Harper.
Plant Flowers

General description
Annual and perennial forbs can be planted to attract a number of wildlife species. A variety of species will flower over a longer period. Species and varieties should be selected to provide food and cover through the year where possible. Forbs should be planted in proximity to other cover sources to make them readily available.

Effect on habitat
• Provides a supplemental source of food and cover.
**Plant / Manage Food Plots**

**General description**
Planting grain and forage food plots can be beneficial for many wildlife species (game and nongame, birds and mammals) primarily by providing supplemental food, but also by providing additional cover in some circumstances. It is important to note, food plots should be considered supplemental to existing natural habitat. The primary objective for food plots should be to provide nutrition for various wildlife species during periods when naturally occurring foods are limited (such as late summer and winter). In addition, food plots are often used to facilitate harvest of some wildlife species, such as white-tailed deer. Plots should not be placed within view of property lines or public roads.

**Grain food plots** are annual warm-season plantings that include corn, grain sorghum, and millet, as well as other seed such as buckwheat, sunflowers, soybeans and cowpeas. **Forage food plots** may be annual or perennial, warm- or cool-season plots. Popular forage plantings include clovers, wheat, oats, rape, chicory, winter peas, soybeans, cowpeas and lablab. Some plantings may provide both forage and grain/seed, such as wheat, soybeans, buckwheat, and cowpeas. In most circumstances, food plots should be well dispersed throughout the property being managed.

Generally, 1 to 5 percent of a property being managed for wildlife may be in food plots. Food plots may be long and narrow (300 to 400 feet long and 15 to 20 feet wide) or blocky in shape (depending on the focal wildlife species and the type of food plot planted), preferably located where two or more vegetation types meet (such as between a woodlot and an old-field, perhaps near a creek) and well distributed across the area being managed. If possible, food plots should be located adjacent to natural cover (such as brushy fencerows, hedgerows and other thicket-type areas). Exclusion cages should be erected in all forage plots to monitor planting success and amount of grazing pressure.

Food plots can be planted for upland wildlife (such as rabbits, quail, turkeys and deer) and waterfowl. Canada geese 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 ducks through winter.

Before planting, the seedbed should be prepared by conventional tillage or with herbicide applications prior to planting seed with a drill or planter. Tillage and herbicide applications, however, should not be recommended as separate practices in order to plant a food plot. The plot should be amended with lime and/or fertilizers as recommended by a soil test, obtained by sending samples of the soil to the Extension office for testing at a soils lab. This is an important step and helps ensure the correct amendments at the correct rate are applied for optimum plant growth.

Perennial forage food plots (such as perennial clovers, alfalfa and chicory) do not have to be planted each year. However, ** Maintaining perennial forage plots requires as much effort as replanting annual plots.** Perennial forage plots must be mowed periodically and sprayed with the appropriate herbicides and/or pesticides to control weed competition and/or problem...
insect pests. This is critical in order to get 4 years to 6 years production from the perennial plot without replanting. If the landowner’s goal is to increase insect production for Northern bobwhites, wild turkey, or songbirds, for example, applying pesticides is not recommended.

Effect on habitat
• In areas where row-cropping (corn, grain sorghum, soybeans) is scarce, grain food plots can supply high-energy foods through fall and into late winter. This can be especially important during years with low mast (acorn) production.
• In areas where little herbaceous vegetation is present (such as large areas of Stages 4, 5 and/or 6) and/or where herbaceous vegetation is of no value to wildlife (such as fields of tall fescue, orchardgrass, bermudagrass, etc.), forage plots can supply high-protein foods, especially during late summer and through winter and spring.

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

Warm-season forage plots, such as these soybeans, can provide an excellent source of protein (leaves) during summer and an energy source (beans) in winter. Photo by Craig Harper.

Cool-season food plots provide nutritious forage fall through spring when availability of naturally occurring forages may be relatively low. Depending on what is planted, such as winter wheat, a nutritious seed source is also available late spring through summer. Photo by Craig Harper.
Plant Shrubs

General description
When properly located, shrubs can provide a tremendous source of cover and soft mast that will benefit many wildlife species. 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/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 very beneficial, especially when planted adjacent to high-quality early successional cover and/or a good food source (such as grain field). Shrubs should be planted in winter while they are still dormant.

Shrubs should not be planted in the woods where there is not adequate sunlight for growth and development. Where additional shrub cover is needed in forested areas, Forest Management (TSI) 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 and/or soft mast are lacking.
• Shrubs can be planted to develop a riparian buffer along creeks, rivers, lakes and other wetland areas. Riparian buffers are important for protecting water quality and can provide excellent cover and travel corridors for wildlife as well. The recommended width is 100 feet, but width may vary with size and order of the stream, as well as topography and landowner objectives.

Shrub plantings, such as this hawthorn, provide nesting cover, escape cover, and an important source of soft mast. Photo by Craig Harper.
Plant Trees

General description
Trees are planted to provide food (hard or soft mast) and/or 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. This reduces the chances of a mast failure in any given year. Region, 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, mulberry, apple and pear.

Note: It may not be appropriate to plant trees in some areas. Some species of wildlife may not need trees. Prairies were historically treeless, and planting trees could be detrimental to grassland species of wildlife.

Effect on habitat
• Provides hard or soft mast production, depending on the species planted.
• Large areas can be planted for reforestation.
• Provides additional nesting, perching, denning and roosting sites.
• Trees can be planted to develop a riparian buffer along creeks, rivers, lakes and other wetland areas. Riparian buffers are important for protecting water quality and can provide excellent cover and travel corridors for wildlife as well. The recommended width is 100 feet, but width may vary with size and order of the stream, as well as topography and landowner objectives.

This planting of longleaf pines is providing important early successional habitat. In time, the forest will close and a different set of species will occupy the site. Photo by Dwayne Elmore.
Ponds: Construction

General description
Ponds can be created using dams, dikes and levees to provide relatively permanent water for fish and wildlife. Although wildlife may use them, ponds are typically managed for fish. Pond design varies, depending on the purpose for constructing the pond and the region where it is constructed. The local Extension office or Natural Resource Conservation Service office can provide design details.

This practice should be recommended when creating new 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 brushpiles. Artificial reefs are normally recommended only for ponds larger than 10 surface acres.

NOTE: The practice Pond: Restock should not be checked when Pond: Construction is prescribed.

Effect on Habitat
• Ponds can provide suitable habitat for some fish and wildlife species.

Note: Although many wildlife species may use ponds for various reasons, this practice is intended primarily for fish habitat. For the purposes of this contest, when additional water or wetland habitat is needed for wildlife species, Water Developments for Wildlife should be recommended. This avoids management conflicts when both fish and wildlife species are being managed on the same property. For example, steep sloping sides benefit fish, while gentle sloping banks with abundant emergent vegetation benefit many wildlife species.
**Ponds: Deepen Edges**

**General description**
In ponds with excessive aquatic vegetation along the margins of a pond, the edges should be deepened to a minimum of two to three feet with steep side slopes. If the pond can be drained, this can be accomplished with a bulldozer or tractor with a rear blade. If the pond cannot be drained, a backhoe can be operated from the top of the pond bank. Soil can be removed from the site or piled around the bank and then smoothed out and planted to native grasses and forbs.

**Effect on habitat**
- Reduces rooted aquatic vegetation around the edge of a pond, making prey more easily available to predator fish.

While the shallow upper end of this pond is providing habitat for waterfowl and amphibians, it is not necessarily productive for a balanced fish population. *Photo by Dwayne Elmore.*
Ponds: Fertilize/Lime

General description
Ponds can be fertilized to increase available natural food organisms and prevent rooted aquatic weeds from becoming established. However, not every pond should 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. Fertilization is needed in fish ponds with water clear enough that you can see clearly to 18 inches below the water surface. Before beginning a fertilization program, total alkalinity and pH of the pond water should be tested. Ponds below 20 mg/l total alkalinity will need liming in order for fertilizers to be effective.

Fish ponds should be fertilized in the spring when the water temperature reaches 60 F. For ponds with moderate hardness (50 mg/l to 100 mg/l calcium hardness), apply 15 pounds of 12-52-4 (or its equivalent) powder, or one gallon of 11-37-0 liquid fertilizer, or 15 pounds of granular (0-46-0) per acre at two-week intervals, or until a good green color (phytoplankton bloom) develops in the pond. Make additional fertilizer applications (at the same rate per surface acre) every three to four weeks, or when the water clears (becomes less green).

Fertilization may be continued until water temperatures drop below 60 F in the fall. Methods for applying fertilizer vary with the type of fertilizer used. Granular fertilizer must be distributed from a fertilizer platform. Liquid fertilizer should be mixed with pond water and broadcast from a boat for large ponds or from the bank of small ponds. Water soluble powdered fertilizers can be broadcast from a boat or from the bank.

Effect on habitat
• Pond fertilization stimulates phytoplankton production, which is the first step in the food chain of a fish pond.

Agricultural lime being distributed evenly over a pond from a pontoon barge. *Photo from “Liming Ponds for Aquaculture,” Southern Regional Aquaculture Center.*

Illustration of pH scale showing recommended range: pH < 7 acidic, pH > 7 basic (Wurts and Durborow 1992), *from “Liming Ponds for Aquaculture,” Southern Regional Aquaculture Center.*
Ponds: Reduce Turbidity / Reseed Watershed

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.

Most events of turbidity are 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 the watershed immediately around the watershed where there is evidence of erosion. Turbidity due to 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. However, the choice of which product and how much to use has to be based on effectiveness, availability, cost and the ability of the pond owner to apply the product correctly.

Effect on habitat
- Improves water quality by removing or settling silt.
- Allows sunlight to stimulate phytoplankton.
- May enhance cover for some wildlife, depending on how and where the watershed is reseeded.

Hydraulic Engineer Eddie Bunch inspecting a recently completed tailwater recovery pond. The banks are seeded with ryegrass for erosion control. Lonoke County, Arkansas. (Note that ryegrass is considered invasive in some portions of Arkansas.) Photo by Jeff Vanuga, NRCS.
**Ponds: Repair Spillway/Levee**

**General description**
Repairing a spillway or levee is needed if the spillway in an existing dam or dike is eroding or otherwise damaged, keeping the pond 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.

**Effect on habitat**
- Enables pond to fill to appropriate level and precludes vegetation from establishing around the inside perimeter of the pond.

*Trees must be removed from dams to prevent the dam from leaking and eventually breaking. Photo by Craig Harper.*
Ponds: Restock

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 warmwater 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.

Fish eggs are hatched and fingerlings raised in tanks before being transferred to fish ponds. *Photo by Peggy Greb, USDA Agriculture Research Service.*
Rooftop / Balcony Gardens

General description
In urban areas, residential green space may be limited. Urbanites can create rooftop or balcony gardens to provide additional food, water and viewing opportunities. Although limited in space, the goal of rooftop or balcony gardens is to create habitat; thus, rooftop or balcony gardens should provide food, water, and cover. Moving water, such as a small waterfall will attract more wildlife than stationary water.

Effect on Habitat
• Provides food, cover, and water, though in small amounts, for wildlife in urban areas.

Backyards can be arranged in various shapes and with various plantings and nest boxes so that they are more attractive and useful for wildlife. Photo by Craig Harper.
Streams: Dams, Boulders or Logs

General description
Small (less than 1.5 feet high) dams are built across streams to raise the water level and create pools. Large boulders or logs are placed in streams (with hard bottoms) to improve fish habitat. The rocks need to be large enough so small floods will not move them. Any structures put in a stream have the potential to alter stream currents in an undesirable manner. Sometimes such structures are used to reduce streambank erosion. The placement and design of such structures should be done with advice from experts.

Effect on habitat
• Used to create pools for fish to hide and rest.
• If designed properly, can be used to reduce some kinds of stream erosion. Used in areas with considerably more riffles than pools.
Tillage Management

General description
Tilling cropland can be delayed in spring to allow wildlife to use standing stubble for nesting. Tillage may be eliminated in the fall to allow wildlife access to waste grain. When fall tillage is necessary, avoid inversion tillage (soil is turned over and covers up crop residue) such as moldboard plowing or disking. Instead, implements such as chisel plows that do not turn the soil over should be used.

Note: This practice should be recommended only if a grain crop is present.

Effect of practice
- Increases supply of waste grain, which is eaten by many wildlife species, and may increase nesting success.

By delaying tillage from fall into spring, waste grain from harvested crops is available through winter. Photo by Craig Harper.
**Water Control Structures**

**General description**
Various structures made of concrete, metal, or wood are used to control the water level in ponds and wetlands. They are usually placed within a dam or dike. This practice should be recommended when inadequate or no structure is present on an existing dam or dike. This practice can also be used to control the water level of beaver ponds. A Clemson Beaver Pond Leveler can be placed through the beaver dam, restricting the pond level from exceeding a desired height and helping prevent flooding into undesirable areas, such as crop fields, roads, woods, etc.

**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.

![Photo by Craig Harper.](image-url)

Water control structures allow manipulation of the water level in ponds and areas flooded for wildlife using a dike or levee. *Photo by Craig Harper.*
Water Developments for Wildlife

**General description**
Water is a critical habitat component. Some wildlife species obtain necessary water from their diet, while others need a free-standing source of drinking 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.

**Dugouts** *(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.

**Ephemeral Pools** are natural depressions which may be seasonally flooded by rainfall. These wetlands provide important habitat for many amphibians (frogs, toads, and salamanders) which breed in these pools during wet periods. During dry periods, these ephemeral pools dry and vegetation often grows within them. When they flood again, this vegetation serves as cover for breeding amphibians and places for their eggs to be attached. Also, waterfowl and other wetland birds use these pools as feeding areas, eating the seeds and aquatic insects associated with the vegetation.

**Shallow impoundments** may be established 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 Stage 6 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 letting 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. Both guzzlers and windmills tend are more likely to be found in the western U.S. than in Arkansas.

**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.
Effect on habitat

- Can provide drinking water and wetland habitat.
- Flooded grain fields or Stage 6 bottomland hardwoods in fall/winter can provide important migrating and wintering areas with abundant food resources for waterfowl.
- Temporary flooding can improve existing wetlands for nesting and brooding for some waterfowl such as redheads and can improve existing forested areas for nesting and brooding wood ducks.
- Can provide a source of prey for many predators.
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 feeding in soybean crops, bobcats/coyotes/owls preying on livestock or pets, rabbits/raccoons eating vegetable gardens, beavers killing trees or flooding crops and roads, red-winged blackbirds eating crops, bird strikes at airports, rock pigeons defecating on buildings, starlings roosting in urban trees and defecating on sidewalks, and Canada geese loitering on lawns and golf courses.

To control these problems, wildlife managers use both lethal and nonlethal methods. Fencing and other exclusion devices, habitat modifications, harassment techniques (such as predator decoys), scare tactics (such as propane cannons, dogs) and taste and odor repellents are examples of nonlethal methods. Changing human activity can also 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 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 are 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 more accepted by the public than lethal methods and can be 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 absolutely identify the species causing the damage. An integrated wildlife damage management program that employees two or more methods is strongly recommended especially when using nonlethal methods. It is imperative to know all the local, state and federal laws related to the species causing the problem and the wildlife damage management method(s).

Note: For the purposes of this contest, it sometimes can be confusing when deciding whether to recommend Increase Harvest or Wildlife Damage Management. If the problem is related to
human structures, livestock or human health, *Wildlife Damage Management* should be recommended. If the problem is related to competition or mortality among wildlife species, *Increase Harvest* should be recommended if the species can be harvested legally. For example, if white-tailed deer are overbrowsing a forest understory and destroying habitat for various songbirds, *Increase Harvest* should be recommended. Likewise, if raccoons have been found to limit wild turkey recruitment, or coyotes have been found to limit fawn survival, *Increase Harvest* should be recommended for raccoons or coyotes. For non-native invasive animal species such as house sparrows, European starlings or rock pigeons, *Wildlife Damage Management* should be recommended to control associated damage as they are not considered game species.

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*House sparrows often displace bluebirds from nest boxes constructed for bluebirds. This invasive non-native species should be removed whenever possible.*

*Photo by Craig Harper.*

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*Netting can be used to protect crops, such as grapes and blueberries, from birds and other wildlife.*

*Photo by Dwayne Elmore.*
Coyotes can be a problem for various reasons. Depending on the situation, either *Wildlife Damage Management Techniques* or *Increase Harvest* can be recommended. If the problem is associated with livestock, *Wildlife Damage Management Techniques* should be recommended. If the problem is associated with competition or mortality among other wildlife species, *Increase Harvest* should be recommended. Trapping is the recommended technique for controlling problematic coyotes.
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: a written narrative and a sketch map illustrating where practices are to be implemented. The narrative portion consists of four main sections that can be either written in paragraph or bullet 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** (20 Points)
  - Species habitat requirements (10 Points)
  - Habitat assessment of current conditions for the selected species (10 points)

- **Plan Implementation** (70 Points)
  - What, when and where management practices will be performed and effect on species
  - Demonstrate an understanding of the appropriate wildlife management practices that should be implemented and the effects of those practices on the habitat and other species managed

- **Plan Evaluation** (10 Points)
  - State what you will do to determine if your plan worked

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 to 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.

- 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.

Sample Written Wildlife Management Plan

The sample below is intended to help you learn the correct format for writing management plans. At a contest, you will be given three blank pieces of paper, two of which are for writing your plan. You must know the format and what is to be included in each section. Write on your paper “Plan Background” and either in narrative or bullet format, provide information addressing this section. Do the same for Plan Development, Plan Implementation, and Plan Evaluation sections.

You can only use one side of each of three sheets of paper. Learn to 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.

Wildlife Management Plan

Plan Background
The species to be managed are Eastern bluebirds, coyote and American kestrel. The management objectives are to increase numbers of Eastern bluebirds, decrease the coyote population, and maintain the number of American kestrels on the property.

Plan Development
Eastern bluebirds are found in early successional areas interspersed with trees and shrubs where they forage on insects. Water is obtained from their diet. Bluebirds nest in cavities when available, but will readily use nesting boxes. The area is primarily Stages 5 and 6. Stages 2 and 3 is lacking for Eastern bluebird.

Plan Implementation
Forest regeneration and chainsawing will open the Stage 6 forest and provide more usable space for bluebirds. Native grasses and forbs should be established to provide suitable foraging areas. Although a few cavity trees are available and should be retained when implementing forest regeneration and chainsaw work, additional nesting cover is desirable and nest boxes should be put in place.

Plan Evaluation
Spring counts and nest box checks will be conducted to determine presence of bluebirds. Vegetation surveys will evaluate if establishment techniques for native grasses and forbs were successful.
Samples of Field Condition Sheets

2012 Arkansas State Contest:

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:
- Butterflies
- Prairie vole
- 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 Contest (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.
**Wildlife Management Plan**

**Senior Event**

**Objectives**
Referring to an identified area, teams make written recommendations based on landowner objectives as stated on a written Field Condition Sheet, which is provided to each team. An aerial photo of the identified area may or may not be provided.

**Overview**
From the Field Condition Sheet (also called landowner scenario), 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 when writing management plans.

**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), aerial photo of the identified area (optional), three blank sheets of 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 of these sheets are for writing the narrative, and the third sheet is for making a sketch map illustrating where practices are implemented. Only write the plan (including the sketch map) on the front of each sheet of paper. Plans not written in the proper format or correctly identified will not be judged.
5. Participants are required to draw a sketch and locate where recommended practices will be implemented. (Sketch maps are NOT optional.)
6. The name and id number of each team member **must** be written on the blank back side of each sheet.
7. Teams will have as hour and a half (1 ½ hours) to complete this event, including preparation for Oral Defense.

**Scoring**
This event is worth 140 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 (20 points maximum per team member) for a total team score of 200 points maximum. Top scores from individual events (except oral defense) are combined with the team score to determine the overall team score.
Judges’ Scoring Sheet – Written Management Plan

Scale for scoring: 0 = not at all, 2 = poor or poorly, 4 = fair or slightly well, 6 = good or fairly well, 8 = excellent or very well, 10 = outstanding

**Plan Background (20 points maximum)**

<table>
<thead>
<tr>
<th>The plan accurately identified the wildlife species to be managed.</th>
<th>0</th>
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<th>4</th>
<th>5</th>
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<tr>
<th>The plan accurately identified the management objective.</th>
<th>0</th>
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<th>2</th>
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Subtotal:________

**Plan Development (20 points maximum)**

<table>
<thead>
<tr>
<th>The team demonstrated understanding of the habitat needs of each species.</th>
<th>0</th>
<th>1</th>
<th>2</th>
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<tr>
<th>The team accurately evaluated the existing habitat (what is present and what is lacking) based on management objectives and species to be managed.</th>
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Subtotal:________

**Plan Implementation (70 points maximum)**

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<th>The team included the <em>appropriate management practices</em>.</th>
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<tr>
<th>The team fully explained <em>when and where</em> each practice will be implemented. The team demonstrated knowledge of practices effects on existing habitat and benefits to each species</th>
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<tr>
<th>The team used the appropriate native plant species in their plan.</th>
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<th>1</th>
<th>2</th>
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<tr>
<th>The team recognized the management compromises necessary to meet the needs of each species and showed understanding of the mutual benefits of implementing certain wildlife management practices.</th>
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Subtotal:________

**Part 4: Plan Evaluation (10 points)**

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<tr>
<th>The team presented a realistic plan for monitoring the success of their plan.</th>
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Subtotal:________

**Part 5: Content (20 points)**

<table>
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<th>The team presented the plan in the appropriate narrative format.</th>
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<th>10</th>
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<table>
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<tr>
<th>The team included a sketch of the area that accurately reflected the management practices to be implemented.</th>
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Subtotal:________

**Comments:**

**FINAL SCORE:**

**Total Score (140 points maximum):**
Oral Defense of Written Plan

Study Guide

In this event, each contestant appears before a panel of judges and answers questions about their team’s wildlife management plan. The questions are intended to test the individual’s knowledge of the team’s plan. The questions may cover anything related to the appropriate species and wildlife management practices. When responding, assume judges have not read your team 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.

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 Stages 2 and 3. 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 grasshopper 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 logic, knowledge of the wildlife species, use of wildlife terms and concepts, poise, and appearance. The majority of points (70 of 100 points) on the scorecard are awarded to your presentation style. The remaining 30 points focus on your knowledge of subject matter pertaining to wildlife habitat management. As such, your manner of presentation greatly affects your score.

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. Note that even if an answer is incorrect, it is possible to score well by exhibiting good presentation skills and giving logical and concise responses.
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 a panel of judges and answers questions about the team’s wildlife management plan. To be successful and score well in the Oral Defense of Written Plan event, it is important that each and every team member actively participates in developing the wildlife management plan. Each team member is expected to demonstrate their 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 two or three judges and answer a series of questions related to their written plan.

Note: Notecards will no longer be provided to contestants in preparation for the oral defense in accordance with the national WHEP contest.

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 (70 of 100 points) on the scorecard are awarded to your presentation style. The remaining 30 points focus on your knowledge of subject matter pertaining to wildlife habitat management.

Overall, this event is worth 60 points of your team’s total score. (The 100 points on the scorecard will be divided into a proportion equaling 20 points maximum per individual.) The top three scores will be added together for a maximum of 60 points. 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. The score for Oral Defense of Written Plan is combined with the written management plan score (140 points) for a total possible score of 200 team points.

Note: Scores for Oral Defense of Written Plan are not included in determining high individual scores.
Judges’ Scoring Sheet - Oral Reasons

Scale for scoring: 0 = not at all, 2 = poor or poorly, 4 = fair or slightly well, 6 = good or fairly well, 8 = excellent or very well, 10 = outstanding

<table>
<thead>
<tr>
<th>Subject Matter (30 points maximum)</th>
<th>(Poor)</th>
<th>(Outstanding)</th>
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<tbody>
<tr>
<td>Understanding of species habitat requirements</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>Understanding of wildlife management practices and their implementation</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
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<tr>
<td>Knowledge of appropriate terms and concepts (e.g., succession, edge, interspersion)</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
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Subject Matter Subtotal ______

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<tr>
<th>Contestant (40 points maximum)</th>
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<th>(Outstanding)</th>
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<tbody>
<tr>
<td>Poise (calm, confident)</td>
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<td></td>
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<tr>
<td>Voice (volume, clarity, enunciation)</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
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<tr>
<td>Grammar</td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
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<tr>
<td>Body language (eye contact, hand gestures, other movements)</td>
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Contestant Subtotal ______

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<tr>
<th>Response to Questions (30 points max)</th>
<th>(Poor)</th>
<th>(Outstanding)</th>
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<tbody>
<tr>
<td>Accuracy of responses</td>
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<tr>
<td>Logic, reasoning and organization</td>
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<tr>
<td>Answered honestly and concisely</td>
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Response to Questions Subtotal ______

Comments:

FINAL SCORE: Total Score (100 points max): _________