

The Life and Times of  
**Bobwhite Quail**  
in Mississippi

A 4-H School Enrichment Program

**Program Curriculum**



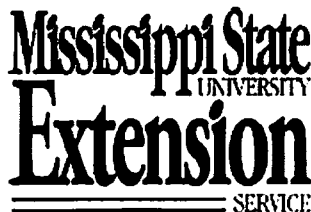
**Mississippi State**  
UNIVERSITY  
**Extension**  
SERVICE



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A 4H School Enrichment Program  
for Third and Fourth Grades



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Department of Wildlife and Fisheries

Dear Third or Fourth Grade Teacher/Partner:

Thank you for utilizing *The Life and Times of Bobwhite Quail in Mississippi! A 4-H School Enrichment Program* as part of your 3<sup>rd</sup> or 4<sup>th</sup> grade classroom curriculum. We are excited about the opportunity to partner with you and your students! All lesson plans, activities, and testing materials are provided for your use. Please keep the lesson plan notebook as a future teaching resource.

You can help us in the following ways:

Prior to arrival of the module on your campus:

- Complete the enclosed Demographic Sheet.
- Pretest your class **prior** to any student exposure to the display, videos and/or slide presentations, and lesson activities.

After completion of the module:

- Post-test your class before the module leaves your campus.
- We will select classes to post-test again approximately two months after initial exposure.
- Take a few moments to complete the Teacher Evaluation Form.
- Return pre-tests, demographic sheet, evaluation form, and post-tests to your 4-H Youth Agent.

Your cooperation in these procedures is greatly appreciated!

The module normally resides on participating campuses for a one-to-two-week period. We have developed a multiple lesson teaching plan for you to follow to ensure maximum exposure to the unit. We suggest that the display unit be set up in the library or other common access area that can be protected to allow multiple classes to visit and interact with the display.

You may photocopy pages from the curriculum notebook for your students as needed. Answer sheets are provided for your use.

By taking part in this project, you are contributing to our youths' education and awareness of our native bobwhite quail resource. If you discover ways that this teaching module can be improved, please don't hesitate to contact me or provide comments on the Teacher Evaluation Form. Good luck, and thanks again for your interest!

Sincerely,

*C. Jared Quillen*

C. Jared Quillen  
Extension Wildlife Assistant

Cooperative Extension Service • Mississippi State University

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- Title:** *The Life and Times of Bobwhite Quail in Mississippi!  
A 4H Wildlife Science School Enrichment Program for  
Third and Fourth Graders*
- Who:** Lesson activities target third and fourth graders; however, any elementary school class that desires to participate while the module is on-site can view the display and associated videos and other materials.
- What:** A bobwhite quail school enrichment program featuring lesson activities, several videos, publications, and a freestanding display to enhance third and fourth graders' awareness and understanding of our bobwhite quail resource.
- When:** Any time during the school year. Schools must request the module at least six weeks prior to desired dates. Teacher notebooks will be forwarded to participating third and fourth grade teachers at least one week prior to module set-up. The exhibit is usually scheduled in one-to-two-week blocks to allow classes sufficient time to participate in all module components.
- Where:** All elementary schools, both public and private, are invited to utilize this module.
- How:** Contact your local county 4H Youth Agent to schedule the module. If you are selected to receive the module, you must complete the pre-test before the module will be assigned to your campus. Fill out the demographic sheet and administer the pre-test before the module arrives on your campus. Visit the display, view the videos, read the publications, and plan to use lesson activities in any order you deem appropriate. Administer the post-test before the module leaves your campus. The pre- and post-tests, demographic sheet, and teacher evaluation must be submitted to your county 4H Youth Agent before the module leaves your campus.
- Why:** To enhance our youth's understanding of various aspects of bobwhite quail ecology and management.

# *The Life and Times of Bobwhite Quail in Mississippi!*

## *A 4H School Enrichment Program*

### **Demographic Sheet**

Date \_\_\_\_\_

Grade \_\_\_\_\_

Teacher \_\_\_\_\_

School \_\_\_\_\_

County \_\_\_\_\_

Town/City \_\_\_\_\_

PLEASE PRINT

Check the appropriate categories

Student name	Sex		African-American	Asian-American	Hispanic-American	White	Other
	M	F					
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# The Life and Times of Bobwhite Quail in Mississippi

## Teacher Evaluation Form

Please **circle** the number that best corresponds to your evaluation *The Life and Times of Bobwhite Quail in Mississippi*: (1=Poor, 5=Excellent)

	Poor			Excellent	
	1	2	3	4	5
1. Quality of Display (attractiveness, informational content, etc.)	1	2	3	4	5
2. Quality and utility of <i>Bobwhite Habitat Management in Mississippi</i> Video	1	2	3	4	5
3. Quality and utility of <i>The Quail Series</i> Videos	1	2	3	4	5
4. Quality of written lesson plans and students' response	1	2	3	4	5
5. Quality of activities and students' response	1	2	3	4	5
6. Contact and support from Extension office (Program Curricula in advance and contact regarding Program)	1	2	3	4	5
7. Ease of set-up and take down of Display	1	2	3	4	5
8. Overall response of students to the Program	1	2	3	4	5
9. Your overall rating of the Program	1	2	3	4	5
10. I would recommend the use of this Program to other teachers	1	2	3	4	5
11. What improvements would you recommend to this Program?					

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Name \_\_\_\_\_

County \_\_\_\_\_

School \_\_\_\_\_

Town/City \_\_\_\_\_

Grade \_\_\_\_\_

Date (mm/dd/yy) \_\_\_\_\_

# The Life and Times of the Bobwhite Quail in Mississippi

## Mississippi Statewide Competencies

Grade	Subject	Competencies	Description
3	Science	(L,S) 3.1	Investigate how objects and organisms influence other objects and organisms.
3	Science	(L) 3.2	Explore the contribution of the components of a system to the operation of a system.
3	Science	(L) 3.3	Explore the diversity of living things.
3	Science	(L,E,P,S) 3.13	Apply the components of scientific processes and methods.
3	Science	(L,E,P,S) 3.14	Investigate the interrelationships of science, technology, and society.
3	Social Studies	(C,H,G,E) 1.a	Develop an understanding of community/local government in relationship to the expanding horizon theme.
3	Social Studies	(C,H,G,E) 1.b	Describe the relationships among people, places, and environments.
3	Social Studies	(C,H,G,E) 3.d	Demonstrate and apply spatial and ecological perspectives in life situations.
3	Math	(P,G,N) 1.a	Recognize, describe, and extend patterns.
3	Math	(P,D,M,G,N)4.a	Compare and interpret quantities represented on different types of graphs and make predictions based on the information collected.
3	Math	(P,D,M,G,N)4.b	Compare data represented on charts and tables.
4	Science	(L) 4.1	Investigate the capacity of living things to adapt to their environment.
4	Science	(L,S) 4.3	Discover how systems respond to stress.
4	Science	(L,E,P,S)4.13	Apply the components of scientific processes and methods.
4	Science	(L,E,P,S)4.14	Investigate the interrelationships of science, technology, and society.
4	Social Studies	(C,H,G,E) 1.a	Develop an understanding of the state in relationship to the expanding horizon theme.
4	Social Studies	(C,H,G,E) 1.b	Describe the history of people who first lived in Mississippi.
4	Social Studies	(C,H,G,E) 3.a	Identify time and space relevant to the student's environment by using social studies tools.
4	Social Studies	(C,H,G,E) 3.c	Demonstrate spatial and ecological perspectives to life situations.
4	Math	(P,M,G,N) 1.a	Recognize, describe, and extend a given pattern.
4	Math	(P,M,G,N) 1.b	Analyze a given pattern and generate a similar pattern.
4	Math	(P,D,M,G,N)4.a	Collect, organize, and interpret data, using bar graphs, circle graphs, line graphs, pictographs, charts, tables, and tally charts.
4	Math	(P,D,M,G,N)4.b	Formulate and solve problems that involve data analysis and prediction.

### Science

**Strands:** L= Life  
E= Earth  
P= Physical  
S= Science

### Social Studies

**Strands:** C= Civics  
H= History  
G= Geography  
E= Economics

### Math

**Strands:** P= Patterns/Algebraic Thinking  
D= Data Analysis/Prediction  
M= Measurement  
G= Geometric Concepts  
N= Number Sense

# ATTENTION TEACHERS!!

- ✓ Be sure to administer the pre-test **BEFORE** students are exposed to any part of *The Life and Times of Bobwhite Quail in Mississippi* module!
- ✓ Fill out the demographic sheet included in the teacher resources packet.
- ✓ Post-test following student participation.
- ✓ Turn in demographic sheet, teacher evaluation, pre-test, and post-test **BEFORE** the module leaves your school. These may be turned in to your 4-H Youth Agent.
- ✓ Keep the teacher resources packet for your future use.



Your Name \_\_\_\_\_

Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_

Grade \_\_\_\_\_

School \_\_\_\_\_

## The Life and Times of Bobwhite Quail in Mississippi

### Pre-Test

(Circle the *best* answer for each question.)

1. The bobwhite gets its name because \_\_\_\_\_.
  - a. Bob White, a famous ornithologist, was the first to observe the bird
  - b. during the breeding season, the male makes a clear, distinctive "bob-white" whistle
  - c. as the bird walks through grass, the white patch on its face can be seen "bobbing" up and down
  
2. Adult male and female bobwhites can easily be identified from each other because \_\_\_\_\_.
  - a. males are much larger than females
  - b. the female's "bob-white" whistle is louder than the male's whistle
  - c. males have a mask of white feathers on their faces, while females have brownish feathers on their faces
  
3. The most important cause of bobwhite population decline is \_\_\_\_\_.
  - a. loss of habitat
  - b. predation
  - c. hunting
  
4. Ideal bobwhite habitat should consist of \_\_\_\_\_.
  - a. mature forests
  - b. a mixture of grassy, weedy, brushy vegetation with some areas of bare ground and agricultural crops
  - c. large fields of row crops
  
5. A group of bobwhites is called a \_\_\_\_\_.
  - a. herd
  - b. school
  - c. covey

6. Bobwhites feed on \_\_\_\_\_.
  - a. insects
  - b. seeds
  - c. berries
  - d. all the above
  
7. The most effective way to increase populations of wild bobwhites is \_\_\_\_\_.
  - a. controlling predators
  - b. releasing large numbers of captive-raised quail
  - c. shortening hunting seasons
  - d. providing high quality habitat
  
8. Bobwhites prefer to feed in areas with lots of bare ground because \_\_\_\_\_.
  - a. predators are less common in these areas
  - b. seeds in these areas are larger and more nutritious
  - c. the lack of vegetative litter makes seeds easier to find
  
9. A bobwhite chick eats mostly \_\_\_\_\_ the first few weeks after hatching.
  - a. seeds
  - b. grass
  - c. insects
  
10. Wildlife managers use \_\_\_\_\_ to "set back" plant succession and create bobwhite habitat.
  - a. timber harvest
  - b. strip disking
  - c. prescribed fire
  - d. all the above

Your Name \_\_\_\_\_

Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_

Grade \_\_\_\_\_

School \_\_\_\_\_

## The Life and Times of Bobwhite Quail in Mississippi

### Post-Test

(Circle the **best** answer for each question.)

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  - c. prescribed fire
  - d. all the above

Your Name \_\_\_\_\_

Date \_\_\_\_\_

Teacher's Name \_\_\_\_\_

Grade \_\_\_\_\_

School \_\_\_\_\_

## The Life and Times of Bobwhite Quail in Mississippi

### KEY

(Circle the *best* answer for each question.)

1. The bobwhite gets its name because \_\_\_\_\_.
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  - c. insects
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- a. timber harvest
  - b. strip disking
  - c. prescribed fire
  - d. all the above

# I. Morphology

## Lesson I

- Grade:** 3-4  
**Focus:** Bird morphology  
**Subject:** Science  
**Materials:** Drawing or painting materials, construction paper and glue, pencil and paper  
**Teaching Time:** One class period (minimum)  
**Vocabulary:** Morphology, vertebrates, thermo-regulation, precocial

## Learning Objectives

- Students will:** Define special design in animals.  
Be able to identify and describe the advantages of bird designs, and evaluate the importance of special design to birds, specifically, quail.



## Background

Morphology is a branch of biology that deals with the form and structure of animals and plants. Birds have a certain form and structure that separate them from other vertebrates (animals with backbones *i.e.* mammals, reptiles, and amphibians). There are more than 9,000 species of birds in the world, and about 800 are found in North America. They have three characteristics which distinguish them from other animals: feathers, hard-shelled eggs, and hollow bones.

**FEATHERS-** Birds use their feathers in many ways; such as flight, regulation of body temperature (thermo-regulation), protection of the body, attraction of mates, and identification of species. Feathers are made of the same material human fingernails and hair are made from—a protein called keratin. The feathers most commonly observed are contour and down feathers. Contour feathers cover the body of a bird and have a strong, hollow shaft and network of hooks or barbules. The contour feathers on the tail and wings have been modified for flight. Down feathers are small and lie under the contour feathers. The purpose of these feathers is to insulate the bird from cold and protect against sunburn. Feathers are also important in bird behavior. Males have colorful feathers used to attract mates, while females usually have drab feathers which act as camouflage.

**HARD-SHELLED EGGS-** Birds lay eggs with hard shells made mostly of calcium carbonate. The hard shell keeps the egg from dehydrating and allows parents to sit on the eggs during incubation. The number of eggs laid varies by species from as few as one for a seabird to nearly 15 for the bobwhite quail.

**HOLLOW BONES-** Simply having feathers does not permit birds to be creatures of the sky. Extremely light-weight bones are necessary for flight. Bird bones are strong and hollow. The hollow bones are thin-walled, but quite resistant to stress from bending. Many bird bones are fused together which increases strength of the bones.

Bobwhites are specially designed for survival. Coloration is important for camouflage and to help identify the sex of the birds. Males are reddish brown above and white with black bars on the belly. The throat and a line above the eye are white; a broad black line extends from the eye backward and around the throat. In females, this white area is replaced by buff, or light brown, coloring. Like most ground-nesting birds, bobwhites are cryptically colored. This camouflage helps them hide from predators. If frightened, bobwhites prefer to run from danger; when flushed (take wing suddenly), they fly rapidly with a loud whirring sound, but quickly drop to the ground after a short burst of flight. Newly hatched chicks are born precocial. This means they are

covered with natal down, are very alert, and move around on the ground quite readily. Bobwhite chicks leave the nest with their parents soon after hatching. This new group of bobwhite chicks is called a brood. Although they do not depend on their parents for delivery of food, they rely on them for food location and for protection. Bobwhite chicks quickly learn what is and is not edible by pecking at objects shown to them by their parents. During the first 6 weeks of their life, bobwhite chicks feed almost exclusively on insects. During the next few weeks, they gradually increase the amount of plant material eaten. Chicks can fly when they reach two weeks of age. They grow rapidly to look like and weigh as much as adults after only 15 weeks. Bobwhites have sturdy legs and can scratch reasonably well for seeds. However, a bird's bill is its key design for feeding. Bobwhite bills are short and more or less conical; they are well designed to pick up hard seeds, and function equally well when eating fleshy fruits.

## Learning Procedure

- 1 View video: *Introduction to the Northern Bobwhite*. View video *Bobwhite Habitat Management in Mississippi*.
- 2 View the display: Visit the display and view the food board section. See how quail are designed to eat seeds and insects. Identify the differences in male and female bobwhites, and adult and juvenile birds. Point out how hens are camouflaged on the nest.
- 3 Distribute publication: *Ecology and Management of the Northern Bobwhite*. Read pages 4 and 5 under the Brood Rearing section.
- 4 Discuss different birds that class members have seen and how they each are designed for different lifestyles.

**Activity 1: Design Artistry.** (Adapted from *Project Wild*). This activity emphasizes the importance of special design in birds.

Students will design and create imaginary birds, and write reports including descriptions of the birds designs.

Birds have a variety of designs - including characteristics of beaks, feet, legs, wings, and coloration. The major purpose of this activity is for students to realize that there are advantages for birds in looking how they do, while recognizing some of the ways in which birds are physically designed, equipped, and adapted for their environments. A variety of major designs are listed in Table 1.

Discuss with the students the various designs given in Table 1, listing the charts on a chalk board for reference by the students. Or, brainstorm a list of bird characteristics, name the birds with such characteristics, and describe the advantage of the design represented by the characteristic.

Tell the students they will each have a chance to design their own original bird—one well equipped for its habitat. Each student should decide: where the bird will live, what it will eat, its type of mobility, and its sex.

Based on these choices, the student will decide the designs that are necessary for their bird, and write them down before proceeding further. Using their list of designs, each student will create his or her own original bird; for example, by drawing or sculpting it.

In conjunction with each drawing or sculpture, each student should write a short report which includes the name of the bird and its food sources, habitat, and lifestyle. Students should also include their lists of designs, the reasons for the designs, and the advantages provided by the designs. Younger audiences can give verbal reports. Completed projects may either be submitted to the teacher, presented to the class, or displayed in the classroom.

## Discussion Points

Name two bird designs for each of the following body parts, listing their advantages: beaks, feet, legs, wings, color.

How are bobwhites designed for life in Mississippi?

How can adult male and female bobwhites be easily distinguished from each other?

## Looking Beyond

Go outside and identify special designs on real birds.

Visit a quail farm or preserve and see, up close, the special designs of quail.

Ask an ornithologist (someone who studies birds), or avid bird watcher to lead the class in a discussion on local birds.

**Lesson I addresses the following Mississippi State Curriculum Objectives for grades 3-4.**

Science (L)3.2, (L)3.3, (L,E,P,S)3.13  
(L)4.1



**Table 1. Special designs which equip birds for survival in their respective habitats.**

Design		Bird	Advantage
Beaks	pouch-like	Pelican	can hold fish, a food source
	long, thin	heron	can probe shallow water and mud for insects, a food source
	pointed	woodpecker	can break and probe bark of trees, for insects, a food source
	curved	hawk	can tear solid tissue, like meat, a food source
	Short, stout	finches	can crack seeds and nuts, a food source
	slender, long	hummingbird	can probe flowers for nectar, a food source
Feet	webbed	duck	aids in swimming and walking on mud, transportation
	long toes	crane, heron	aids in walking on mud, transportation
	clawed	hawk, eagle	can grasp food when hunting prey
	grasping	chicken	aid is sitting on branches, roosting, protection
Legs	flexor tendons	chicken	aid in perching and grasping
	long, powerful	ostrich	aids in running, transportation
	long, slender	heron, crane	aids in wading, transportation
	powerful	eagle, owl	aids lifting, carrying prey, transportation
Wings	large	eagle	aids flying with prey, soaring while hunting
	short, rounded	quail	quick bursts of flight, rapid maneuvers, escape from predators
	long, narrow	albatross	high speed gliding in high winds
Color	bright plumage	male birds	attraction in courtship, mating
	drab plumage	female birds	aids in camouflage while nesting, protection in shelter
	change of plumage with seasons	owl, ptarmigan	provides camouflage protection (brown in summer, white in winter), protection in shelter



# II. Population Trends

## Lesson II

<b>Grade:</b>	3-4
<b>Focus:</b>	Population Trends, Loss of Habitat
<b>Subject:</b>	Science, Math, Social Studies
<b>Materials:</b>	Video - Part 1: <i>Introduction to the Northern Bobwhite and Bobwhite Habitat Management in Mississippi</i> (beginning through Herbert Stoddard). Publication - <i>The Quail Series, The Northern Bobwhite</i> , pages 3-7; and <i>Ecology and Management of the Northern Bobwhite</i> , pages 1-3, Introduction through Historical Land Use Patterns. Display - Sections with population and harvest trends graphs Activity 1 - Graph paper, markers Activity 2 - Small slips of colored paper, markers
<b>Teaching Time:</b>	One class period (minimum)
<b>Vocabulary:</b>	Population change, density, edge habitat

## Learning Objectives

<b>Students will:</b>	Describe factors that have influenced bobwhite populations. Construct a time line illustrating trends in population density. Role play historical changes in the bobwhite population.
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## Background

Early settlers to America were exposed to many new species of wildlife. White-tailed deer, raccoons, opossums, beavers, bobwhite quail, wild turkeys, wood ducks, passenger pigeons, and copperhead snakes were among these new species.

As America was settled, population levels of wildlife species changed. Some species required forested areas while others were designed for cleared areas. Bobwhites flourished in areas where woodland, brush, and cropland came together.

In the South, bobwhites experienced a growth in population until about 1890. They remained stable until the mid-1900's when changes in farming techniques lowered the population. Large farms with clean fence rows replaced small fields interspersed among wood and dotted with areas of brushy cover. This resulted in a loss of habitat that caused decline in the bobwhite population. Some states have experienced a critical decline of bobwhites. In response to this environmental challenge, agencies

and scientists have formed groups to conduct research and develop habitat management plans.

## Learning Procedure

- 1 View video Part 1: *Introduction to the Northern Bobwhite*. View video *Bobwhite Habitat Management in Mississippi* from beginning through mention of Herbert Stoddard.
- 2 Distribute publications: *The Northern Bobwhite*. Read pages 3-7 for supplemental information; and *Ecology and Management of the Northern Bobwhite*. Read sections on Introduction, Population Trends, and Historical Land-Use Patterns (pages 1-3).
- 3 Discuss major changes in bobwhite population levels in 50-year blocks of time, from 1750 through 2000. What caused these changes?

④ Visit Display and examine declining trends in populations and harvests over the last 30 years.

**Activity 1:** Graph population changes in 50-year blocks of time. Include a time line listing major social trends and agricultural practices that affected the bobwhite population. Discuss what is being done to reverse the trend of decreasing bobwhite populations. Discuss how populations of species with habitat requirements different from bobwhites may have changed historically.

Visit Display and look at aerial habitat photograph and “Create a Habitat” section.

**Activity 2:** *No Place to Hide.* This activity simulates the plight of bobwhites.

For a class of 30 students, use 30 strips of (colored) paper:

- Write bobwhite on 10 (white).
- Write woods on 5 (gray).
- Write grassy field on 5 (green).
- Write fence row on 5 (brown).
- Write predator on 5 (red).

Designate a playing area, outside if possible. Define boundaries with two lines about 10 yards apart. Let the students randomly choose a slip of paper to decide their role in the simulation.

Predators line up on one line. Bobwhites line up on the other line. Woods, grassy fields, and fence rows spread out between the lines. The object is for bobwhites to grab onto the different types of habitat before predators tag them. Grassy fields and fence rows can each provide shelter for up to two bobwhites. Woods can provide shelter for only one bobwhite.

*Round 1--1750:* The new land is largely forested; habitat for bobwhites is scarce.  
Play the round with: 10 bobwhites, 5 predators, 5 woods, 0 grassy fields, 0 fence rows.

*Round 2--1800:* New settlers begin to clear forests and cultivate crops in small fields; habitat for bobwhites is increasing.  
Play the round with: 10 bobwhites, 5 predators, 4 woods, 2 grassy fields, 2 fence rows.

*Round 3--1850:* More land is cleared for agriculture; habitat for bobwhites increases.  
Play the round with: 10 bobwhites, 5 predators, 3 woods, 4 grassy fields, 4 fence rows.

*Round 4--1900:* Farming practices and land use

practices provide excellent bobwhite habitat.  
Play the round with: 10 bobwhites, 5 predators, 2 woods, 5 grassy fields, 5 fence rows.

*Round 5--1950:* Farming practices and land use practices change; habitat available for bobwhite begins to decrease.  
Play the round with: 10 bobwhites, 5 predators, 2 woods, 4 grassy fields, 4 fence rows.

*Round 6--2000:* Bobwhite population is in severe decline; habitat is scarce.  
Play the round with: 10 bobwhites, 5 predators, 1 woods, 2 grassy fields, 2 fence rows.

## Discussion Points

How did changes in habitat affect population density?

What improvements could be made through habitat management? Implement these changes and conduct Round 7 using the new habitat portions.

## Looking Beyond

Research and share the history of other wildlife species native to America.

Contact a local wildlife biologist or other specialist to talk about their occupations and related work.

Ask a farmer to talk about his farming practices and discuss how they affect wildlife. Ask him if farming practices have changed over the period of time he has farmed. How have they changed?

**Lesson II addresses the following Mississippi State Curriculum Objectives for grades 3-4.**

Science (L,S)3.1, (L,E,P,S)3.13, (L,E,P,S)3.14  
(L,S)4.3, (L,E,P,S)4.13, (L,E,P,S)4.14

Math 3<sup>rd</sup> grade - (P,G,N)1.a, (P,D,M,G,N)4.a, 4.b  
4<sup>th</sup> grade - (P,M,G,N)1.a, 1.b,  
(P,D,M,G,N)4.a, 4.b

Social Studies (3<sup>rd</sup> and 4<sup>th</sup> grade)  
(C,H,G,E)1.a, (C,H,G,E)1.b

# III. Life History and Behavioral Ecology

## Lesson III

<b>Grade:</b>	3-4
<b>Focus:</b>	Life History, Population Dynamics.
<b>Subject:</b>	Science, Math.
<b>Materials:</b>	Display - Center Section with Life Cycle Video - Part 2: <i>The Role of Research</i> . Video <i>Bobwhite Habitat Management in Mississippi</i> (life history section). Publication - <i>The Northern Bobwhite</i> , pages 8-10, and <i>Ecology and Management of the Northern Bobwhite</i> , pages 3-6. Activity 1 - Paper, drawing supplies. Activity 2 - Gymnasium or other playing area.
<b>Teaching Time:</b>	One class period (minimum).
<b>Vocabulary:</b>	Reproduction, population dynamics, natality, mortality.

## Learning Objectives

<b>Students will:</b>	Describe the nesting and brood-rearing activities of bobwhites. Construct a figure depicting the rear-round activities of bobwhites. Participate in an exercise illustrating the importance of reproduction.
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## Background

During the winter, bobwhites live in social groups of 10-16 individuals called coveys. From April to September, males (cocks) and females (hens) live in pairs and their activities focus on reproduction.

Bobwhites build their nest on the ground in grassy or weedy areas. When the nest is complete, the female deposits one egg each day until the clutch of about 12 eggs is complete. Incubation takes about 23 days with the female generally doing the incubation. Predators often destroy bobwhite nests and eat eggs. If early nesting attempts are not successful, bobwhites can renest up to three or four times during the breeding season.

Chicks leave the nest with their parents soon after hatching. This new group of bobwhite chicks is called a brood. During the first two weeks of their life, chicks feed almost exclusively on insects. During the next few weeks, they gradually increase

the amount of plant material eaten. Chicks can fly when they reach two to three weeks of age. They grow rapidly to look like and weigh as much as adults after only 15 weeks.

The bobwhite population on a given area is the result of a balance achieved between natality (births) and mortality (deaths). Bobwhites have a high reproductive potential. They are capable of producing many offspring in any given year. The annual production rate for quail is 70 to 80 percent and is matched by an equivalent death rate. Deaths can result from a variety of factors, such as predators, hunting, pesticides, or weather.

Habitat and land use practices heavily influence bobwhite population levels. During the nesting season, bobwhites need areas of nesting and brood-rearing cover. Bobwhites prefer to nest in thin to moderate stands of grasses, especially broomsedge

and other native, warm-season grasses. Areas of clovers, lespedezas, or alfalfa can serve as brood-rearing cover. These areas produce high numbers of insects that are important in the diet of young chicks.

## Learning Procedure

① View video Part 2: *The Role of Research*. View video *Bobwhite Habitat Management in Mississippi* beginning after Stoddard with bobwhite whistling and through life history section to second bird whistling.

② Distribute publication: *The Northern Bobwhite*. Read pages 8-10 for supplemental information, and read pages 3-6 beginning with Can Quail Be Managed Successfully, Life History-through Covey Structure.

③ Visit the display: Examine the life history sectional circle in the center of the display.

④ Discuss the year round activities of bobwhites. Why do these activities change throughout the year?

**Activity 1:** Have students draw a diagram depicting the yearly life cycle of bobwhites. The figure should be circular and indicate the major stages in each of the 12 months. Have students include more detailed information for reproductive activities, such as the number of days required for laying and incubating a clutch of eggs and the number of weeks required for chicks to develop.

**Activity 2:** *Oh Quail*. (Adapted from *Project Wild*) This activity emphasizes the importance of nesting habitat and reproduction to the population dynamics of bobwhites.

Mark two parallel lines on the ground about 10 or 20 yards apart. Have the students count off in fours. Have the ones line up behind one line and the rest of the students line up behind the other.

The ones become quail. To survive and reproduce, they need good habitat throughout the year, especially nesting and brood rearing areas during the spring and summer.

The twos, threes, and fours become habitat components. They will represent one of three habitat categories: 1) Nesting Cover, 2) Brood Rearing Cover, or 3) Winter Food and Cover.

To begin the first round (or the first year), have the students line up on their respective lines with their backs to the students on the other line. Students that are habitat components choose one of the three categories to represent. Students that are quail choose one habitat component that they will need. Have students make a visible sign to indicate what they represent (if they are habitat) or what they are looking for (if they are quail). Students should:

Fold their arms across their chest if they are Nesting Cover.

Put their hands on top of their head if they are Brood Rearing Cover.

Hold their arms out to the side if they are Winter Food and Cover.

Once students have chosen a habitat component, they are not allowed to change it until the next round. At the beginning of the next round all students (both quail and habitat components) may change the type of habitat they are seeking or representing.

On the count of three, have the two groups turn and face each other. When quail see the habitat component they need, they are to run to it. Each quail that obtains its necessary habitat component brings that component back to the quail side of the playing area. In the next round, that habitat component becomes a quail. This represents the quail surviving through the year and successfully reproducing.

Any quail that fails to obtain its habitat component dies and becomes part of the habitat. That is, the quail that died becomes either Nesting Cover, Brood Rearing Cover, or Winter Food and Cover and is available to quail in the next round. Habitat components that the quail do not obtain remain in the habitat in the next round, as well.

Continue the game for about 15 rounds. The instructor or students should keep track of the number of quail alive at the beginning of each round.

After 15 rounds graph the results of the exercise on a chalkboard. Plot the round (x-axis) against the number of quail alive at the beginning of each round (y-axis). Each round represents one year's time. The students will see that the population increased sharply for the first few years and then fluctuated for the remainder of the exercise. These fluctuations are to be expected. As long as there is good habitat and enough individuals to reproduce, the population will persist.

## Discussion Points

What role does reproduction play in population dynamics?

Why do population levels fluctuate?

What role does habitat play in population dynamics?

Lesson III addresses the following Mississippi State Curriculum Objectives for grades 3-4.

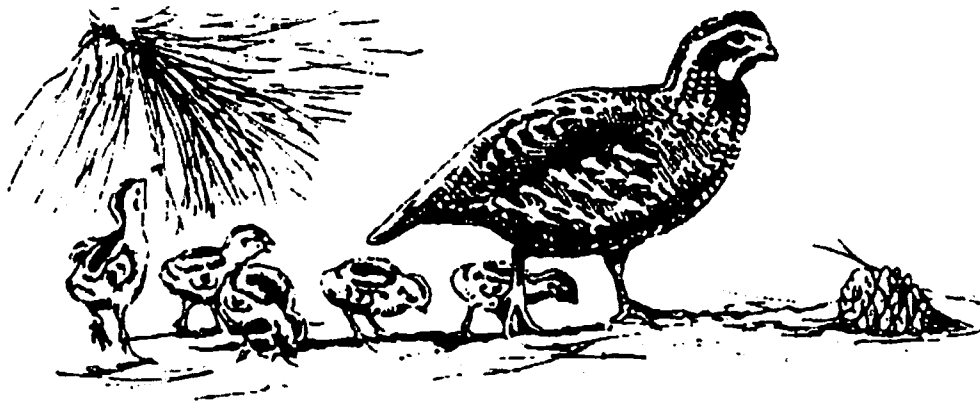
Science (L)3.3, (L,E,P,S)3.13  
(L)4.3, (L,E,P,S)4.13

Math 3<sup>rd</sup> grade - (P,G,N)1.a, (P,D,M,G,N)4.a, 4.b  
4<sup>th</sup> grade - (P,M,G,N)1.a, 1.b,  
(P,D,M,G,N)4.a, 4.b

## Looking Beyond

Have a wildlife biologist speak to the class about population dynamics.

Research and share the reproductive activities of other species, such as black bears, bullfrogs, rabbits, bald eagles.



# IV. Plant Succession



## Lesson IV

<b>Grade:</b>	3-4
<b>Focus:</b>	Plant Succession, Changes in Vegetation over Time
<b>Subject:</b>	Science
<b>Materials:</b>	Display-Section on Plant Succession Video-Bobwhite <i>Habitat Management in Mississippi</i> (Soil Disturbance and Succession Section in Habitat Management part). Publication- <i>Ecology and Management of the Northern Bobwhite</i> , pages 6-7, first two paragraphs under Habitat Needs section. Activity 1 - Aquarium, several large clear plastic containers, soil, seeds, water, poster paper, markers
<b>Teaching Time:</b>	One class period (minimum)
<b>Vocabulary:</b>	Succession, annual, perennial, seral stage

## Learning Objectives

**Students will:** Learn how basic plant succession takes place. Understand how bobwhite need habitat with early successional stages with frequent soil disturbance. Grow a "Forest in a Jar" to illustrate plant succession.

## Background

Plant succession is an orderly and natural process of change in vegetation over time. There are different types of environments that allow succession to take place in different ways and with different plants. These may include deserts and grasslands like those found in the western part of America, or they might be forestland like that found in the Southeast. If land is left undisturbed in the Southeast, bare ground will quickly become colonized (grow up) to early successional plants like annual weeds, then perennial weeds and later grasses. After the grasses, shrubs or small sapling trees will grow on the site, crowding out the weeds and grasses. These saplings will be replaced by, or grow up into, mature pine or hardwood trees, and eventually the process is completed by what we term a "climax forest," which in much of Mississippi includes oak and hickory trees. A climax forest will not change much for a long, long time, unless some catastrophic event like a fire or hurricane damages it.

Bobwhite need early successional habitats to survive and reproduce. They eat seed from grasses and annual weeds, make their nests in dead bunches of grass, and need some bare dirt to move around and find food on the ground. We can manipulate the plant community to provide good early successional habitat for bobwhite. Wildlife biologists use habitat management practices like timber harvest, disking, farming, and prescribed burning that you will learn about in later lessons. Early successional habitats can also be provided beneath a forest, if open enough for sunlight to shine down through the trees and produce grass and weeds.

## Learning Procedure

① View display: Visit the display and view the plant succession section. See how habitat management techniques are used in different successional stages.

② View video: Watch the *Bobwhite Habitat Management in Mississippi* video and section in Habitat Management portion that discusses soil disturbance and succession.

③ Distribute publication: *Ecology and Management of the Northern Bobwhite*. Read pages 6-7, first two paragraphs under Habitat Needs section.

④ Discuss different successional stages that are found outside and around your home. Can you remember any areas that have "grown up" or changed in plant composition over time? Describe them.

**Activity 1:** Conduct an experiment using soil, water, seeds, plants and a large gallon jar or aquarium (bigger the better). Gather the seeds from the wild plants or use bird or garden vegetable seeds to represent grass, trees, etc. Draw a poster to represent plant succession and the results of the experiment.

As a class project, use a large aquarium. Individually, use large, clear, plastic jars.

Place several inches of soil in the container(s), and saturate the soil with water. This can represent a wetland. Plant 3-4 seeds in the container once or twice per week. Knowing what type seeds are used can help you to design the successional process. Put grass or weed seeds in one end, and plant something taller (like sunflower seeds) at the other end to represent trees. Add water as needed to represent rainfall. After the plant succession takes place (fully grown) over several weeks, make a change in the habitat. For example, clip the sunflowers to illustrate a tornadic event or timber harvest. Then plant grass or weed seed where the sunflowers were and see the process of succession start again!

Have each student make a poster, drawing, or other visual representation of what they observed with their container and the class container. Ask them to talk about what they have learned about how environments can change.

## Discussion Points

How fast did the plant changes take place in the experiment? How would that compare to plant succession in the real world (climax forest in 100+ years)?

Brainstorm what catastrophes or man-caused events can impact succession.

Discuss why bobwhite need early successional stages.

## Looking Beyond

Compare the way bobwhite fit into succession with other wildlife species like cottontail rabbits (very similar) or black bears (different).

Take a trip to a Wildlife Management Area or Farm. Can you find areas that exhibit natural plant succession? Are there areas where landowners or wildlife managers are manipulating habitat and altering successional stage?

Lesson III addresses the following Mississippi State Curriculum Objectives for grades 3-4.

Science (L,S)3.1, (L)3.2, (L)3.3  
(L,S)4.3



# V. Habitat Requirements

## Lesson V.

<b>Grade:</b>	3-4
<b>Focus:</b>	Habitat Requirements
<b>Subject:</b>	Science, Social Studies
<b>Materials:</b>	Display – view bobwhite foods section and life history wheel Video – Part 3: <i>Habitat is the Key</i> ; and <i>Bobwhite Habitat Management in Mississippi</i> Publication – <i>The Northern Bobwhite</i> , pages 11-12, and <i>Ecology and Management of the Northern Bobwhite</i> Activity 1 – Drawing paper, crayons Activity 2 – Space for the class to form a large circle
<b>Teaching Time:</b>	One class period (minimum)
<b>Vocabulary:</b>	Habitat requirements, home range, cover

## Learning Objectives

<b>Students will:</b>	Describe the habitat components necessary for bobwhite quail. Describe how changes in habitat availability affect populations. Participate in a game illustrating the habitat needs of bobwhites.
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## Background

All wildlife species, including bobwhite quail, need adequate food, water, cover, and space to survive. Areas with an interspersed of cropland, grassland, and brushy cover or woodlands offer excellent habitat for bobwhites. Typically, prime bobwhite habitat consists of 30 to 40 percent grassland, 40 to 60 percent cropland, and 5 to 40 percent brushy cover or woodlands.

Although bobwhites are predominately seed eaters, they also feed on a variety of insects, berries, fruits, and green, leafy vegetation. This diet generally provides them with enough moisture, so standing water is rarely a critical habitat component.

Bobwhites require a variety of cover. They need adequate protective cover, such as dense thickets of honeysuckle and briars, for roosting and to shield them from the elements and predators. Grassy and

weedy areas are necessary as nesting cover. Sparse stands of weeds or grains with lots of bare ground provide excellent feeding cover.

Bobwhites can typically live in relatively small areas. Bobwhites living in good habitat need less space than those living in less suitable habitat. Yearly homeranges of bobwhites usually range from 15 to 100 acres in size.

## Learning Procedure

① Visit display – view bobwhite foods and life history wheel.

② View video – Part 3: *Habitat is the Key* and *Bobwhite Habitat Management in Mississippi*.

③ Distribute publications – *The Northern Bobwhite*.  
Read pages 11-12  
*Ecology and Management of the Northern Bobwhite*.  
Read pages 6-8

④ Discuss the habitat needs of bobwhites. Are their habitat needs related to different activities? What types of habitat are necessary during spring and summer? What types are important in winter?

## Activity 1

Have half of the class draw a map of an area that would provide excellent bobwhite habitat. Have the other half of the class draw a map of an area that lacks some critical habitat components and offers poor bobwhite habitat. Reinforce the lesson by having students explain to the class why their area offers either good or bad habitat. Using encyclopedias or other sources of information, discuss how suitable these areas would be for other species such as the following:

American robins	wood thrushes
white-tailed deer	gray squirrels
bullfrogs	peregrine falcons

## Activity 2: *Habitat Lap Sit* (Adapted from *Project Wild*)

Have the students form a circle and number off “one,” “two,” “three,” and “four.” The “ones” become “croplands,” the “twos” become “grasslands,” the “threes” become “woodlands,” and the “fours” become “space.”

Have the students turn sideways and squeeze toward the center until the circle is very tight. The students should be standing close together and looking at the back of the head of the student in front of him or her.

*Situation 1 – Habitat components are available and in the proper arrangement.*

At this point, all the students need to be attentive and listening carefully. Everyone should place his or her hands on the waist of the person in front of them. On the count of three, everyone sits down against the knees of the person behind them, while keeping their own knees together to support the person in front of them. The circle is complete because the habitat requirements are met.

*Situation 2 – Remove some critical habitat components.*

Change the circumstance and remove the appropriate habitat components from the circle. For example:

“Urban sprawl has removed the amount of space available for wildlife” or “farming techniques become more efficient and limit the amount of grasslands available for wildlife.”

Without allowing the students to squeeze the circle in closer, have them attempt to sit down again. The circle will collapse or become disrupted as a result of the missing habitat components.

## Discussion Points

Why do alterations in habitat affect wildlife populations?

Will habitat changes have the same effect on all species?

How might minor habitat changes in an area affect bobwhites or wildlife? What about major changes?

## Looking Beyond

Research and share the habitat requirements of other wildlife species.

Visit a nearby park or natural area and determine if the habitat is suitable for bobwhites or other types of wildlife. Identify habitat components that are suitable and those that are lacking.

## Lesson V addresses the following Mississippi State Curriculum Objectives for grades 3-4

Science (L,S)3.1, (L)3.2, (L,E,P,S)3.13  
(L)4.1, (L,S)4.3, (L,E,P,S)4.13

Social Studies

3<sup>rd</sup> grade - (C,H,G,E)1.a, (C,H,G,E)3.d  
4<sup>th</sup> grade - (C,H,G,E)3.a, (C,H,G,E)3.c

# VI. Habitat Management

## Lesson VI.

- Grade:** 3-4  
**Focus:** Managing wildlife habitat  
**Subject:** Science, Social Studies  
**Materials:** Display – view specific habitat management techniques  
Videos – Part 4: *Habitat Enhancement* and *Bobwhite Habitat Management in Mississippi*  
Publications – *The Northern Bobwhite*, pages 13-16, and *Ecology and Management of the Northern Bobwhite*, pages 9-12  
Activity 1 – Paper, drawing tools  
Activity 2 – Hula hoops, long pieces of rope or string, orange safety vests, poster board (for making signs), colored paper  
**Teaching time:** One class period (minimum)  
**Vocabulary:** Habitat management, cover, succession, interspersions, limiting factors

## Learning Objectives

- Students will:** Describe wildlife habitat management techniques.  
Evaluate habitat quality and suggest ways for improvement.  
Participate in an exercise illustrating the importance of proper habitat management.



## Background

Properly managed habitat will produce an abundance of wildlife. To benefit bobwhite, management practices should focus on providing adequate cropland, grassland, and woodlands. The habitat types should intersperse (mix) to provide the maximum amount of “edge” habitat that bobwhites prefer.

If we neglect fields and open areas for several years, woody tree species will invade the sites. These woody species will grow, and eventually a mature forest will replace what was once an open field. We refer to this natural progression of advancing from open fields to mature woods as succession.

There are several techniques that we can use to maintain vegetation in early stages of succession. Prescribed fire is an effective and inexpensive way to

manage idle grasslands areas. Fire creates desirable nesting cover and promotes the growth of native seed-bearing plants important for bobwhite. Disking is another way to set back vegetation. Disking will open up bare ground, stimulate the growth of annual weeds, and prevent woody species from dominating fields.

Bobwhite need some areas of heavy cover for roosting and protection from the elements and predators. Simply allowing vegetation to grow up naturally around fencerows and other areas can provide enough protective cover to support a bobwhite population. Plants such as honeysuckle, greenbrier, and blackberry can grow naturally and provide excellent cover.

In some areas, food may be scarce and limit the

bobwhite population. Disking can be used to promote the growth of many annual weeds that provide seeds. In agricultural areas, an easy way to provide food is to leave some crops standing near suitable cover. Cultivated food plots can also be useful in providing food and are most useful when planted next to protective cover.

## Learning Procedure

① Visit display: view specific habitat management techniques

② View video Part 4: *Habitat Enhancement and Bobwhite Habitat Management in Mississippi*, beginning after life history section (after second bobwhite whistling)

③ Distribute publications: *The Northern Bobwhite*. Read pages 13-16  
*Ecology and Management of the Northern Bobwhite*. Read pages 9-12

④ Discuss the habitat requirements and management techniques important for bobwhites.

### Activity 1

Have students make a map of the school grounds or a nearby area. Include things such as woods, fields, streams, etc. Discuss if the area is suitable habitat for bobwhites. Identify areas where habitat is sufficient or could be improved. Discuss what management techniques would help remedy the problems.

**Activity 2:** *Habitat is the Key* (Adapted from *Project Wild*). This exercise illustrates that survival is difficult without proper habitat.

Identify students as either “hawks” or “quail.” For a class of thirty students, identify three hawks and let the remainder be quail. Have the hawks wear orange safety vests so that they are clearly identifiable.

Use a gymnasium or playing field that is about 100 feet across. Place the hula-hoops within the area to areas of available habitat. Each hula-hoop will be either nesting cover, feeding cover, or protective cover. Place the protective cover areas in between the nesting and feeding covers areas to provide a “safety corridor” for travel between hula-hoops. The students must know what types of habitat are available, so mark the hula-hoops with signs indicating the type of habitat they represent. Also,

place colored slips of paper within the hula-hoops, and use a different color for each habitat type.

The objective is for the quail to travel across the playing area without the hawks tagging them. The habitat patches function as “safety” areas – hawks cannot tag quail while the quail has at least one foot in a habitat patch.

To stimulate the need for a variety of habitats, the quail must visit and collect a slip of colored paper from each type of habitat at least once in their trek across the area.

To stimulate the process of evaluating and managing habitat, conduct the exercise in three rounds, with each round having different amounts of available habitat.

*Round 1 – Protective cover is lacking.*

For a class of thirty students, distribute the following amounts of each type of cover in the playing area:

5 areas of feeding cover  
5 areas of nesting cover  
2 areas of protective cover

With only two areas of protective cover, the quail will become bottlenecked and susceptible to the hawks. It should quickly become obvious to the hawks and quail that there is a lack of protective cover. Play several rounds so that all students can play the roles of both predator and prey.

*Round 2 – Manage the habitat.*

Allow the students to discuss and recommend ways to improve the “habitat” of the playing area for quail. Have them name several management techniques that we can use to increase the amount of protective cover such as allowing thickets to develop or creating brush piles. After doing so, play a few more rounds of the game with the following amounts of each type of cover in the playing area:

5 areas of feeding cover  
5 areas of nesting cover  
5 areas of protective cover

With the increase in protective cover it is much easier for the quail to travel across the playing area. The quail must still travel across areas of open ground between the patches of cover, and the hawks will still tag some.

### *Round 3 – Connect the habitat.*

Discuss how interconnecting the different types of habitat, instead of isolating them, is more useful to quail. Wildlife managers often connect blocks of habitat with fencerows and hedgerows.

Allow the students to use long pieces of rope as “fencerows” to connect the patches of cover. Give the students enough rope to make connections between four or five habitat patches.

The “fencerows” are just like the patches of cover in that they are “safety” areas that provide protection from the hawks. Play several more rounds with the same amount of habitats as in *Round 2*.

## Discussion Points

In the first two rounds, what were the limiting factors of the habitat?

How did we correct the limiting factors and what were the results?

## Looking Beyond

Research and share management techniques used for other species of wildlife.

Have a wildlife biologist or other natural resource professional speak to the class about management techniques.

### Lesson VI addresses the following Mississippi State Curriculum Objectives for grades 3-4.

Science (L,S)3.1, (L,E,P,S)3.14  
(L,S)4.3, (L,E,P,S)4.13, (L,E,P,S)4.14

#### Social Studies

3<sup>rd</sup> grade - (C,H,G,E)1.a, 1.b, 3.d

4<sup>th</sup> grade - (C,H,G,E)3.a, 3.c



# VII. Hunting the Bobwhite

## Lesson VII

<b>Grade:</b>	3-4
<b>Focus:</b>	Role of hunting in bobwhite conservation
<b>Subject:</b>	Science, math
<b>Materials:</b>	Display - view hunting related portions Video - <i>Bobwhite Habitat Management in Mississippi</i>
<b>Teaching Time:</b>	One class period (minimum)
<b>Vocabulary:</b>	Bag limits, carrying capacity, conservation, renewable resources

## Learning Objectives:

<b>Students will:</b>	Describe the historical importance of bobwhite hunting in Mississippi. Describe how regulated bobwhite hunting is incorporated into the wise use of this renewable resource. Describe two ways that hunters have provided primary funding sources for wildlife management efforts in
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## Background

Hunting bobwhite quail is an important recreational pastime in Mississippi and throughout the Southeast. Additionally, the sport of quail hunting has a great history in the Magnolia State. During the 1940s, 1950s, and 1960s, while wildlife managers worked to restore depleted populations of many game species (such as white-tailed deer and wild turkey), bobwhite populations flourished across the state. Most Mississippians introduced to the sport of hunting during these years likely went in search of small game species, such as the bobwhite and cottontail rabbit, in the absence of the big game species so popular today.

Bobwhite are generally hunted with the aid of "pointing" dogs, which are specially bred and trained to locate bobwhite and then "freeze," making the bird's position known to the hunter. These fascinating dogs, with their incredible ability to detect scent and their tendency to stand "on point" for prolonged periods, add greatly to the appeal of quail hunting.

While the unregulated exploitation of any wildlife species (including bobwhite) can lead to the demise of the species, carefully regulated sport hunting can provide outdoor recreational opportunities while

having no negative impacts on the wildlife pursued. Wildlife managers set bobwhite hunting seasons (a framework of dates when bobwhite hunting will be allowed) and daily bag limits (the maximum number of bobwhite a hunter can take in a day) to regulate the level of legal harvest on bobwhite populations.

Wildlife conservation means the wise use of our wildlife resources (as opposed to preservation, which means non-use). Wildlife populations, including the bobwhite, are renewable resources. This means with wise use through managed hunting and other management options, there are as many bobwhite around in years after hunting as there were before hunting began. This phenomenon is caused by a basic principle of wildlife ecology known as carrying capacity. Carrying capacity is the number of animals (in this case bobwhite) that the habitat can support. Additional animals produced (beyond the area's carrying capacity) will not survive, succumbing to such factors as starvation, disease, predation, or other factors. In a perfect situation, sport bobwhite hunting removes surplus birds that would otherwise be lost to other causes.

Ethical bobwhite hunters are conservationists, taking only a few birds from each covey found and

supporting sound conservation practices. Additionally, hunters have aided in wildlife restoration, management, and conservation by being the primary source of funding for wildlife management efforts! Hunters have paid for wildlife management through two primary means: 1) purchase of hunting licenses (these funds go to state fish and wildlife agencies) and 2) paying excise taxes on firearms and ammunition (these funds were the result of the 1937 Pittman-Robertson Act, and they are used to help restore and conserve wildlife populations).

You could probably ask 20 bobwhite hunters why they enjoy bobwhite hunting, and you would probably get 20 unique answers. Harvesting bobwhite is part of hunting them, but it is not necessary to bag a bird to enjoy a hunt. Some might hunt as a family tradition, or to spend time with friends. Others may enjoy the taste of bobwhite, which are delicious table fare. Still others just enjoy watching well-trained bird dogs work to find the elusive bobwhite quail. Probably the most important reason people enjoy quail hunting is because it provides a rewarding form of outdoor recreation that is compatible with the conservation of this important wildlife species.

## Learning Procedure

- 1 View video *Bobwhite Habitat Management in Mississippi* - introduction portion of video which gives an overview of the historical importance of bobwhite hunting in Mississippi.
- 2 Visit display: view section on bobwhite hunting.
- 3 Discuss how renewable resources allows hunters to ethically harvest bobwhite without negatively influencing the population.

### Activity 1:

In a large jar place one piece of candy for each student in the class (this represents a quail population, with each piece being one quail). Add one additional piece for each student (this represents annual recruitment into the quail population). Now allow each student to "harvest" one piece of candy (only one, as this is the "bag limit"). Show students that as long as you do not take more than the annual recruitment, you can harvest and use a number of quail and still have the same population number after the "hunt" as before. This targets the concept of a renewable resource.

Now, again add one additional piece for each student (the next year's annual recruitment). Allow each student to "harvest" three pieces of candy. You will run out of candy before the class finishes this "hunt." This shows that the same population that could sustain a regulated harvest would also crash with unregulated heavy harvest.

Use this exercise to discuss the concepts of renewable resources, bag limits, regulated vs. unregulated harvest, and annual fluctuations in wildlife populations.

## Discussion Points

What are renewable resources?

How do the concepts of "bag limits" and regulated harvests tie in with hunting ethics and renewable resources?

## Looking Beyond

Have a wildlife biologist speak to the class about how hunting is an important element of wildlife conservation and the primary funding source for modern wildlife management efforts.

Have a bird dog trainer give a demonstration to the class on pointing dogs.

Lesson VII addresses the following Mississippi State Curriculum Objectives for Grades 3-4:

Science (L.S)3.1  
(L.S)4.3

Math 3<sup>rd</sup> grade - (P,G,N)1.a  
4<sup>th</sup> grade - (P,M,G,N)1.a

# VIII. WILDLIFE RESEARCH

## Lesson VIII. The role of research in bobwhite management

**Grade:** 3-4  
**Focus:** Wildlife research, scientific method, research methods  
**Subject:** Science, Math  
**Materials:** FWRC News Publication: "State Quail Populations Rebound With Habitat Management"; Publication- The Quail Series II. *The Role of Research*, pages 8-10.

- Activity 1. Sampling theory and estimation: Coffee can with 100 marbles (25 one color, 75 another color).  
 Activity 2. Hypothesis development and testing, effects of environmental conditions on germination of radish seeds: Radish seeds, baby food jars, paper towels, water, salt water, vinegar

**Teaching Time:** 2 class periods

### Learning Objectives

**Students will:** Identify important reasons for wildlife research  
 Understand scientific method  
 Differentiate between descriptive and experimental research  
 Describe estimation  
 Develop and test hypotheses



## Background

Scientific research, involves learning about the world we live in. Wildlife scientists conduct research using the scientific method (see box) to learn about our environment, processes, and relationships. In wildlife research we are interested in understanding *what* animals do, *how* they do things, and *why*. As an example, understanding why animals select certain habitat types helps us to understand *why* they do the things they do. Wildlife research focuses on animal behavior (how they act), populations (how many there are), communities (how animals act around other animals), habitats (where the animals live), impacts by humans, and their views and uses of animals.

What we know about bobwhite today is because of nearly 100 years of research. In the early 1900's Herbert Stoddard studied bobwhite populations in great detail in south Georgia and Northern Florida. His detailed research produced a description of the habitats used by bobwhite, important predators of bobwhite, and response of bobwhite populations to different land management practices. Stoddard studied wild, free-ranging bobwhite as well as captive birds in large pens so that he could describe what bobwhite did. He found many bobwhite nests to determine the types of habitats bobwhite nested in and what happened to the nests. Stoddard's work laid the foundation for scientific management of bobwhite populations. He was the first to identify the important use of prescribed burning to improve bobwhite habitat. At the same time that Stoddard was studying bobwhite in Florida, Paul Errington



was studying bobwhite in Wisconsin. Errington also formed important theories about how weather, winter cover, and predators influence the numbers of bobwhite. In the 1930s and 40's another early wildlife researcher named Aldo Leopold studied quail in Iowa. Based on his research on quail and other species he developed many principles of wildlife management and wrote them in the first wildlife management textbook "*Game Management*". Since the time of these researchers, many other wildlife scientists have continued study of bobwhite. Our understanding of bobwhite habitat needs, behavior, and population processes has increased tremendously because of this wildlife research. Science-based management is ever more important as modern wildlife biologists implement management practices that help increase and restore declining bobwhite populations.

## Research Tools

### Census methods

One of the most fundamental questions we ask about a wildlife population is "How many birds are found on a given parcel of land at a given point in time?" This is also one of the most difficult questions to answer because wild animals are difficult to observe and count. Quail have been censused (counted) using numerous different methods. One method, called a flush count uses a line of observers (people) that systematically walk across an area attempting to flush (make fly) all the quail in the path of the observers. As birds are flushed they are counted. The line of observers walks a transect (line) across an area, then moves over and walks a new path back across the area. This is repeated until the entire area is traversed. One problem with flush counts is that not all birds in the path of the observers are detected. A flush count typically detects only about 1/2 the birds on a property. Thus the number of birds observed in a flush count is often multiplied by 2 to generate a population estimate.

Other census methods are based on hearing birds make distinctive calls. During the spring to early summer breeding season male bobwhite sit on elevated spots such as fence posts and call "bobwhite" in an effort to attract females. During the peak of the breeding season (June), biologists record the number of male bobwhite heard from various listening posts distributed throughout an area of interest. The average number of calling males heard

per listening post provides a measure of the relative size of the breeding population and over several years provides a trend (increase, decrease, stable) in the population.

During the fall and winter, bobwhite are in social groups called coveys. During early fall, at dawn, birds in coveys make a distinctive call to communicate with other nearby coveys. Similar to breeding season calling male counts, biologists use the number of coveys heard at dawn from listening posts distributed throughout an area as a measure of the number of coveys in the population. Because not all coveys call every morning, covey call counts are adjusted for this.

Biologists also catch bobwhites and put bands on them to estimate population size. Wire boxes are used to capture birds during the fall. Captured birds are banded then released. The proportion of banded birds captured in a second trapping interval allows biologists to estimate the total population size at the time of the first trapping interval.

### Radio-telemetry

To provide the habitats and foods needed by bobwhite populations, biologists need to know what plant vegetation and habitat birds use throughout the year. Researchers use miniature radio-transmitters to follow the movements, habitat use, and survival of bobwhite. Bobwhite are captured in wire box traps, banded, then fitted with a miniature radio-transmitter. The birds are then released and tracked by biologists using a radio-receiver and antenna. Radio-telemetry has enabled biologists to determine kinds of habitat used for nesting, raising chicks, feeding, and roosting (sleeping at night on ground). Radios also permit biologists to determine the proportion of nests that successfully hatch and the main predators of bobwhite.

### Micro-video cameras

Radio-transmitters allow biologists to track individual quail and locate bobwhite nests. Miniature video cameras placed at nests located through radio-telemetry help biologists to determine the reasons nests do not hatch. Researchers installed miniature video cameras on nests of bobwhite in Florida and determined that snakes were the most common predator causing nest destruction. Additionally, they learned that raccoons and

armadillos also destroyed many nests. Technology tools like radio-transmitters and micro-video cameras help researchers to better understand quail ecology and manage quail habitats and populations.

## Learning Procedure

- ① View video Part II: The Quail Series. View video Bobwhite habitat Management in Mississippi.
- ② View the display: Visit the display and sections on habitat requirements and predation. Ask students "How do you think scientists determine what makes for good quail habitat or which predators are important?" Say "In today's lesson on wildlife research we will learn how scientists know about bobwhite habitat needs and ecology"

**Activity 1.** *Sampling theory and estimation:* Coffee can with 100 marbles (25 one color, 75 another color). (You may also use beans or other objects).

A population is the total of all animals of a given species occupying a specific area, during a specific time period. A parameter is a characteristic of a population (for example population size, growth rate, birth rate, death rate). Most of the time, researchers cannot measure the characteristic of interest for all individuals in the population, thus we rarely know the true value of a population parameter. Therefore we use a technique called *estimation* to get a close approximation of the population parameter of interest. We estimate population characteristics (parameters) by measuring these characteristics using a sample of the total population (a sample is a small proportion of the total population, randomly selected for study). For example, a scientist might monitor a sample of 100 quail during a year to determine how many survive (live) the entire year. From this sample we draw conclusions about the annual survival of the entire population.

In the associated exercise the jar with 100 marbles is the population. The population parameter of interest is the proportion of the population that is red (or

whatever color is represented by 25 marbles). Tell the students that "We want to know what percent of the population are red marbles. We cannot count the entire jar of marbles so we will take a sample and determine the percentage of the sample that is red." Mix the marbles thoroughly. Without looking (to ensure randomness), have each student take a sample of 10 marbles. Have them count the number of red marbles. Divide the number of red marbles by 10. This quotient is a *sample statistic* and will be that student's estimate of the population proportion. Record this value. Have the first student replace their marbles and repeat for each student in the class. The estimates of the population proportion will clearly vary among students, likely from 0-50%. An average across the entire classroom should provide an estimate very close to 25%, which is the true population parameter. This illustrates that the expected value (average across a large number of samples) of the sample statistic called the *sample proportion* is an unbiased estimator of the population parameter the *population proportion*.

**Activity 2.** *Hypothesis development and testing.* Effects of toxic stress on germination of radish seeds: Radish seeds, baby food jars, paper towels, water, salt water, vinegar

For each child or group of children provide the following:

- 4 baby food jars, with lids
- 16 radish seeds
- 1 heavy paper towel

For the entire classroom, prepare the following solutions

- 1 teaspoon of table salt dissolved in 8 oz of water.
- 8 oz of white vinegar
- 8 oz of water

Have each child or group of children fold the heavy paper towel lengthwise, accordion style, to create a 2" wide x 12" long sheet with 4 layers. Have them trace around a baby food jar lid to create 4 circles on the folded paper towel. Cut the circles out. Now they should have 4 circles, each 4 layers thick, the size of a baby food jar lid. Soak 1 circle (4 layers thick) in the pure water, gently squeeze it out, and place the damp circle in the bottom a jar labeled "Water". Repeat for the vinegar, salt water, and dry towel. Label each jar appropriately. Press 4 radish seeds into the towel in each jar. Place the lid on the

jar and set in a warm, well lit space.

Have the children predict (hypothesize) what will happen to the seeds in each jar (germinate and grow, germinate and die, not germinate). Have the children write down their predictions for each jar. After 2-3 days, have the students come back and observe and record the outcome of their experiments. Discuss possible causes of their results. Discuss hypothesis formation, experiments, observation, drawing conclusions.

### Lesson VIII addresses the following Mississippi State Curriculum Objectives for Grades 3-4:

Science (L.S)3.1  
(L.E.P.S)3.13, 3.14  
(L.E.P.S)4.13,4.14

Math 3<sup>rd</sup> grade - (P,G,N)1.a  
4<sup>th</sup> grade - (P,M,G,N)1.a, 1.b  
- (P.D.M,G,N)4.b

Social Studies  
(C,H,G,E)3.d

## *The Scientific Method* (for teachers)

Scientists, from all disciplines, use research to gain knowledge about components and processes within our universe. The manner in which research is conducted determines the reliability of the resulting knowledge. Scientists, including wildlife scientists, conduct research using a systematic approach to knowledge acquisition involving a series of steps. We refer to these steps as the *scientific method*. Wildlife scientists use the scientific method to avoid drawing false conclusions. The specific manner in which these steps are applied may vary slightly among various scientific disciplines. The first step is *observation*. Scientists observe a process, identify the question of interest, and determine what is already known about this process. Next researchers formulate a theory or *research hypothesis*. A research hypothesis is a possible explanation for the problem under study, stated in a manner that allows it to be tested. The researcher identifies specific *predictions* that arise from the hypothesis. Predictions are events that will occur if the hypothesis is true and will not occur if the hypothesis is not true. The researcher designs and conducts an *experiment* to test the predictions. The researcher analyzes the data from the experiment and draws conclusions about the truth of the hypothesis based on results of the experiment. The theory might be modified or new hypotheses formulated based on conclusions from these experiments. Science is an *iterative* process, meaning these steps are repeated over and over, gradually refining our understanding of the process under observation.

In wildlife science we use both *descriptive research* and *experimental research*. Descriptive research uses systematic observation and measurement to characterize or describe animal behavior and populations. Descriptive research emphasizes estimation of population parameters. A population is the total of all animals of a given species occupying a specific

area, during a specific time period. A parameter is a characteristic of a population (for example population size, growth rate, birth rate, death rate). We estimate population characteristics (parameters) by measuring these characteristics for a sample of the total population (a sample is a small proportion of the total population, randomly selected for study). For example a scientist might monitor a sample of 100 quail during a year to determine how many survive (live) the entire year. From this sample we draw conclusions about the annual survival of the entire population.

Ideas from descriptive studies can be tested more closely using *experimental research*. Experimental research allows for more critical testing of ideas generated by descriptive research. In experimental studies, researchers identify all factors that might influence the process of interest, then manipulates one of these factors, while controlling as many of the remaining factors as possible. For example, researchers might suspect that food availability, habitat quality, and predator abundance might affect survival. They might increase food availability without changing habitat quality or predator abundance to test the effects of food on survival.

Careful application of the scientific method in wildlife research helps us to understand more about how individuals behave and what factors influence population processes like reproduction, survival, and population growth. Wildlife research on bobwhite quail has dramatically improved our understanding of this important species.

# IX. PREDATION

## Lesson IX. Predation

**Grade:** 3-4  
**Focus:** Bobwhite mortality, predation, production  
**Subject:** Science, Math  
**Materials:** MSU Extension Publication: Ecology and Management of the Northern Bobwhite - Section on Life History: Courtship and nesting, Brood rearing, and Covey Structure.

Activity 1. Effects of nest destruction and mortality on numbers of quail.

Teaching Time: 2 class periods

### Learning Objectives

Students will: Understand that predation is a natural process.  
Understand that bobwhite experience high annual mortality.  
Understand that bobwhite experience high nest predation.  
Understand the seasons of the year in which most mortality occurs.  
Identify important predators of adult bobwhite.  
Identify important predators of bobwhite nests and chicks.  
Understand that bobwhite compensate for high mortality by producing large numbers of nests, eggs, and chicks.

## Background

Bobwhite are found in many places including more than 1/2 the United States. There are not as many as in previous years, but they can be locally abundant (> 2 birds/acre) where good habitats occur. Yet bobwhite have low annual survival (not many of them survive an entire year) and only live a short time. Only 30 - 50% of the birds alive in October will survive to become breeders the following spring. Less than 20% of the population will survive an entire year. Most mortality is due to predation.

A *predator* is an animal that kills and eats another animal. *Predation* is the act of a predator catching, killing, and consuming another animal. A *prey* species is one that is the target of predation, the species at risk of being consumed. Predation is a natural process and an important influence on the physical and behavioral characteristics that we observe in wildlife. Prey species, including bobwhite, exhibit physical and behavioral characteristics like camouflage coloration, rapid flight, and use of cover that reduce their vulnerability to predation. Predators, such as Cooper's hawks or raccoons, exhibit physical and behavioral



characteristics like excellent eyesight, keen sense of smell, speed, claws, talons, and teeth that increase their efficiency at catching prey. Predators are constantly trying to locate a meal, and prey species are constantly trying to avoid becoming a meal.

Most bobwhite mortality is directly caused by predation. However, weather, habitat quality, and availability of food resources may weaken and expose birds to predation. Severe snow and ice may limit food supplies for quail, weakening them and increasing their vulnerability to predators. Prolonged drought conditions reduce plant growth, resulting in sparser protective ground cover and increasing visibility of bobwhite to predators. Low food abundance increases the amount of time bobwhite spend actively feeding, potentially increasing their exposure to predators.

The specific predators that are important vary throughout the annual cycle. During November and December predation by other birds, especially Cooper's hawks, is high as large numbers of northern hawks migrate to Mississippi. January and February is the breeding season for great-horned owls. They increase their hunting activity and catch many bobwhite trying to feed young nestlings. During March and April, predation by Cooper's hawks increases as migratory hawks move through heading back north. During the nesting season, adults incubating nests are particularly vulnerable to mammalian predators including feral cats, foxes, bobcats, and raccoons. Nests are well camouflaged, but are vulnerable to animals that hunt using scent. Mammalian predators have keen senses of smell and can detect a hen sitting on a nest from a considerable distance. After the nests hatch, adults accompany the young chicks, brooding (keeping them warm), leading them through insect rich habitats, and protecting them from predators. Chicks are flightless during the first 2 weeks

after hatch. During this flightless period the adults are protective parents, defending them from all threats.

Large snakes, including rat snakes and king snakes, cause significant mortality for young broods and attending adults.

Adult birds are not the only life stage vulnerable to

predation. Eggs and chicks also experience high predation. On average, even in good habitat, only 33-60% of nests will survive the 23 day incubation period. There are many predators that enjoy eating quail eggs. Snakes, including rat snakes, king snakes, and racers, are the most important nest predators, accounting for nearly 1/2 of all nest failures. Mammalian predators, including raccoons, armadillos, skunks, and opossums, are next most important. Even fire ants can cause nest destruction in some areas. Many of the same predators that destroy nests also like to eat quail chicks. Most chick mortality occurs during the first 2 weeks after hatching. Only 30 - 50% of the chicks that hatch will survival to 3 weeks of age. After the chicks can fly (12-14 days of age), mortality declines substantially.

The relative importance of predation to bobwhite populations and the specific group of predators that are important varies across the geographic range of the bobwhite. In general, as you move from north (Wisconsin, Iowa, Indiana, etc) to south (Mississippi, Alabama, Georgia, Florida, etc) the number of kinds and abundance of predators increases. For northern populations severe winter weather seems to be more important in determining population patterns. In southern populations



facing more complex and abundant predator communities, predation may be more important.

Regardless of the geographic location all bobwhite populations experience high mortality during all life stages (egg, chick, and adult). Many other animals, including humans, like to eat quail. Bobwhite populations deal with this high mortality by exhibiting very high productivity. Females lay large clutches (12-15 eggs/nest), readily re-nest following nest failure, and some attempt more than 1 nest per season. Bobwhite populations are adapted or designed to deal with high mortality by producing many offspring.

Understanding how predation influences bobwhite numbers is of greater relevance today than ever. This is due to loss of habitat and increasing population trends exhibited by certain bobwhite predators. Generally, bobwhite habitat is not as good as it once was, because our farming, ranching, and forestry practices have changed. Today, individual landowners in many cases comprise the only active bobwhite habitat managers. These areas of good quail habitat provide high population, but they are isolated examples. The need to understand how predation affects quail numbers *at a given location* is greater than ever. Scientists at Mississippi State University and throughout the Southeast are working together to better understand how the diversity and abundance of predators, plant communities, and land use practices interact to affect bobwhite populations.

## Learning Procedure

## Activity 1

Bobwhite experience high mortality at every life stage. Bobwhite start out life as an egg in a nest. To survive long enough to become an adult bobwhite the young bird has to survive through the nest stage, chick stage, and juvenile stage. There are many predators along the way that wish to make a meal out of the young birds.

This activity will require the student to use basic math skills in a simple population model, students will demonstrate how important it is for bobwhite to produce lots of young, given their high mortality rate.

Photocopy the attached worksheet labeled "Lesson IX-Activity 1." Provide each student with a worksheet.

## Discussion Points

How do weather patterns affect Bobwhite Quail predators?

How do Bobwhite Quail adults offset the loss of nests?

## Looking Beyond

Discuss the food web. Where do the predators of Quail fit into the food web.

Discuss the human role as a predator.

**Lesson IX addresses the following Mississippi State Curriculum Objectives for grades 3-4.**

Science (L)3.2, (L)3.3, (L)4.1

Math

3<sup>rd</sup> grade (P, D, M, N) 7e, 9a

4<sup>th</sup> grade (P, D, M, N) 4b, 7c

# Predation and Bobwhite Productivity

## Lesson IX - Activity 1.

### Background

Bobwhite experience high mortality at every life stage. Bobwhite start out life as an egg in a nest. To survive to become an adult breeding bobwhite the young bird has to survive through the nest stage, chick stage, and juvenile stage. There are many predators along the way that wish to make a meal out of the young birds. This activity will demonstrate how important it is for bobwhite to produce lots of young.

### Instructions

#### Nest Stage



In good habitat approximately 1/2 of all the nests incubated by bobwhite will survive long enough to hatch. The remainder will be destroyed by predators.

Ten pairs of bobwhite (20 breeding adults) each produce a nest. Each of these 10 nests contains 12 eggs.

Question 1. How many eggs did the 10 pairs produce? \_\_\_\_\_  
(Hint:  $10 \times 12 = ??$ )

#### Hatching



Half the nests were destroyed by predators, the other 1/2 hatched.

Question 2. How many nests hatched? \_\_\_\_\_  
(Hint:  $1/2$  of  $10 = ??$ )

Question 3. How many chicks hatched out of the successful nests? \_\_\_\_\_  
(Hint: Multiply the answer from question #2 by 12)

#### Chick Survival



Two-thirds of the chicks were eaten by predators, the other 1/3 survived.

Question 4. How many chicks survived to fall \_\_\_\_\_  
(Hint:  $1/3$  of the answer from Question 3)



## Juvenile Survival



Of those chicks that survived to fall, 1/2 made it through the winter to become breeding adults.

Question 5. How many chicks survived to become a breeding adult? \_\_\_\_\_  
(Hint: 1/2 of the Answer from Question 4)

## Breeders



Question 6. Did the original 20 breeding adults produce enough nests, eggs, and chicks to replace themselves?  
\_\_\_\_\_

It is a good thing that bobwhite are productive and can reneest many times!!!



# Predation and Bobwhite Productivity

## Lesson IX - Activity 1 Key

### Background

Bobwhite experience high mortality at every life stage. Bobwhite start out life as an egg in a nest. To survive to become an adult breeding bobwhite the young bird has to survive through the nest stage, chick stage, and juvenile stage. There are many predators along the way that wish to make a meal out of the young birds. This activity will demonstrate how important it is for bobwhite to produce lots of young.

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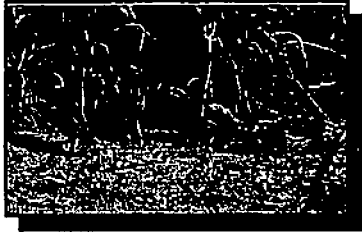
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## Juvenile Survival



Of those chicks that survived to fall, 1/2 made it through the winter to become breeding adults.

Question 5. How many chicks survived to become a breeding adult? \_\_\_\_\_  
(Hint: 1/2 of the Answer from Question 4)

## Breeders



Question 6. Did the original 20 breeding adults produce enough nests, eggs, and chicks to replace themselves?  
\_\_\_\_\_

It is a good thing that bobwhite are productive and can reneest many times!!!



**Answers:**

1. 120
2. 5
3. 60
4. 20
5. 10
6. NO

## Video presentation

### Material covered

***Bobwhite Habitat Management in Mississippi*** is a production of the Mississippi State University Extension Service/Department of Wildlife and Fisheries. This video provides students with an overview of Mississippi's bobwhite quail. While watching ***Bobwhite Habitat Management in Mississippi***, students will learn about the history and hunting tradition that have been associated with this princely game bird, its annual life cycle, habitat requirements, and habitat management techniques. They will also find out what some landowners and bobwhite enthusiasts have done to encourage bobwhite on their land, and who can provide technical assistance with bobwhite habitat. The material in this video will not only help students learn more about bobwhite quail and its habitat requirements, but hopefully will generate interest to learn more about Mississippi's wonderful wildlife resources.

This video will also serve as an introduction to the concepts to be presented in ***The Life and Times of Bobwhite Quail in Mississippi*** program.

### Running time

35 minutes

### Use

This video can be used as an introduction to ***The Life and Times of Bobwhite Quail in Mississippi*** program at the beginning of the various lesson plans. See the lesson plans for details.

The Northern Bobwhite



PB1611

Agricultural Extension Service  
The University of Tennessee



## ACKNOWLEDGMENTS

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## FOR ADDITIONAL INFORMATION

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### ■ Books

*The Bobwhite Quail: Its Habits, Preservation, and Increase*, by Herbert L. Stoddard provides a great deal of information on many aspects of bobwhite ecology.

*A Sand County Almanac*, by Aldo Leopold, is an insightful look into how our society views conservation.

### ■ Agencies

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<http://www.state.tn.us/twra/index.html>

**Tennessee Department of Agriculture,  
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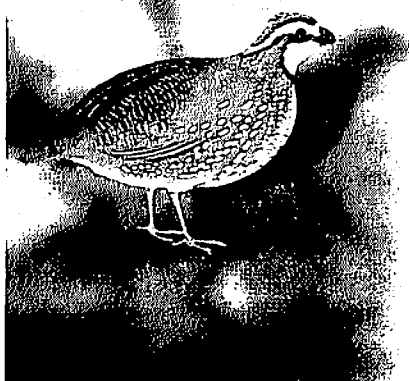
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When youth have completed the activities outlined in this workbook and viewed the companion video series on the ecology and management of the northern bobwhite, they will have gained an understanding of many ecological and conservation principles. Specifically, they will be able to do the following:

- 1. Describe the physical characteristics and life history of the northern bobwhite.
- 2. Describe quail habitat features including primary food, water, cover, and space needs.

## OBJECTIVES

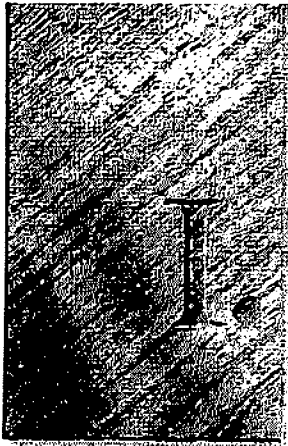
- 3. Explain basic features of bobwhite population dynamics.
- 4. Explain the importance of research and describe several research techniques.
- 5. Explain how hunting, predation, and other mortality factors affect quail populations.
- 6. Explain the importance of habitat management and describe quail habitat management practices.

populations of many species of wildlife are in decline and wildlife habitat is being lost at an alarming rate. Many private organizations and state wildlife agencies are working to reverse these trends. Wildlife scientists are conducting research and are using the information that they generate to develop more effective management strategies and techniques. Many conservation groups such as Quail Unlimited and Wildlife Forever promote conservation practices and the wise use of renewable natural resources. Youth groups, such as 4-H, are involved, too. Many members of our society, however,

## INTRODUCTION

still lack a basic understanding of ecology and conservation. This workbook and companion video series will provide youth with information necessary to understand and appreciate the ecology of the northern bobwhite, a popular game bird whose populations are in serious decline. The principles of ecology and management regarding bobwhite quail are applicable to many other species of wildlife. Although this booklet and video series focus on the bobwhite quail, they can aid in understanding basic ecological principles that apply to many other species and situations.





# INTRODUCTION TO THE NORTHERN BOBWHITE

## *General Information*

### ■ History of Wildlife in the United States

When Europeans first settled North America, they were amazed at the abundance and diversity of natural resources in their new homeland. There were great networks of streams and rivers, and expanses of forests, prairies, and rugged mountains. There was much to learn and do to make this new land a hospitable place to live.

The colonists were exposed to many species of wildlife that Europeans had never seen. White-tailed deer, raccoons, opossums, beavers, northern bobwhites, wild turkeys, wood ducks, passenger pigeons, copperheads and rattlesnakes, and many others were new to them. Many of these species became sources of food and clothing for the new settlers as they had been for native Americans for thousands of years.

The supply of wildlife seemed inexhaustible. The settler's pressure on wildlife caused many species to decline in numbers. Little thought was given to placing limits on the number of animals that hunters could take or to the fact that clearing land for farms and towns greatly changed the landscape. White-tailed deer, wild turkey, wood duck, bison, and many other species became rare.



### ■ The Northern Bobwhite

Not all species were hurt by the settlement of North America. Species like the northern bobwhite were actually helped. On most farms there were places where woodland, brush, and cropland came together. This **"edge" habitat** was ideal for bobwhites. Thus, in the late 1800s and early 1900s, quail were a common sight on most farms. Bobwhites became a source of food and recreation. Across the Southeast it became the "prince of game birds."

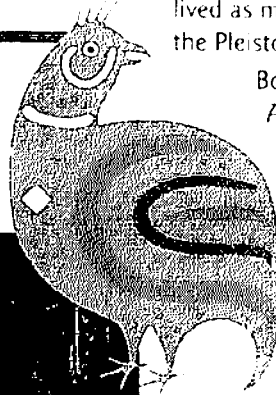
In the mid-1900s, farming practices changed greatly. New technologies and practices led to more intensive farming. Farms with small fields and areas that provided habitat for wildlife became obsolete. Farms with large fields and little wildlife habitat were more common. Many areas were no longer able to support quail or other species of wildlife. As a result, bobwhite numbers have declined sharply during the last 50 years.



## ■ Taxonomy and Distribution

Northern bobwhites are related to other chicken-like birds (sometimes called **Gallinaceous** birds) such as wild turkeys, grouse, pheasants, and domestic chickens. The official classification for bobwhites is:

Order **GALLIFORMES**  
Family **Phasianidae**  
Genus **Colinus**  
Species **virginianus**



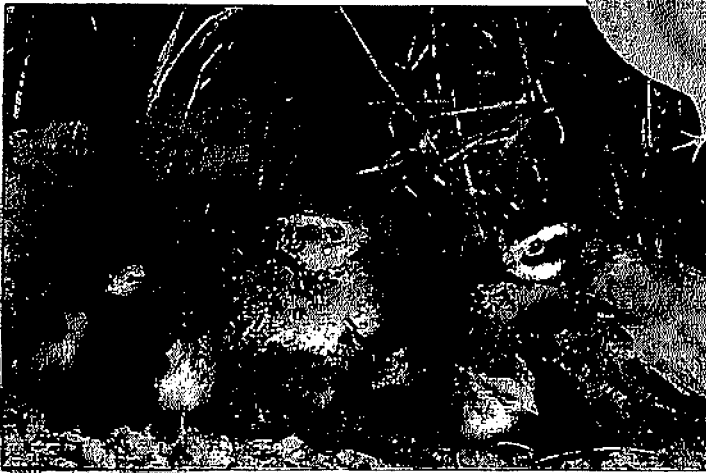
## ■ History and Current Status

We know little about the bobwhite's evolutionary history. Fossil remains of quail and their ancestors are scarce. Scientists, however, have discovered fossils in Florida that indicate the bobwhite we know today lived as many as 15,000 years ago during the Pleistocene Era.

Bobwhite remains at early Native American village sites are scarce even though they probably were a food source. Remains of larger animals like white-tailed deer and wild turkeys are found more often. Most likely, these animals were more abundant, provided more food, and were easier to obtain than the small bobwhite.

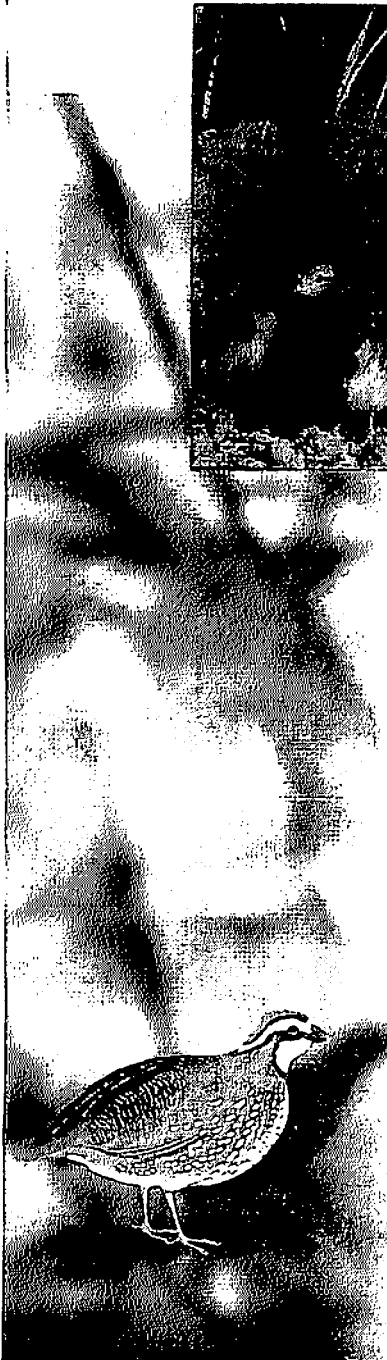
Quail probably didn't receive much attention as a source of food or recreation until European settlers reached the United States. William Penn, the founder of Pennsylvania, listed the bobwhite as a valuable food source for early colonists. Early explorers listed the bobwhite as being relatively common in the early 1800s. By the mid-1800s, they were capturing and selling bobwhites in many states. John James Audubon, a famous naturalist, reported seeing many quail and wrote that large numbers were trapped for market.

Quail populations in the United States were increasing in the North until about 1860 and increasing in the South until about 1890. After this, populations were large and remained fairly stable until about 1940. Since 1940, populations have been decreasing. In spite of this downward trend, the northern bobwhite is still one of the most commonly harvested game birds in the United States. Population declines are primarily the result of deteriorating habitat conditions. Woodlands have become too dense, pastures have replaced row-crop farming, and hedgerows and other protective areas are becoming scarce.



Bobwhites are found in the eastern half of the United States, eastern Mexico, and parts of Central America. Scattered populations exist in a few western states where man introduced bobwhites many years ago.

There are five other species of quail in the United States. The mountain quail (*Oreortyx pictus*) lives at high altitudes in the mountains of the Pacific Coast region. California quail (*Callipepla californica*) are found in the valleys of the far west. Gambel's quail (*C. gambelli*) and scaled quail (*C. squamata*) live in the desert-shrub and grassland habitats of the West. The harlequin quail (*Cyrtonyx montezumae*) lives on desert slopes in Texas, Arizona, and New Mexico.



## Bobwhite Life History

The bobwhite is a small, **gallina-ceous** bird belonging to the family Phasianidae, which includes the other North American quails. Bobwhites are 9 to 10.5 inches long and weigh 6 to 7 ounces when full grown. You can distinguish males from females by a white eye stripe and throat patch that are buff-colored in the females. Quail are social birds and spend the fall, winter, and early spring living in groups called **coveys**.

Coveys generally contain 10 to 16 individuals, but on occasion may have as few as six or as many as 25.

### ■ Reproductive Cycle

The "bob-white" whistle of early spring is an indication that quail coveys are beginning to break up and individual males and females are beginning their courtship behavior. An adult hen (female) and cock (male) quail will usually form a pair for the entire nesting season. In Tennessee, the nesting season usually lasts from April until September. Most quail nests are built in May, June, and July.

Both females and males help build the nest. They choose a site in a grassy or weedy area and build their nest on the ground. The hen quail will lay a **clutch** of about 12 eggs. During the laying period, hens lay one egg each day, and spend little time at the nest before the clutch is complete. Incubation lasts for 23 days and is usually carried out by the female, though males may incubate eggs in some instances. During incubation, one of the parents will sit on the nest about 21 to 22 hours each day. Once the eggs start to hatch, all chicks hatch within a 24-hour period and leave the nest together a few hours later when they are dry. This new group of quail chicks is called a **brood**.

Predators often destroy quail nests and eat eggs. If their early nesting attempts are not successful, quail can renest up to three



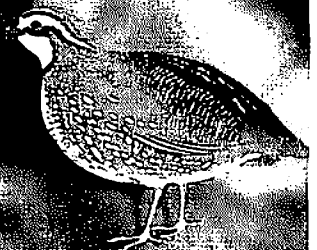
or four times during the year. Quail may successfully hatch eggs as late as October, but chicks hatched after September 1 are not as likely to survive as those born earlier in the year. Quail usually rear only one brood in a season.

Chicks can fly when they reach 2 to 3 weeks of age. They grow rapidly and weigh as much as adults after only 15 weeks. The brood remains together until fall. Mixing of individual quail among broods and coveys takes place in the fall. In winter, coveys contain 10 to 16 individuals.

The average life span for bobwhites is relatively short and populations are characterized by high annual turnover. Generally, only 15 to 25 percent of a population will live longer than a year.

### ■ Habitat Requirements

Like all wildlife species, quail need adequate food, water, cover, and space to survive. The available habitat must provide these requirements in appropriate amounts and in the proper arrangement throughout the year. Although quail will use a wide variety of habitats, prime areas typically consist of 30 to 40 percent grassland, 40 to 60 percent crop land, and 5 to 40 percent brushy cover or woodlands all interspersed (mixed together). The more we divide the land into food producing areas located near good cover, the better suited it is for quail.



# Bobwhite Population Dynamics

Two major trends in land use have hurt quail populations in Tennessee. One trend has been the outright loss of habitat as urban sprawl and road construction consumes farmland. Habitat loss also occurs when open fields are abandoned and allowed to develop as forests. Since 1970, Tennessee has lost farmland habitat at a rate of almost 1 percent per year. The other significant trend has been the decline in quality of much of the remaining habitat. More intensive practices have made much of the remaining farmland less useful for wildlife.

## Mortality Factors

As is the case with other highly productive species, quail have many natural causes of death that serve to balance the birth rate. Their annual production rate of 70 to 80 percent is matched by an equal death rate. About 80 percent of the fall quail population consists of 3- to 7-month-old birds. Each year, about 75 to 85 percent of the quail present in the fall will die by the following fall, whether we hunt them or not.

## Predation

Many predators, including mammals (foxes, skunks, rodents, domestic dogs and cats, raccoons, opossums), birds (hawks, crows, grackles), and even reptiles (snakes) will prey on bobwhite eggs, chicks, and adults. Though predation on eggs is high, it happens at a time when renesting can offset the losses. Although biologists do not fully understand predation on chicks, they do think the effects may be substantial. Only a few predators are capable of effectively catching adult bobwhites. The Cooper's hawk is probably the most efficient predator of older birds.

Quail numbers are the result of a balance between **natality** (births) and **mortality** (deaths) in the population. Bobwhites are capable of producing many offspring in any given year. This is because they lay large clutches of eggs, the laid eggs have high fertility



rates (>90%), and their long nesting season permits ample time for re-nesting if early nests fail. The number of quail on a given area changes throughout the year. Quail numbers are highest during the summer when new chicks join the population during nesting. Numbers decrease during the fall and winter because of adverse weather, hunting, accidents, predators, disease, and other factors. Year-to-year changes in numbers can result from poor reproduction or winter survival, which sometimes results from adverse weather. The quality of habitat causes long-term changes in quail populations over several decades.



## ■ Hunting

Hunting can be a significant cause of death in bobwhite populations. According to research, hunters remove anywhere from 0 to 80 percent of the quail in a given population. Generally, we consider hunting to be a form of **compensatory mortality** in quail populations. In other words, deaths from hunting replace deaths from other causes, such as predators and weather. If hunting pressure is excessive, however, it may reach non-compensatory levels. In the absence of hunting, predation and other forms of mortality serve to regulate the population.

## ■ Parasites

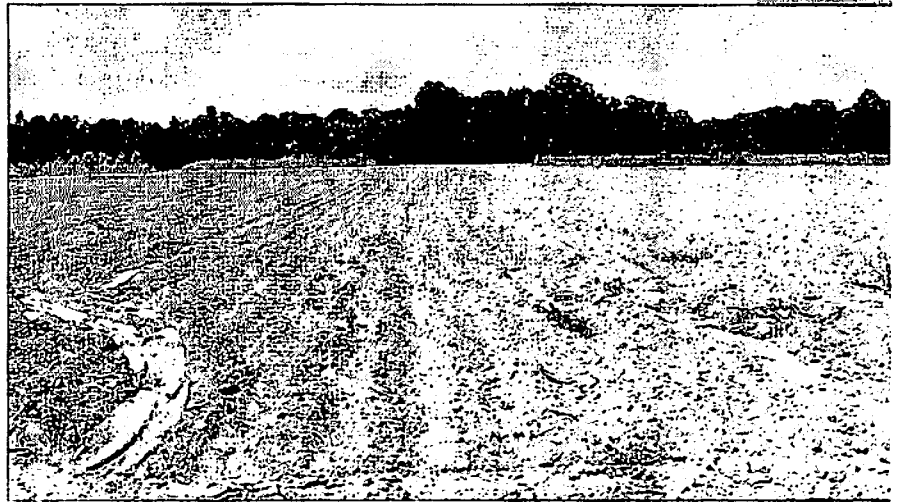
Internal parasites, such as roundworms and tapeworms, commonly infect bobwhites. Bobwhites in dense populations generally carry more parasites than bobwhites in sparse populations. Dense bobwhite populations also contain a greater number of parasite species. Though parasites are common, they cause little direct mortality. In some cases, they may indirectly affect bobwhites by aiding the transmission of diseases.

## ■ Diseases

Diseases are rarely a problem for bobwhites in the wild. On occasion, outbreaks of avian pox occur in the southeastern United States, and affect mortality rates in localized areas. Histomoniasis, ulcerative enteritis, and quail bronchitis kill many bobwhites in captive populations, but are not known to occur in wild populations.

## ■ Pesticides

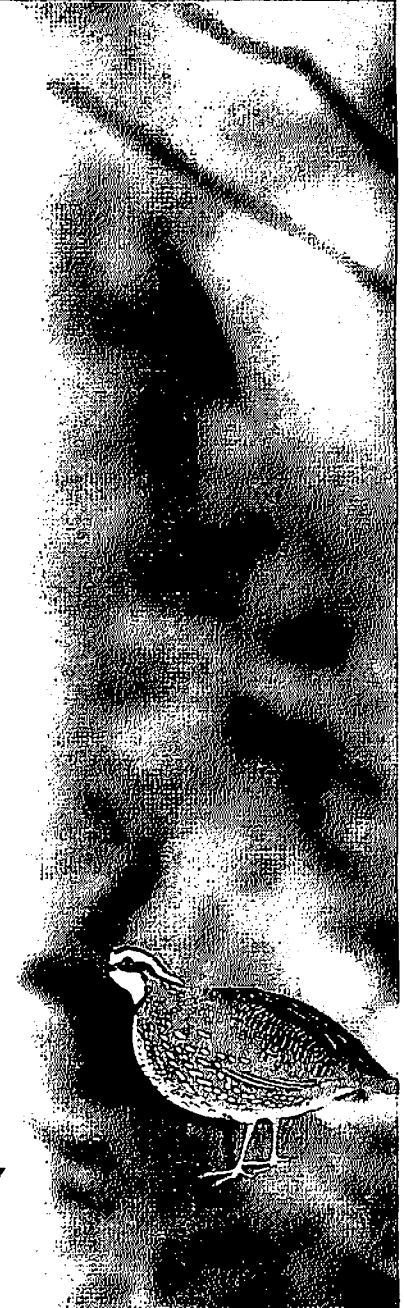
Modern agricultural operations rely heavily on insecticides, herbicides, and rodenticides. Some of these pesticides are harmful or lethal to bobwhites. Some are extremely toxic and can kill bobwhites that come in contact with them. Insecticides kill insects that could be an important food source for young chicks.



Though pesticides may often be an economic necessity, we can take steps to minimize their impacts on bobwhites and other wildlife. When possible, we should use less toxic pesticides and limit their application in areas where bobwhite use is highest, such as along field edges and near cover. Use granular pesticides cautiously and do not let them pile up because bobwhites may mistake the grains for food or grit.

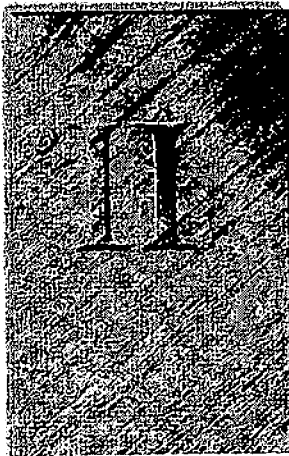
## ■ Weather

Harsh weather events can cause heavy mortality in bobwhite populations, particularly in areas on the fringe of the species' range. In the North, winter storms can make survival difficult. Deep snows and ice make food unavailable. Even if quail do not die directly from harsh weather, a severe winter may lead to poor reproduction the following summer. In the Southwest, droughts can cause substantial numbers of deaths. Plant growth is poor during droughts, and the loss of available food leads to starvation. In the southeastern United States, harsh weather is less frequent and has only minor impacts on bobwhites.



# THE ROLE OF RESEARCH

## The Importance of Research



scientific research is an excellent way to learn about ecological communities and relationships. Bobwhite quail are part of a complex system. Their well-being depends on many different factors, so research must be detailed and thorough. Research projects can examine things such as the diet, reproductive behavior, or physical characteristics of bobwhite quail. Also, we can design studies that show how factors such as weather, habitat management, or predators affect quail populations.

The knowledge that we have today about bobwhite quail is the result of research. Some of the earliest wildlife research focused on bobwhites. In the early 1900s, Herbert Sioddard studied bobwhites in great detail. His book, *The Bobwhite Quail: Its Habits, Preservation and Increase*, was published in 1931 and is still useful for understanding the basics of bobwhite ecology. Aldo Leopold, another early researcher who worked with quail, established many of the principles of wildlife management. *A Sand County Almanac*, written by Leopold in 1949, lends valuable insight into how our society views conservation.

Research has given us valuable information about the life history and habitat requirements of bobwhites. We have devoted many studies to such subjects as behavior, reproduction, and habitat needs. Research has also allowed us to overcome many myths and misconceptions. For instance, we now know that predators are not the cause of all quail population declines, an idea that was considered true in the past.



## The Scientific Method

Researchers conduct wildlife research by following a series of steps. We refer to these steps as the **scientific method** and they may vary slightly depending on the type of research. In **descriptive research**, scientists closely observe and record facts from which they draw conclusions. For example, a researcher might collect a sample of quail from hunters to see what foods the birds have eaten. From this type of information, the researcher may draw conclusions about the diet of bobwhites.

Ideas from descriptive studies can be more closely tested with **experimental research**. Experimental research projects allow for a critical examination of the facts and are controlled by closely following the scientific method. For example, researchers may provide quail with equal

amounts of a large number of different foods. By controlling the available foods, researchers could determine what foods are truly the most preferred.

Wildlife researchers follow the scientific method to avoid drawing false conclusions. With the scientific method, researchers must first identify a problem and determine what information already exists on the subject. The next step is to develop a research hypothesis. A **hypothesis** is a possible explanation for the problem that can be stated in a way that allows it to be formally tested. Next, researchers design and conduct an experiment that allows them to test the hypothesis. Finally, researchers analyze their data and draw conclusions about their hypothesis.



## Research Tools

To address specific concerns about wildlife ecology, researchers need to collect very detailed information. Depending upon the type of research conducted, they can use a variety of tools and techniques. When working with bobwhite quail, researchers use some of the following tools.

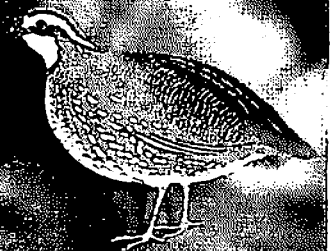
### ■ Artificial Nests

Reproduction is a key part of bobwhite population dynamics. Predators that prey on bobwhite nests have a big impact on the reproductive process. Research on this subject is difficult because bobwhite nests are hard to locate. To avoid this problem, researchers can make artificial nests that mimic the real ones made by bobwhites. By comparing the fate of nests in different habitats, researchers can learn what habitat

types are most valuable for nesting. Researchers sometimes put clay eggs in the nests. Clay eggs will show the unique tooth marks of a predator that bites down on them. Thus, artificial nests with clay eggs help researchers learn which predators have the greatest impacts.

### ■ Computer Mapping

Computers can be a great tool for wildlife research. Researchers can use computers to generate maps that identify habitat types and allow them to see if an area is suitable for bobwhites. We can produce computer mapping for extremely large areas including counties, states, or countries. We refer to these large computer systems as a GIS, which is short for Geographical Information System. Computers help researchers answer large-scale questions about bobwhite population trends.



### ■ Radio-Telemetry

Sometimes, scientists will place small radio transmitters on bobwhite quail, as well as many other species of wildlife. Researchers can locate the animal with a directional antenna and a receiver tuned to the correct frequency. Thus, researchers can monitor the animal without disturbing it. Radio-transmitters used on quail weigh about 5 grams and emit a signal that we can detect from up to a mile away. Some transmitters contain a "mortality switch" that changes the signal when the quail has died or been killed. Radio telemetry can provide researchers with a great deal of knowledge about wildlife ecology. In a good research project, it can yield valuable information about things such as habitat use, mortality patterns, movements, and home range size.

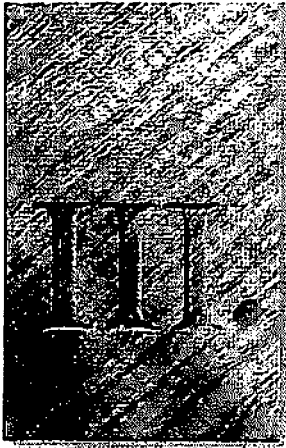
### ■ Walk Census

We can use a walk census to determine how many bobwhites live on an area. To conduct a walk census, 6 to 8 people line up about 20 meters apart, walk back and forth through an area, and count the number of bobwhite coveys they flush. A walk census will consistently flush about 50 percent of the coveys on an area. Thus, multiplying the number of coveys flushed by two gives a good estimate of the population size.

Researchers can track bobwhite population trends on an area by using walk censuses over a period of many years. They can compare changes in population size to changes in habitat quality or land use patterns. This allows researchers to determine the effects of different management practices.







# HABITAT IS THE KEY

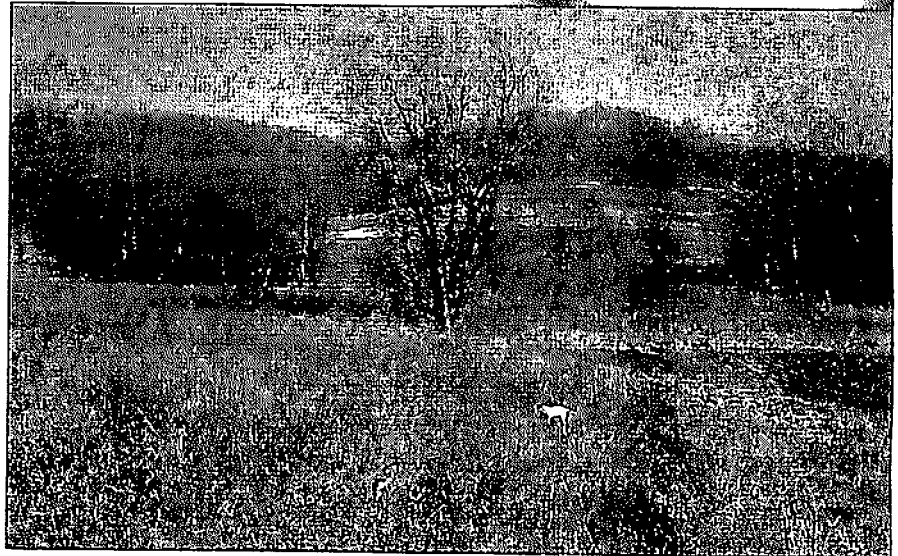
## *Habitat Requirements*

Like all wildlife species, quail need adequate food, water, cover, and space to survive. The available habitat must provide these requirements in appropriate amounts and in the proper arrangement throughout the year. Although quail will use a wide variety of habitats, prime areas typically consist of 30 to 40 percent grassland, 40 to 60 percent cropland, and 5 to 40 percent brushy cover or woodlands all interspersed (mixed together). The more we divide the land into food producing areas located near good cover, the better suited it is for quail.

### ■ Food

Bobwhites eat a wide variety of insects, berries, fruits, and green leaves, but seeds are the main food item. A complete list of quail foods would include hundreds of items. Quail feed mainly in the early morning and late afternoon. They focus on different foods throughout the year. The spring diet is high in insects and green vegetation. Summer and fall diet includes seeds and fruits, while winter foods are principally seeds.

Quail chicks feed almost exclusively on insects during the first 2 weeks of their life. Insects are high in protein and very nutritious. During the next few weeks, the chicks gradually increase the amount of plant material eaten. By 10 weeks of age, their nutritive needs have changed and their diet consists almost entirely of plant material.



### ■ Water

Bobwhites in Tennessee can generally get the water they need from the moisture they obtain from dew, insects, berries, and succulent vegetation.

### ■ Cover

Bobwhites require several different types of cover. These requirements are met when adequate amounts of woody and herbaceous plants lie within the habitat. Herbaceous plants, such as grasses and forbs (weedy plants), provide cover for nesting, roosting, feeding, and travel. Quail can use woody areas — brush, mature woods, and woody vines — for protection, roosting, and travel.

**Protective/escape cover** shields birds from the elements (ice, snow, wind, etc.), hunters, and predators. Hardwood brush,





fallen tree tops, brushpiles, and dense vegetation such as blackberry, honey suckle, greenbrier, and grapevines offer excellent protection.

**Roosting cover** provides protection for bobwhites when they are resting. Bobwhites use night roosts (dusk to dawn) and day roosts (late morning to early afternoon). Coveys form a tight circle, about the size of a dinner plate, with bodies touching and heads pointing outward. This formation helps to conserve body heat while helping the covey watch for predators. The same cover used for protection or nesting often serves well as roosting cover.

**Nesting cover** includes thin to moderate stands of grasses and weeds such as broomsedge, wheat straw, barnyard grass, or other dried weeds. Good nesting sites are typically old fields dominated by broomsedge or similar grasses 12 to 24 inches tall. As excellent as broomsedge dominated fields are for nesting cover, they become almost useless when invaded by sod-forming grass species like tall fescue and Bermuda grass. Sod

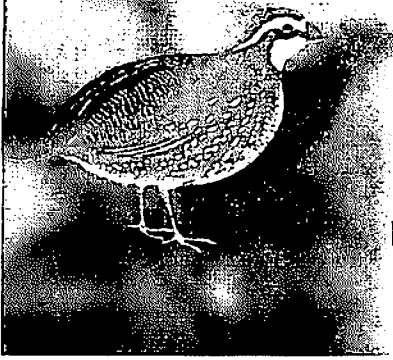
forming grasses are too thick for bobwhites to move through freely.

**Feeding cover** includes thin stands of weeds or grains that have 50 to 70 percent bare ground. This allows quail to move easily and find seeds without having to scratch through heavy vegetation or litter.

Good **brood rearing habitat** consists of thin to moderate stands of native weeds or grasses, and includes legumes such as clovers, lespedezas, or alfalfa. These areas attract insects that are important in the diet of young chicks and are best if located near areas of protective cover.

### ■ Space

Though bobwhites are capable of being very mobile, they usually spend most of their life in a fairly small area if the habitat is of good quality. Coveys typically have a home range of 15 to 100 acres. Coveys living in good habitat will generally have smaller home ranges than those living in poor habitat. Within their home ranges, bobwhites will use two or three "headquarter" areas. These headquarters offer good protective cover that the quail can use repeatedly for protection, roosting, and loafing.





# HABITAT ENHANCEMENT

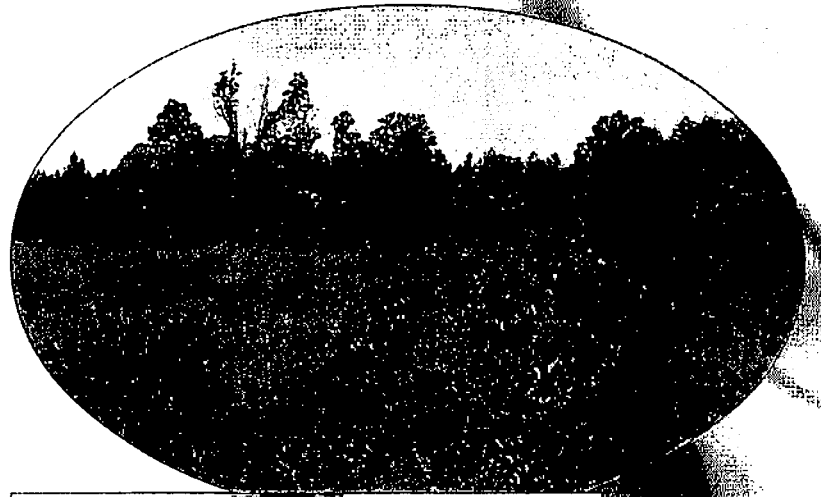
## Improving Habitat for Quail

Bobwhites thrive only where habitat conditions fulfill their needs. As discussed earlier, they need food and cover of various types. Quail management consists mainly of manipulating food and cover to meet their needs. Sometimes the best management is to do nothing for a few years and let vegetation grow. The most important goal in quail management is to provide a mixture of food and cover over a large area. This pattern of cropland, idle grassland, brush cover, and woodland creates **"edge" habitat** that is highly desirable for bobwhites. Practices such as predator control, stocking captive-reared quail, and closing or shortening hunting seasons have very little, if any, beneficial effect on quail populations.

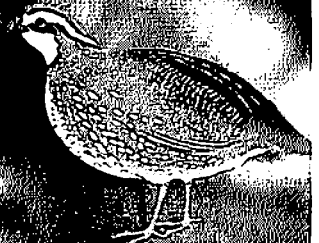
Properly managed habitat will produce an abundance of quail. Under the best of conditions, Tennessee quail habitat can support an average fall density of about one bird per acre. Below is a discussion of some habitat management practices that will improve habitat for quail.

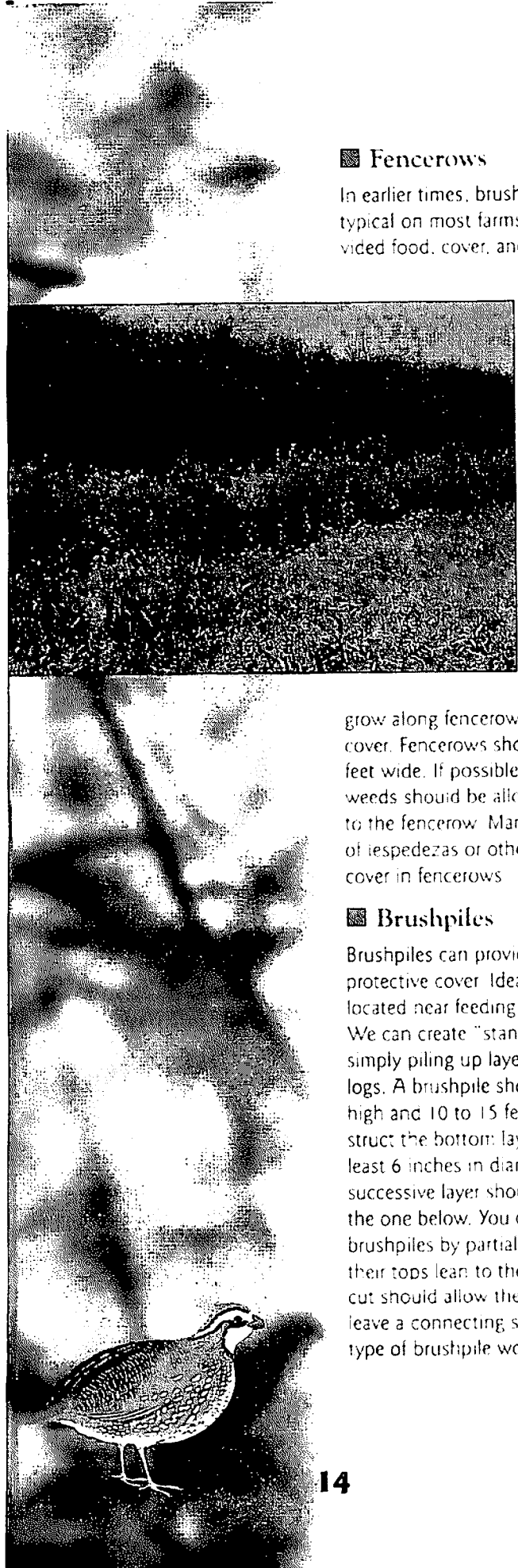
### Wooded Areas

Wooded areas with heavy undergrowth produce food and cover for quail. Borders between woodlands and open fields are especially valuable if managed properly. Removal of some trees along the edge of woodlots will allow more sunlight to reach the ground. This will promote the growth of grasses, saplings, and herbaceous vegetation.



Normally, crops planted close to tall woodland borders do not produce high yields because of shading and competition for moisture. We should consider planting this area next to the tree line in wildlife food and cover plants such as shrub lespedeza or allow it to develop naturally. If crops are planted all the way to the tree line, a few rows of the crops can be left unharvested as a source of cover and food.





### ■ Fencerows

In earlier times, brushy fencerows were typical on most farms. These areas provided food, cover, and travel lanes for quail. Clean farming practices have removed many fencerows. By simply allowing vegetation to develop in fencerows, farmers can provide the bulk of cover needed to support a quail population. Plants such as honeysuckle, greenbrier, blackberry, wild grape, and others naturally

grow along fencerows and provide excellent cover. Fencerows should be from 10 to 30 feet wide. If possible, a strip of tall grass or weeds should be allowed to grow adjacent to the fencerow. Many farmers plant strips of lespedezas or other shrubs to establish cover in fencerows.

### ■ Brushpiles

Brushpiles can provide bobwhites with protective cover. Ideally, they should be located near feeding and roosting areas. We can create "standard" brushpiles by simply piling up layers of branches and logs. A brushpile should be at least 5 feet high and 10 to 15 feet in diameter. Construct the bottom layers of large logs (at least 6 inches in diameter) and each successive layer should be perpendicular to the one below. You can create "living" brushpiles by partially cutting trees so that their tops lean to the ground. The partial cut should allow the tree top to fall, but leave a connecting strip of live bark. This type of brushpile works as a living shelter.

### ■ Odd Areas and Corners

Most farms have several areas that are too small or inaccessible to farm. Ditches, gullies, field corners, rock out-crops, and other such areas can be managed simply by letting brushy vegetation and grass grow to provide valuable quail habitat.

### ■ Grassy Areas

The lack of adequate nesting cover is probably the habitat factor that most limits quail populations in Tennessee today. Fescue pastures dominate much of Tennessee. Farmers like fescue because it can be heavily grazed, it is relatively inexpensive to maintain, and it forms a dense sod that holds soil and helps stop erosion. This dense sod, however, is much too thick for good nesting cover and it often crowds out other plants beneficial to quail as food sources.

Quail prefer "**bunchgrasses**" that offer a fair amount of bare ground that allows the quail to feed and move around freely. Quail will usually nest at the base of a clump of grass, pulling dead blades of grass around and under them to form the nest.

Broomsedge is a bunchgrass that is native to Tennessee. You can often promote it by disking or burning the existing vegetation. Because broomsedge prefers slightly acidic soils, you should not lime areas in which you want to establish broomsedge. Broomsedge fields with a dominant undergrowth of fescue, however, are not good quail habitat. In most situations where fescue is the dominant vegetation, the best recommendation is to completely eliminate the fescue and establish new vegetation. We can do this with one or two properly timed herbicide applications.

Farmers can also convert pastures to other native bunchgrasses. Grasses such as big bluestem, switchgrass, and eastern gamagrass can provide good habitat for quail and other wildlife species. Research shows that these grasses contain high levels of protein, and are useful for cattle as well.

Without certain management practices, grass will not dominate an area permanently. If we neglect fields for several years, then woody tree species invade them. These woody species will grow, and eventually a mature forest will replace what was once an open field. We refer to this process of advancing from open fields to mature woods as succession.

In fields that have been left idle for several years, it may be necessary to "set back" the vegetation and allow annual weeds to grow by removing the woody species. Disking in 10- to 20-foot wide strips 20 feet apart each year is a good way to accomplish this goal. Disk the vegetation a strip or area at a time instead of disking all the cover in any one year. Disk in early spring before the quail nesting season begins.

### ■ Prescribed Burning

Prescribed burning is an effective and inexpensive method to manage bobwhite habitat. Burning creates desirable nesting cover and promotes the growth of native plants important to quail. Idle grasslands burned in late winter provide excellent

brood habitat the following spring and summer. Burning numerous small areas with unburned acres in between produces a "patchwork" of habitat that is excellent for quail. Before you burn, however, you should contact professional biologists and foresters. Biologists from the Tennessee Wildlife Resources Agency can give advice on where and when to use burning to improve your land for quail. You must always contact the Tennessee Division of Forestry to obtain necessary permits before burning.



## Food Plots

habitat management plan must meet all the needs of the bobwhite quail. Concentrating management efforts on one habitat component while ignoring others will lead to frustrating and ineffective results. For example, planting scattered food plots but not addressing a shortage of nesting cover will not increase your quail population. If you meet other habitat needs but natural foods or waste grains are not plentiful, then it may be helpful to establish food plots.

An easy way to provide food is to leave some grain crops standing near suitable cover. A 15- to 30-foot-wide strip of soybeans, milo, millet hay, corn, or wheat left standing next to a fencerow can serve

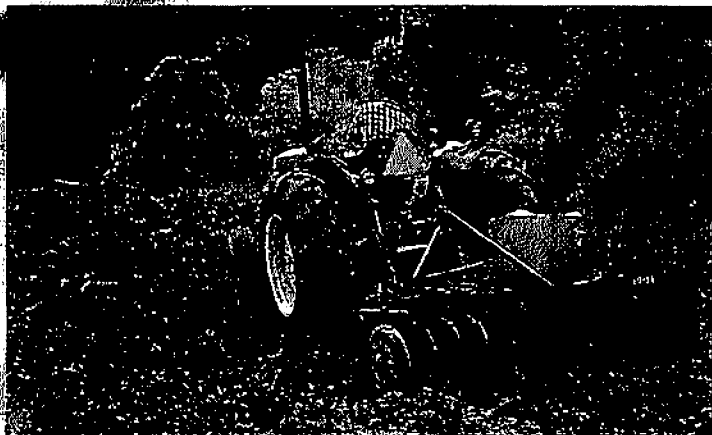
as an excellent food plot. Cultivate these outside rows only once. This will give the grain a head start on weeds and will increase the available food. It will also furnish better cover by permitting annual weeds to grow between rows.

Ragweed, smartweed, foxtail millet, wild legumes, and other annual weeds are excellent quail foods. Usually, they provide quail with an ample food supply. We can promote their growth by simply disking in fallow fields or odd areas. Disking strips every year or every other year will maintain annual weed growth. Except for areas where it is practical to burn, disking is usually the most inexpensive method of manipulating the land to produce desirable quail food



plots. Fertilization of the disked strips may be useful, especially on poor soils.

Cultivated food plots should be established at the rate of one 1/8- to 1/4-acre plot for each 10 to 30 acres of land. Food plots are most beneficial when planted next to good escape cover.



### ■ Annual Food Plots

Annual food plots must be planted every year. Most grains make excellent foods, especially soybeans and corn, since their seeds are large, hard, and last through late winter. They are available as a food source when most other seeds have deteriorated. You may plant various grains separately or in a mixture. Fertilize food plots as you would field crops. If possible, do not plant annual plots in the same spot each year. Research has shown that year-old annual plots are important as brood cover for young chicks. The annual weeds that grow in year-old food plots attract insects that chicks feed on heavily.

### ■ Reseeding Annuals

There are several types of reseeded annual legumes that are valuable food sources for quail. Because they reseed themselves well, we don't have to replant stands of these plants for several years. In the past, farmers commonly used Kobe and Korean lespedeza for hay and pasture. Prolific seed producers, you can sow them by themselves or in a mixture with ryegrass or

orchardgrass. Planting 20-foot wide strips of lespedeza around the border of cropfields or in strips through fallow fields greatly improves quail habitat. To achieve adequate stands, broadcast seed over well prepared ground in January or early February. The freezing and thawing action of the ground, combined with the action of rain or melting snow helps work the seed into the soil.

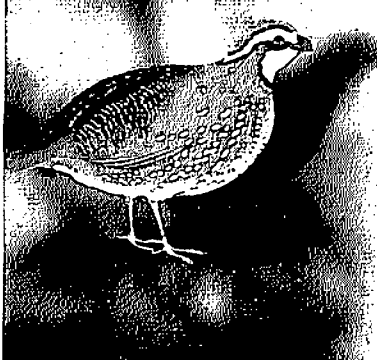
Partridge pea is another reseeded annual that is a good food source for quail. Although you can buy it in stores, many areas in Tennessee have an ample native seed source lying dormant in the soil. We can stimulate these dormant seeds simply by burning or disking. Once established, you can maintain a stand of partridge pea by annual disking or burning and occasional fertilization.

### ■ Perennial (Permanent) Food Plots

You don't have to plant perennial food plots every year. Be sure to locate them in areas that will not be disturbed or grazed for several years. Perennial plots can provide superb protective cover. Plant perennial plots as linear strips 15 to 20 feet wide. Shrub lespedezas are often used in perennial plots because they grow 6 to 8 feet high and produce small hard seeds that quail love.

Mow or burn shrub lespedeza every 3 to 4 years to reduce stem thickness and rejuvenate seed production. Plant shrub lespedeza in 1/4-acre blocks, in 15-foot-wide strips around or across fields to provide escape cover, or next to brush piles.

Wild crabapple, wild plum, and indigobush are plants that are native to Tennessee, and you can get seedlings through commercial growers. These plants are effective when planted in multiple rows to create travel lanes, or in small clumps of 10 or more seedlings to provide protective cover as well as food for bobwhite quail and other wildlife.



# GLOSSARY

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**brood** — A group of young quail chicks. After hatching, a brood will remain with their parents throughout the summer.

**bunchgrass** — A term used to describe species of grass that grow in scattered clumps, rather than form dense sod. Broomsedge is a native Tennessee bunchgrass that serves as excellent nesting cover for bobwhites.

**clutch** — The group of eggs that a hen lays during the nesting process. A complete bobwhite clutch usually contains about 12 to 14 eggs.

**compensatory mortality** — Deaths from one factor (typically hunting) that replace deaths from another factor (such as predators or weather).

**covey** — A group of quail. Bobwhite coveys generally contain between 10 and 16 individuals.

**descriptive research** — Research in which scientists base general conclusions simply on what they have observed, rather than on the results of controlled experiments.

**"edge" habitat** — Brushy, weedy, and grassy vegetation that occurs where two types of habitat meet, especially woodlands and fields. "Edge" habitat is good for bobwhites.

**experimental research** — Research in which scientists evaluate a hypothesis using a closely controlled experiment. Conclusions about the hypothesis are based on the results of the experiment.

**Gallinaceous** — A taxonomic term used to denote birds that belong to the order Galliformes. Quail, wild turkeys, pheasants, and grouse are all Gallinaceous birds.

**habitat** — The environment in which an animal lives. Quail need several different types of habitat, such as grasslands, woodlands, and brushlands.

**home range** — The area in which an animal lives. Home ranges for bobwhite quail are usually between 15 and 100 acres.

**hypothesis** — A theory or possible explanation for an observed set of facts. Scientists design experiments to test the validity of a hypothesis.

**mortality** — Death or death rate. In quail populations, mortality can result from factors such as predation, severe weather, or hunting.

**natality** — Birth or birth rate.

**radio-telemetry** — A wildlife research technique that uses transmitters and receivers. Radio-telemetry allows researchers to monitor animals without disturbing them.

**scientific method** — A logical series of steps that researchers follow to avoid drawing false conclusions.

**succession** — Process of vegetational change that take place on an area. Open fields developing mature forests is an example of succession.



Agricultural Extension Service  
The University of Tennessee



PB1612

A detailed black and white illustration of a quail, likely a Northern Bobwhite, perched on a large, stylized letter 'Q'. The quail is facing right, with its tail feathers tucked under its body. The 'Q' is thick and has a decorative, slightly curved top and bottom.

THE  
Quail  
SERIES

The Northern Bobwhite  
*Lesson Plans and Activities*  
INSTRUCTOR'S MANUAL



# INTRODUCTION

This material contains four lesson plans for you to use with the video series and booklet associated with this project. Following the lesson plans and activities will help reinforce the information presented in the videos and booklet.

The lessons and activities address many of the Tennessee State Curriculum Objectives for grades 6-8 in Science, Math, and Social Studies. A list of the specific objectives covered follows each lesson plan.

At the end of this manual, there are four sets of questions that you can use for testing purposes. Each set of questions corresponds with a video segment and booklet chapter.

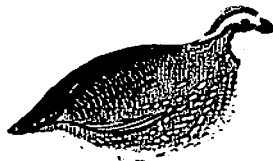


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# ACKNOWLEDGMENTS

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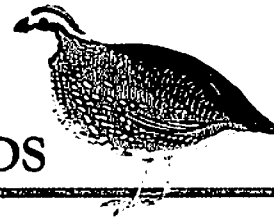
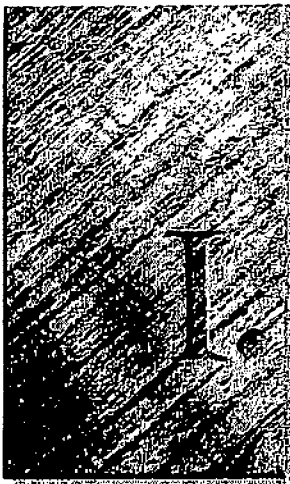
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**Wildlife Forever**

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# POPULATION TRENDS

## Lesson I

**Grade:** 6-8

**Focus:** Population Trends, Loss of Habitat

**Subject:** Science, Math, Social Studies

**Materials:** Video — Part 1: *Introduction to the Northern Bobwhite*  
Publication — *The Northern Bobwhite*, pages 3-7  
Activity 1 — Graph paper, markers  
Activity 2 — Small slips of paper

**Teaching Time:** One class period (minimum)

**Vocabulary:** Population change, density, edge habitat

## Learning Objectives

- Students Will**
- ↓ Describe factors that have influenced bobwhite populations.
  - ↓ Construct a time line illustrating trends in population density.
  - ↓ Role play historical changes in the bobwhite population.

## Background

Early settlers to America were exposed to many new species of wildlife. White-tailed deer, raccoons, opossums, beavers, bobwhite quail, wild turkeys, wood ducks, passenger pigeons, and copperheads were among these new species.

As America was settled, population levels of wildlife species changed. Some species required forested areas while others were better adapted to cleared areas. Northern bobwhite quail flourished in areas where woodland, brush, and cropland came together.

In the South, bobwhites experienced a growth in population until about 1890. They remained stable until the mid-1900s when changes in farming techniques lowered the population. Large farms with clean fence rows replaced small fields interspersed among woods and dotted with areas of brushy cover. This resulted in a loss of habitat that caused a decline in the bobwhite population. Some states have experienced a critical decline of bobwhites. In response to this environmental challenge, agencies and scientists have formed groups to conduct research and develop habitat management plans.

## Learning Procedure

- 1 View video Part 1: *Introduction to the Northern Bobwhite*.
- 2 Distribute publication: *The Northern Bobwhite*. Read pages 3-7 for supplemental information.
- 3 Discuss major changes in bobwhite population levels, in 50-year blocks of time, from 1750 through 1998. What caused these changes?

■ **ACTIVITY 1:** Graph population changes in 50-year blocks of time. Include a time line listing major social trends and agricultural practices that affected the bobwhite population. Discuss what is being done to reverse the trend of decreasing bobwhite populations. Discuss how populations of species with habitat requirements different from bobwhites may have changed historically.

■ **ACTIVITY 2: *No Place to Hide.*** This activity simulates the plight of bobwhites.

For a class of 30 students, use 30 strips of paper:

- Write *bobwhite* on 10.
- Write *woods* on 5.
- Write *grassy field* on 5.
- Write *fencerow* on 5
- Write *predator* on 5.



Designate a playing area, outside if possible. Define boundaries with two lines about 10 yards apart. Let the students randomly choose a slip of paper to decide their role in the simulation.

Predators line up on one line. Bobwhites line up on the other line. Woods, grassy fields, and fencerows spread out between the lines. The object is for bobwhites to grab onto the different types of habitat before predators tag them. Grassy fields and fencerows can provide shelter for up to two bobwhites. Woods can provide shelter for only one bobwhite.

**Round 1 — 1750:** The new land is largely forested; habitat for bobwhites is scarce.

Play the round with: 10 bobwhites  
5 predators  
5 woods  
0 grassy fields  
0 fencerows

**Round 2 — 1800:** New settlers begin to clear forests and cultivate crops in small fields; habitat for bobwhites is increasing.

Play the round with: 10 bobwhites  
5 predators  
4 woods  
2 grassy fields  
2 fencerows

**Round 3 — 1850:** More land is cleared for agriculture; habitat for bobwhites increases.

Play the round with: 10 bobwhites  
5 predators  
3 woods  
4 grassy fields  
4 fencerows

**Round 4 — 1900:** Farming practices and land use practices provide excellent bobwhite habitat.

Play the round with: 10 bobwhites  
5 predators  
2 woods  
5 grassy fields  
5 fencerows

**Round 5 — 1950:** Farming practices and land use practices change; habitat available for bobwhites begins to decrease.

Play the round with: 10 bobwhites  
5 predators  
2 woods  
4 grassy fields  
4 fencerows

**Round 6 — 1998:** Bobwhite population is in a severe decline; habitat is scarce.

Play the round with: 10 bobwhites  
5 predators  
1 woods  
2 grassy fields  
2 fencerows

## Discussion Points

- ↘↘ How did changes in habitat affect population density?
- ↘↘ What improvements could be made through habitat management? Implement these changes and conduct Round 7.

## Looking Beyond

- ↘↘ Research and share the history of other wildlife species native to America.
- ↘↘ Contact a local wildlife biologist or other specialist to talk about their occupations and related work.
- ↘↘ Ask a farmer to talk about his farming practices and discuss how they affect wildlife.

## ■ Lesson I addresses the following Tennessee State Curriculum Objectives for grades 6–8

### Science

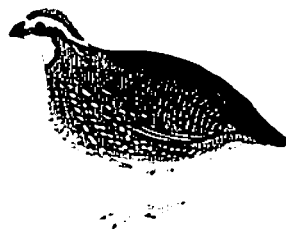
- Standard 2.1a: Models are often used to represent concepts of various magnitudes.
- Standard 2.5a: Human activities have decreased the capacity of the environment to support some life forms.
- Standard 3.5a: New technology can change cultural values and social behavior.

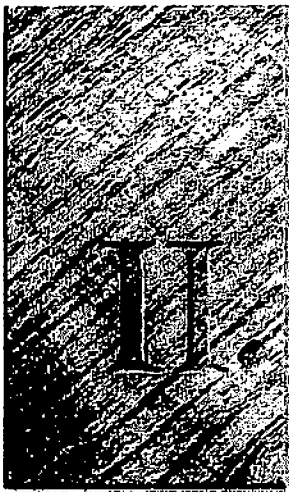
### Math

Patterns, Functions, and Algebraic Thinking —  
Learning Expectation: Represent situations with tables, graphs, verbal rules, and equations and describe the interrelationships of the representations.

### Social Studies

History Standard 1: Students will exhibit a knowledge of history, identifying and describing major events, people, and trends.





# THE ROLE OF REPRODUCTION

## Lesson II

**Grade:** 6-8

**Focus:** Life History, Population Dynamics

**Subject:** Science, Math

**Materials:** Video — Part 2: *The Role of Research*

Publication — *The Northern Bobwhite*, pages 8-10

Activity 1 — Paper, drawing supplies

Activity 2 — Gymnasium or other playing area.

**Teaching Time:** One class period (minimum)

**Vocabulary:** Reproduction, population dynamics, natality, mortality

## Learning Objectives

### Students Will

- ↓ Describe the nesting and brood-rearing activities of bobwhites.
- ↓ Construct a figure depicting the year-round activities of bobwhites.
- ↓ Participate in an exercise illustrating the importance of reproduction.



## Background

During the winter, bobwhites live in social groups of 10-16 individuals called coveys. From April to September, males (cocks) and females (hens) live in pairs and their activities focus on reproduction.

Quail build their nest on the ground in grassy or weedy areas. When the nest is complete, the female deposits one egg each day until the clutch of about 12 eggs is complete. Incubation takes about 23 days with the female generally doing it. Predators often destroy quail nests and eat eggs. If early nesting attempts are not successful, quail can re-nest up to three to four times during the breeding season.

Chicks leave the nest with their parents soon after hatching. This new group of quail chicks is called a brood. During the first 2 weeks of their life, quail chicks feed almost exclusively on insects. During the next few weeks, they gradually increase the amount of plant material eaten. Chicks can fly when they reach 2 to 3 weeks of age. They grow rapidly to look like and weigh as much as adults after only 15 weeks.

The quail population on a given area is the result of a balance achieved between natality (births) and mortality (deaths). Bobwhites have a high reproductive potential. They are capable of producing many offspring in any given year. The annual production rate for quail is 70 to 80 percent and

is matched by an equivalent death rate. Deaths can result from a variety of factors, such as predators, hunting, pesticides, or weather.

Habitat and land use practices heavily influence quail population levels. During the nesting season, bobwhites need areas of nesting and brood-rearing cover. Quail prefer to nest in thin to moderate stands of grasses, especially broomsedge and other native warm season grasses. Areas of clovers, lespedezas, or alfalfa can serve as brood-rearing cover. These areas produce high numbers of insects that are important in the diet of young chicks.

## Learning Procedure

- 1** View video Part 2: *The Role of Research*.
- 2** Distribute publication: *The Northern Bobwhite*. Read pages 8-10 for supplemental information.
- 3** Discuss the year round activities of bobwhites. Why do these activities change throughout the year?

■ **ACTIVITY 1:** Have students draw a diagram depicting the yearly life cycle of bobwhites. The figure should be circular and indicate the major stages in each of the 12 months. Have students include more detailed information for reproductive activities, such as the number of days required for laying and incubating a clutch of eggs and the number of weeks required for chicks to develop.

■ **ACTIVITY 2: Oh Quail.** This activity emphasizes the importance of nesting habitat and reproduction to the population dynamics of bobwhites. (Adapted from *Project Wild*.)

Mark two parallel lines on the ground about 10 or 20 yards apart. Have the students count off in fours. Have the "ones" line up behind one line and the rest of the students line up behind the other.

The "ones" become "quail." To survive and reproduce, they need good habitat throughout the year, especially nesting and brood rearing areas during the spring and summer.

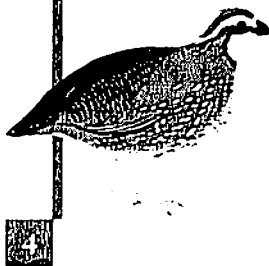
The "twos," "threes," and "fours" become "habitat components." They will represent one of three habitat categories: 1) Nesting Cover, 2) Brood Rearing Cover, or 3) Winter Food and Cover.

To begin the first round (or the first "year"), have the students line up on their respective lines **with their backs to the students on the other line**. Students that are "habitat components" choose one of the three categories to represent. Students that are "quail" choose one habitat component that they will need. Have students make a visible sign to indicate what they represent (if they are habitat) or what they are looking for (if they are quail). Student should:

- ↘ Fold their arms across their chest if they are **Nesting Cover**.
- ↘ Put their hands on top of their head if they are **Brood Rearing Cover**.
- ↘ Hold their arms out to the side if they are **Winter Food and Cover**.

Once students have chosen a habitat component, they are not allowed to change it until the next round. At the beginning of the next round all students (both "quail" and "habitat components") may change the type of habitat they are seeking or representing.

On the count of three, have the two groups turn and face each other. When quail see the habitat component they need, they are to run to it. Each quail that obtains its necessary habitat component brings that component back to the "quail" side of the playing area. In the next round, that habitat component becomes a quail. This represents the quail surviving through the year and successfully reproducing.



Any quail that fails to obtain its habitat component "dies" and becomes part of the habitat. That is, the quail that died becomes either Nesting Cover, Brood Rearing Cover, or Winter Food and Cover and is available to quail in the next round. Habitat components that the quail do not remain as habitat in the next round, as well.

Continue the game for about 15 rounds. The instructor or students should keep track of the number of quail alive at the beginning of each round.

After 15 rounds graph the results of the exercise on a chalkboard. Plot the round (x-axis) against the number of quail alive at the beginning of each round (y-axis). Each round represents one year's time. The students will see that the population increased sharply for the first few years and then fluctuated for the remainder of the exercise. These fluctuations are to be expected. As long as there is good habitat and enough individuals to reproduce, the population will persist.

## Discussion Points

- ↘ What role does reproduction play in population dynamics?
- ↘ Why do population levels fluctuate?
- ↘ What role does habitat play in population dynamics?

## Looking Beyond

- ↘ Have a wildlife biologist speak to the class about population dynamics.
- ↘ Research and share the reproductive activities of other species, such as black bears, bullfrogs, rabbits, bald eagles, etc.

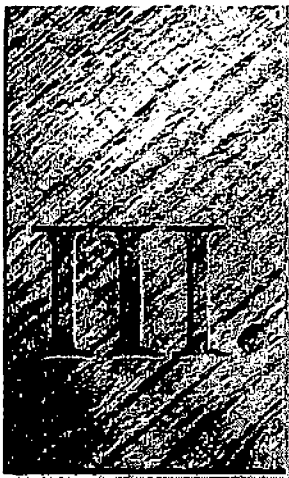
■ Lesson II addresses the following Tennessee State Curriculum Objectives for grades 6–8

### Science

- Standard 2.1a: Models are often used to represent concepts of various magnitudes.
- Standard 2.3b: Thinking about things as systems means looking for how every part relates to others.
- Standard 2.4b: In any particular environment, the growth and survival of organisms depend on the physical conditions.

### Math

Patterns, Functions, and Algebraic Thinking —  
Learning Expectation: Represent situations with tables, graphs, verbal rules, and equations and describe the interrelationships of the representations.



# HABITAT REQUIREMENTS

## Lesson III

**Grade:** 6-8

**Focus:** Habitat Requirements

**Subject:** Science, Social Studies

**Materials:** Video — Part 3: *Habitat Is the Key*  
Publication — *The Northern Bobwhite*, pages 11-12  
Activity 1 — Drawing paper, crayons  
Activity 2 — Space for the class to form a large circle

**Teaching Time:** One class period (minimum)

**Vocabulary:** Habitat requirements, home range, cover

## Learning Objectives

- Students Will**
- ↓ Describe the habitat components necessary for bobwhite quail.
  - ↓ Describe how changes in habitat availability affect populations.
  - ↓ Participate in a game illustrating the habitat needs of bobwhites.



## Background

All wildlife species, including bobwhite quail, need adequate food, water, cover, and space to survive. Areas with an interspersed of cropland, grassland, and brushy cover or woodlands offer excellent habitat for bobwhites. Typically, prime quail habitat consists of 30 to 40 percent grassland, 40 to 60 percent cropland, and 5 to 40 percent brushy cover or woodlands.

Although bobwhites are predominantly seed eaters, they also feed on a variety of insects, berries, fruits, and green leafy vegetation. This diet generally provides them with enough moisture, so standing water is rarely a critical habitat component.

Bobwhites require a variety of cover. They need adequate protective cover, such as dense thickets of honeysuckle and briars, for roosting and to shield them from the elements and predators. Grassy and weedy areas are necessary as nesting cover. Sparse stands of weeds or grains with lots of bare ground provide excellent feeding cover.

Bobwhites can typically live in relatively small areas. Bobwhites living in good habitat need less space than those living in less suitable habitat. Yearly home ranges of bobwhites usually range from 15 to 100 acres in size.

## Learning Procedure

- 1 View video Part 3: *Habitat Is the Key*.
- 2 Distribute publication: *The Northern Bobwhite*. Read pages 11-12 for supplemental information.
- 3 Discuss the habitat needs of bobwhites. Are their habitat needs related to different activities? What types of habitat are necessary during spring and summer? What types are important in winter?

**ACTIVITY 1:** Have half the class draw a map of an area that would provide excellent bobwhite habitat. Have the other half of the class draw a map of an area that lacks some critical habitat components and offers poor bobwhite habitat. Reinforce the lesson by having students explain to the class why their area offers either good or bad habitat. Using encyclopedias or other sources of information, discuss how suitable these areas would be for other species such as the following:

American robins	wood thrushes
white-tailed deer	gray squirrels
bullfrogs	peregrine falcons

■ **ACTIVITY 2: Habitat Lap Sit.** (Adapted from *Project Wild.*)

Have the students form a circle and number off "one," "two," "three," and "four." The "ones" become "crop-lands," the "twos" become "grasslands," the "threes" become "woodlands," and the "fours" become "space."

Have the students turn sideways and squeeze toward the center until the circle is very tight. The students should be standing close together and looking at the back of the head of the student in front of him or her.

*Situation 1 — Habitat components are available and in the proper arrangement.*

At this point, all the students need to be attentive and listening carefully. Everyone should place their hands on the waist of the person in front of them. On the count of three, everyone sits down against the knees of the person behind them, while keeping their own knees together to support the person in front of them. The circle is complete because the habitat requirements are met.

*Situation 2 — Remove some critical habitat components.*

Change the circumstance and remove the appropriate habitat components from the circle. For example: "Urban sprawl has reduced the amount of **space** available for wildlife" or "farming techniques become more efficient and limit the amount of **grasslands** available for wildlife."

Without allowing the students to squeeze the circle in closer, have them attempt to sit down again. The circle will collapse or become disrupted as a result of the missing habitat components.

## Discussions Points

- ↓ Why do alterations in habitat affect wildlife populations? Will habitat changes have the same effect on all species?
- ↓ How might minor habitat changes in an area affect bobwhites or wildlife? What about major changes?

## Looking Beyond

- ↓ Research and share the habitat requirements of other wildlife species.
- ↓ Visit a nearby park or natural area and determine if the habitat is suitable for bobwhites or other types of wildlife. Identify habitat components that are suitable and those that are lacking.

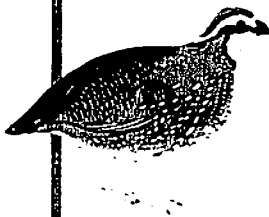
■ Lesson III addresses the following Tennessee State Curriculum Objectives for grades 6–8

### Science

- Standard 2.3b: Thinking about things as systems means looking for how every part relates to others.
- Standard 2.4b: In any particular environment, the growth and survival of organisms depend on the physical conditions.

### Social Studies

- Geography Standard 1: Students will be able to use maps, globes, and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.





# HABITAT MANAGEMENT

## Lesson IV

**Grade:** 6-8

**Focus:** Managing wildlife habitat

**Subject:** Science, Social Studies

**Materials:** Video — Part 4: *Habitat Enhancement*

Publication — *The Northern Bobwhite*, pages 13-16

Activity 1 — Paper, drawing tools

Activity 2 — Hula hoops, long pieces of rope or string, orange safety vests, poster board (for making signs), colored paper

**Teaching Time:** One class period (minimum)

**Vocabulary:** Habitat management, cover, succession, interspersions, limiting factors



## Learning Objectives

- Students Will**
- ✓ Describe wildlife habitat management techniques.
  - ✓ Evaluate habitat quality and suggest ways for improvement.
  - ✓ Participate in an exercise illustrating the importance of proper habitat management.

## Background

Properly managed habitat will produce an abundance of quail. To benefit quail, management practices should focus on providing adequate cropland, grassland, and woodlands. The habitat types should intersperse (mix) to provide the maximum amount of "edge" habitat that bobwhites prefer.

If we neglect fields and open areas for several years, woody tree species will invade them. These woody species will grow, and eventually a mature forest will replace what was once an open field. We refer to this natural progression of advancing from open fields to mature woods as succession.

There are several techniques that we can use to maintain vegetation in early stages of succession. Prescribed fire is an effective and inexpensive way to manage idle grasslands areas. Fire creates desirable nesting cover and promotes the growth of native seed-bearing plants important for quail. Disking is another way to set back vegetation. Disking will open up bare ground, stimulate the growth of annual weeds, and prevent woody species from dominating fields.

Quail need some areas of heavy cover for roosting and protection from the elements and predators. Simply allowing vegetation to grow up naturally around fencerows and other areas can provide enough protective cover to support a quail

population. Plants such as honeysuckle, greenbrier, and blackberry can grow naturally and provide excellent cover.

In some areas, food may be scarce and limit the bobwhite population. Disking can be used to promote the growth of many annual weeds that provide seeds. In agricultural areas, an easy way to provide food is to leave some crops standing near suitable cover. Cultivated food plots can also be useful in providing food and are most useful when planted next to protective cover.

## Learning Procedure

- 1 View video Part 4: *Habitat Enhancement*.
- 2 Distribute publication: *The Northern Bobwhite*. Read pages 13-16 for supplemental information.
- 3 Discuss the habitat requirements and management techniques important for bobwhites

**ACTIVITY 1:** Have students make a map of the school grounds or a nearby area. Include things such as woods, fields, streams, etc. Discuss if the area is suitable habitat for bobwhites. Identify areas where habitat is insufficient or could be improved. Discuss what management techniques would help remedy the problems.



■ **ACTIVITY 2: *Habitat Is the Key.*** (Adapted from *Project Wild.*) This exercise illustrates that survival is difficult without proper habitat.

Identify students as either "hawks" or "quail." For a class of 30 students, identify three hawks and let the remainder be quail. Have the hawks wear orange safety vests so that they are clearly identifiable.

Use a gymnasium or playing field that is about 100 feet across. Place the hula hoops within the area to designate areas of available habitat. Each hula hoop will be either nesting cover, feeding cover, or protective cover. The students must know what types of habitat are available, so mark the the hula hoops with signs indicating the type of habitat they represent. Also, place colored slips of paper within the hula hoops, and use a different color for each type of habitat.

The object is for the quail to travel across the playing area without the hawks tagging them. The habitat patches function as "safety" areas — hawks cannot tag quail while the quail has at least one foot in a habitat patch.

To simulate the need for a variety of habitats, the quail must visit and collect a slip of colored paper from **each type of habitat** at least once in their trek across the area.

To simulate the process of evaluating and managing habitat, conduct the exercise in three rounds, with each round having different amounts of available habitat.

#### **Round 1 — Protective cover is lacking.**

For a class of 30 students, distribute the following amounts of each type of cover in the playing area:

- 5 areas of Feeding Cover
- 5 areas of Nesting Cover
- 2 areas of Protective Cover

With only two areas of protective cover, the quail will become bottlenecked and susceptible to the hawks. It should quickly become obvious to the hawks and quail that there is a lack of protective cover. Play several rounds to all students to play the role of both predator and prey.

#### **Round 2 — Manage the habitat.**

Allow the students to discuss and recommend ways to improve the "habitat" of the playing area for quail. Have them name several management techniques that we can use to increase the amount of protective cover such as allowing thickets to develop or creating brushpiles. After doing so, play a few more rounds of the game with the following amounts of each type of cover in the playing area:

- 5 areas of Feeding Cover
- 5 areas of Nesting Cover
- 5 areas of Protective Cover

With the increase in protective cover it is much easier for the quail to travel across the playing area. The quail must still travel across areas of open ground between the patches of cover, and the hawks will still tag some.

#### **Round 3 — Connect the habitat.**

Discuss how interconnecting the different types of habitat instead of isolating them is more useful to quail. Wildlife managers often connect blocks of habitat with fencerows and hedgerows.

Allow the students to use the long pieces of rope as "fencerows" to connect the patches of cover. Give the students enough rope to make connections between four or five habitat patches.

The "fencerows" are just like the patches of cover in that they are "safety" areas that provide protection from the hawks. Play several more rounds with the same amount of habitat as in *Round 2*.

## *Discussions Points*

- ↘ In the first 2 rounds, what were the limiting factors of the habitat?
- ↘ How did we correct the limiting factors and what were the result?

## *Looking Beyond*

- ↘ Research and share management techniques used for other species of wildlife.
- ↘ Have a wildlife biologist or other natural resource professional speak to the class about management techniques.
- ↘ Contact your county 4-H Agent at the County Agricultural Extension Service Office to find information about planting a FACE (Food And Cover Establishment for Wildlife) plot on your school grounds or other appropriate location.

## ■ Lesson IV addresses the following Tennessee State Curriculum Objectives for grades 6–8

### **Science**

- Standard 2.1a: Models are often used to represent concepts of various magnitudes.
- Standard 2.3b: Thinking about things as systems means looking for how every part relates to others.
- Standard 2.4b: In any particular environment, the growth and survival of organisms depend on the physical conditions.

### **Social Studies**

- Geography Standard 1: Students will be able to use maps, globes, and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.





# QUESTIONS

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On the following pages, there are four sets of questions that you can use for testing purposes. Each set of questions corresponds with a video segment and a chapter from *The Northern Bobwhite* booklet. Feel free to copy and use the questions as you wish. The answers to each set follows.

## Answers

Section I	Section II	Section III	Section IV
1. b	1. b	1. b	1. a
2. c	2. a	2. c	2. b
3. a	3. b	3. a	3. a
4. c	4. c	4. b	4. a
5. b	5. b	5. c	5. d
6. c	6. d	6. d	6. c
7. a	7. c	7. b	7. d
8. a			
9. b			
10. c			
11. c			
12. c			
13. b			

NAME \_\_\_\_\_

GRADE \_\_\_\_\_ CLASS \_\_\_\_\_

SCHOOL \_\_\_\_\_

TEACHER \_\_\_\_\_

## SECTION I: INTRODUCTION TO THE NORTHERN BOBWHITE



*These questions cover information in video segment 1 and booklet pages 3-7. Circle the correct answer.*

1. Bobwhite quail belong to the same group of birds as \_\_\_\_\_.
  - a. hawks, owls, and eagles
  - b. turkeys, grouse, and pheasants
  - c. robins, bluebirds, and cardinals
2. A bobwhite chick eats almost entirely \_\_\_\_\_ until it is about 6 weeks old.
  - a. seeds
  - b. grass
  - c. insects
3. A female bobwhite lays an average of \_\_\_\_\_ eggs and it takes them about \_\_\_\_\_ days to hatch.
  - a. 12, 23
  - b. 4, 10
  - c. 25, 50
4. \_\_\_\_\_ bobwhites participate in building nests.
  - a. Only male
  - b. Only female
  - c. Both male and female
5. The northern bobwhite gets its name because \_\_\_\_\_.
  - a. Bob White, a famous ornithologist was the first to observe the bird
  - b. of its clear, distinctive "bob-white" whistle
  - c. as the bird walks through the grass the white patch on its face can be seen "bobbing" up and down
6. Adult male and female bobwhites can be easily distinguished from each other because \_\_\_\_\_.
  - a. males are much larger than females
  - b. the female's "bob-white" whistle is higher pitched than the male's call
  - c. males have white markings on their faces while females have buff-brown facial markings
7. The annual mortality (death) rate in a bobwhite population in any given year is about \_\_\_\_\_.
  - a. 70 to 80 percent
  - b. 40 percent
  - c. 10 percent
8. The most important cause of bobwhite population declines is \_\_\_\_\_.
  - a. loss of appropriate habitat
  - b. predation
  - c. hunting
9. Ideal bobwhite habitat should consist of \_\_\_\_\_.
  - a. mature forestland
  - b. a mixture of grassy, brushy, wooded vegetation with some areas of bare ground and near agricultural crops
  - c. large fields of row crops
10. Bobwhites always build their nests \_\_\_\_\_.
  - a. in the fork of a mature deciduous tree
  - b. in thick brush about 3 feet off the ground
  - c. on the ground in grassy areas
11. A group of quail is typically called a \_\_\_\_\_.
  - a. herd
  - b. school
  - c. covey
12. The average adult bobwhite stands about \_\_\_\_\_ tall and weighs about \_\_\_\_\_.
  - a. 12 to 15 inches; 1 pound
  - b. 2 to 3 inches; 2 to 3 ounces
  - c. 5 to 7 inches; 6 to 7 ounces
13. Most bobwhite nesting occurs during \_\_\_\_\_.
  - a. February, March, and April
  - b. May, June, and July
  - c. August, September, and October

NAME \_\_\_\_\_

GRADE \_\_\_\_\_ CLASS \_\_\_\_\_

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## SECTION II: THE ROLE OF RESEARCH

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*These questions cover information in video segment 2 and booklet pages 8-10. Circle the correct answer.*

1. A possible explanation for a problem can be referred to as a \_\_\_\_\_.
  - a. conclusion
  - b. hypothesis
  - c. solution
2. A wildlife biologist drawing conclusions based on field observations is conducting \_\_\_\_\_ research.
  - a. descriptive
  - b. experimental
  - c. radio-telemetry
3. A well-designed study that allows researchers to critically test a hypothesis is an example of \_\_\_\_\_ research.
  - a. descriptive
  - b. experimental
  - c. radio-telemetry
4. The logical progression of steps researchers follow to avoid drawing false or incorrect assumptions is referred to as \_\_\_\_\_.
  - a. the hypothesis
  - b. descriptive research
  - c. the scientific method
5. A quail researcher needing to estimate the number of bobwhites living in a particular area could use \_\_\_\_\_.
  - a. radio-telemetry
  - b. a walk census
  - c. a research hypothesis
6. A researcher studying the habitat needs of bobwhite quail during the nesting season could use \_\_\_\_\_.
  - a. radio-telemetry techniques
  - b. artificial nests
  - c. computer generated habitat maps
  - d. all the above
7. A walk census will consistently flush about \_\_\_\_\_ percent of the bobwhites living in a given area.
  - a. 100
  - b. 75
  - c. 50
  - d. 25

NAME \_\_\_\_\_

GRADE \_\_\_\_\_ CLASS \_\_\_\_\_

SCHOOL \_\_\_\_\_

TEACHER \_\_\_\_\_



## SECTION III: HABITAT IS THE KEY

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*These questions cover information in video segment 3 and booklet pages 11-13. Circle the correct answer.*

1. The size of a bobwhite's home range is typically \_\_\_\_\_.
  - a. about 5
  - b. between 15 and 100
  - c. more than 1,000
2. Bobwhites must be able to obtain free-standing water \_\_\_\_\_.
  - a. every day
  - b. at least once each week
  - c. only during droughts
3. During winter, bobwhites feed mainly on \_\_\_\_\_.
  - a. seeds
  - b. insects
  - c. plant material
4. A dense patch of honeysuckle and briars could function as \_\_\_\_\_.
  - a. nesting cover
  - b. protective cover
  - c. feeding cover
5. Bobwhites prefer areas with lots of bare ground for feeding because \_\_\_\_\_.
  - a. predators are less common in these areas
  - b. seeds in these areas are larger and more nutritious
  - c. the lack of vegetative litter makes seeds easier to obtain
6. Bobwhites feed on \_\_\_\_\_.
  - a. insects
  - b. seeds
  - c. berries
  - d. all the above
7. Fields dominated by broomsedge that is about \_\_\_\_\_ tall are good nesting habitat for bobwhites.
  - a. 5 inches
  - b. 1 to 2 feet
  - c. 3 to 4 feet

NAME \_\_\_\_\_

GRADE \_\_\_\_\_ CLASS \_\_\_\_\_

SCHOOL \_\_\_\_\_

TEACHER \_\_\_\_\_



## SECTION IV: HABITAT ENHANCEMENT

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*These questions cover information in video segment 4 and booklet pages 13-16. Circle the correct answer.*

1. In Tennessee, well-managed quail habitat can support a fall density of about \_\_\_\_\_ quail per acre.
  - a. 1
  - b. 2
  - c. 3
2. Pastures dominated by \_\_\_\_\_ are especially poor habitat for quail and other wildlife species.
  - a. switchgrass
  - b. fescue
  - c. broomsedge
3. Nesting habitat can be provided by \_\_\_\_\_.
  - a. maintaining broomsedge fields with prescribed fire
  - b. planting shrub lespedezas along fencerows
  - c. planting perennial food plots
4. Brushy fence rows as narrow as \_\_\_\_\_ feet can offer cover and serve as effective travel corridors for bobwhites.
  - a. 20
  - b. 60
  - c. 100
5. The most effective way to manage for bobwhite quail is \_\_\_\_\_.
  - a. controlling predators
  - b. releasing large numbers of captive-raised quail
  - c. shortening hunting seasons
  - d. providing high quality habitat
6. One of the simplest ways of providing cover for bobwhites is \_\_\_\_\_.
  - a. allowing cattle to graze in woodlands
  - b. planting fields with fescue
  - c. allowing natural vegetation to develop along fencerows
7. \_\_\_\_\_ is a simple and relatively inexpensive way to enhance habitat for bobwhites.
  - a. Allowing annual weeds and grasses to develop naturally in disked areas
  - b. Leaving a strip of crops unharvested along the edge of fields
  - c. Allowing brush and grass to develop in ditches and gullies which cannot be farmed
  - d. All the above



College of Forest Resources

Mississippi State University

Forest & Wildlife Research Center



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## State quail populations rebound with habitat management

Some 10,000 Mississippi hunters are expected to take to the field Thanksgiving Day when bobwhite quail season opens.

Ensuring that quail remain a viable game bird in this and other Southeastern states is a major research goal of scientists at Mississippi State's Forest and Wildlife Research Center. Clearly, university avian ecologist Wes Burger and his colleagues will be busy.

"Quail populations have been falling during the past three decades in the Southeast and currently are declining almost four percent each year," said Burger, an associate professor of wildlife and fisheries.

Changes in agricultural and forest practices have been a major factor in tipping the natural balance against the small ground-feeding birds.

"Bobwhite thrive in areas with a mixture of weeds, grasses and shrubs," Burger said. "Thirty years ago, fields of row crops, native grass and annual weeds were well distributed among forested lands, creating a patchy habitat that was perfect for bobwhite quail.

"Today's land use practices, such as increased field size and reduced brushy cover along field borders, have reduced the places where they can prosper, as well as the population size which an area can support."

To counter this trend, Burger and other MSU scientists teamed in 1996 with the Mississippi Department of Wildlife, Fisheries and Parks to study the quail's response to habitat management.

Conducted on the nearly 6,000-acre Black Prairie Wildlife Management Area in Lowndes County, the study used radio-telemetry tracking to monitor the response of quail to habitat changes and to track predators.

"Fall populations of bobwhite have increased from one bird per 13 acres to one bird per two acres in just three years," Burger said. "The results indicate that proper habitat management is the key to increasing quail populations."

The Mississippi findings are being integrated with results from similar collaborative research in Florida, Georgia and Tennessee to provide a more comprehensive picture of regional population processes.

Individual landowners wishing to increase quail populations on their property can use some simple management practices, Burger said.

"Every tract of land is unique," he explained. "There is no fixed formula for quail management, but general practices include the intentional use of fence rows, hedge rows, idle grassy areas and fallow annual weed patches to recreate a complex landscape.

"Periodic disturbance with fire and disking is used to create and maintain weedy and grassy habitats," he added. "Creation around row crop fields of a 10- to 15-foot fallow field border that is disked every three years can enhance quail habitat in agricultural landscapes."

For more information, contact Burger at (662) 325-8782 or [wburger@cfr.msstate.edu](mailto:wburger@cfr.msstate.edu).

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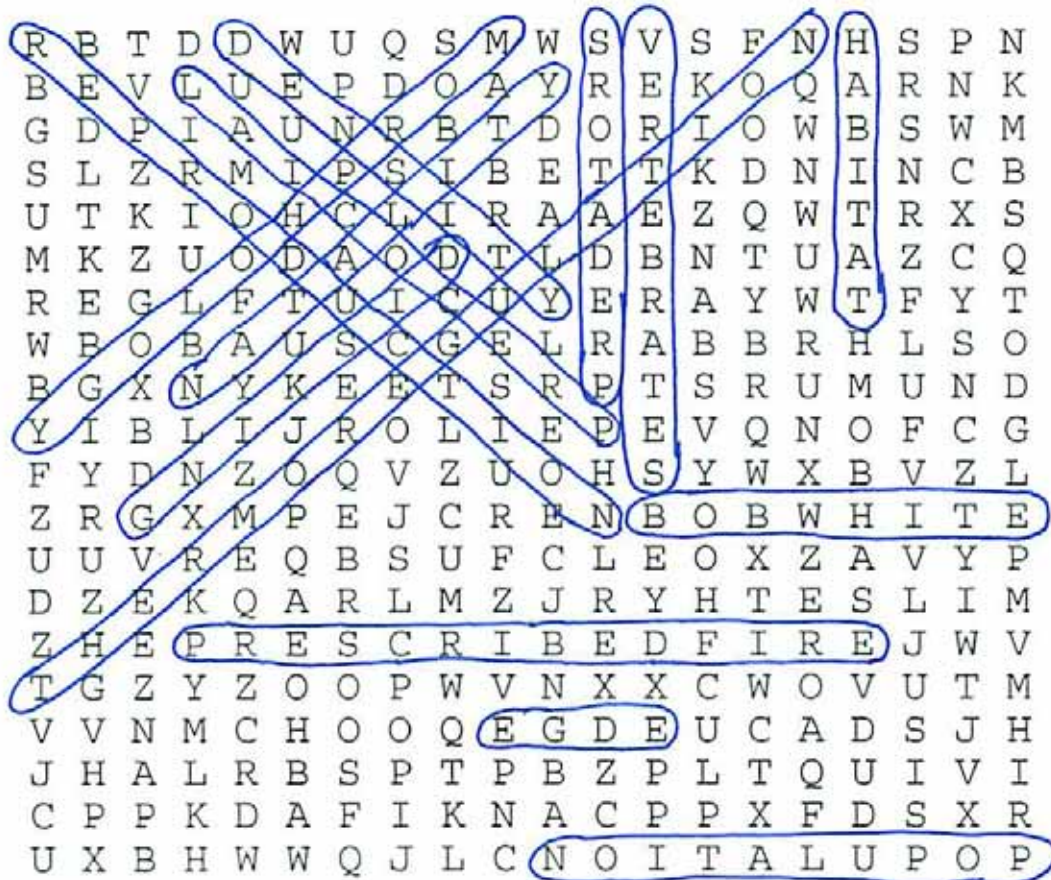
This page last updated January 8, 2001





# Bobwhite Quail Word Find #1

KEY



- BOBWHITE
- DENSITY
- DISKING
- EDGE
- HABITAT
- MORPHOLOGY
- NATALITY
- POPULATION
- PRECOCCIAL
- PREDATORS
- PRESCRIBEDFIRE
- REPRODUCTION
- THERMOREGULATION
- VERTEBRATES

14 of 14 words were placed into the puzzle

*Solution | How to Save Your Puzzle*

# Bobwhite Quail Word Find #1

R B T D D W U Q S M W S V S F N H S P N  
 B E V L U E P D O A Y R E K O Q A R N K  
 G D P I A U N R B T D O R I O W B S W M  
 S L Z R M I P S I B E T T K D N I N C B  
 U T K I O H C L I R A A E Z Q W T R X S  
 M K Z U O D A O D T L D B N T U A Z C Q  
 R E G L F T U I C U Y E R A Y W T F Y T  
 W B O B A U S C G E L R A B B R H L S O  
 B G X N Y K E E T S R P T S R U M U N D  
 Y I B L I J R O L I E P E V Q N O F C G  
 F Y D N Z O Q V Z U O H S Y W X B V Z L  
 Z R G X M P E J C R E N B O B W H I T E  
 U U V R E Q B S U F C L E O X Z A V Y P  
 D Z E K Q A R L M Z J R Y H T E S L I M  
 Z H E P R E S C R I B E D F I R E J W V  
 T G Z Y Z O O P W V N X X C W O V U T M  
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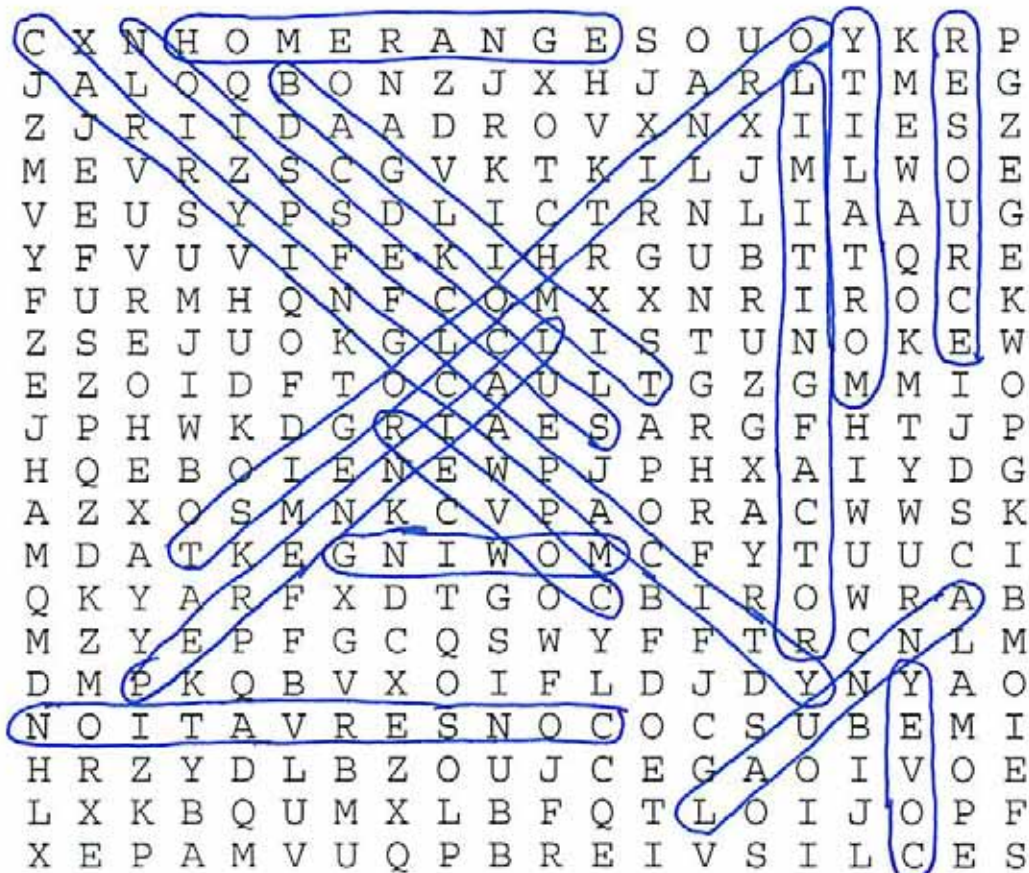
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 MORPHOLOGY  
 NATALITY  
 POPULATION  
 PRECOICIAL  
 PREDATORS  
 PRESCRIBEDFIRE  
 REPRODUCTION  
 THERMOREGULATION  
 VERTEBRATES

14 of 14 words were placed into the puzzle.

*Solution | How to Save Your Puzzle*

# Bobwhite Quail Word Find #2

**KEY**



- ANNUAL
- BAGLIMIT
- CARRYINGCAPACITY
- CONSERVATION
- COVER
- COVEY
- HOMERANGE
- LIMITINGFACTOR
- MORTALITY
- MOWING
- ORNITHOLOGIST
- PERENNIAL
- RESOURCE
- SUCCESION

14 of 14 words were placed into the puzzle.

[Solution](#) | [How to Save Your Puzzle](#)

# Bobwhite Quail Word Find #2

C X N H O M E R A N G E S O U O Y K R P  
 J A L O Q B O N Z J X H J A R L T M E G  
 Z J R I I D A A D R O V X N X I I E S Z  
 M E V R Z S C G V K T K I L J M L W O E  
 V E U S Y P S D L I C T R N L I A A U G  
 Y F V U V I F E K I H R G U B T T Q R E  
 F U R M H Q N F C O M X X N R I R O C K  
 Z S E J U O K G L C L I S T U N O K E W  
 E Z O I D F T O C A U L T G Z G M M I O  
 J P H W K D G R I A E S A R G F H T J P  
 H Q E B O I E N E W P J P H X A I Y D G  
 A Z X O S M N K C V P A O R A C W W S K  
 M D A T K E G N I W O M C F Y T U U C I  
 Q K Y A R F X D T G O C B I R O W R A B  
 M Z Y E P F G C Q S W Y F F T R C N L M  
 D M P K Q B V X O I F L D J D Y N Y A O  
 N O I T A V R E S N O C O C S U B E M I  
 H R Z Y D L B Z O U J C E G A O I V O E  
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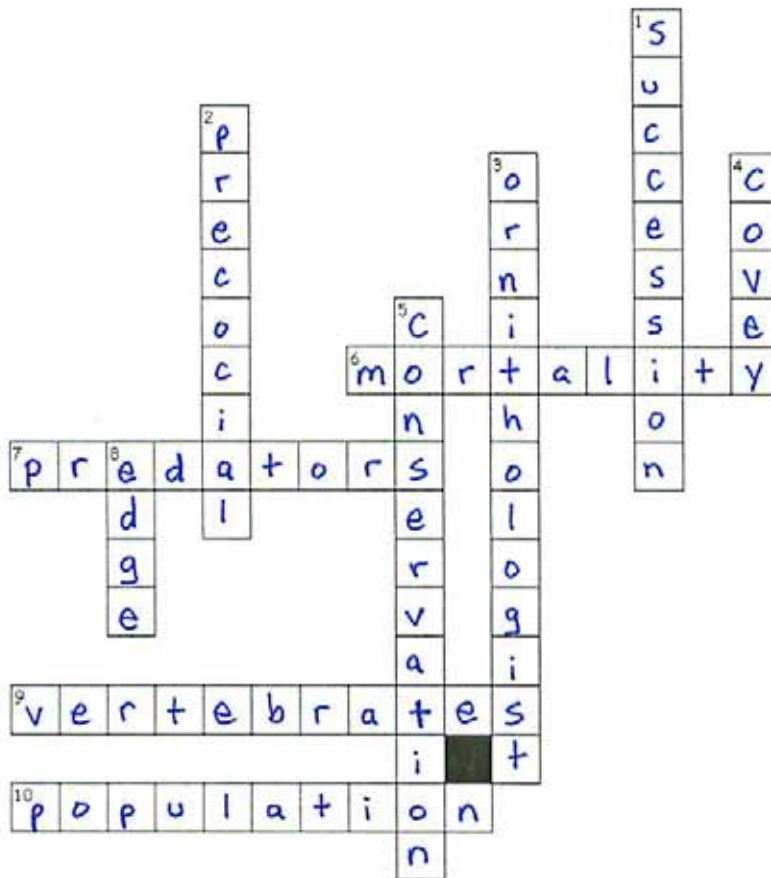
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 MORTALITY  
 MOWING  
 ORNITHOLOGIST  
 PERENNIAL  
 RESOURCE  
 SUCCESSION

14 of 14 words were placed into the puzzle.

[Solution | How to Save Your Puzzle](#)

# Bobwhite Quail Crossword Puzzle

**KEY**



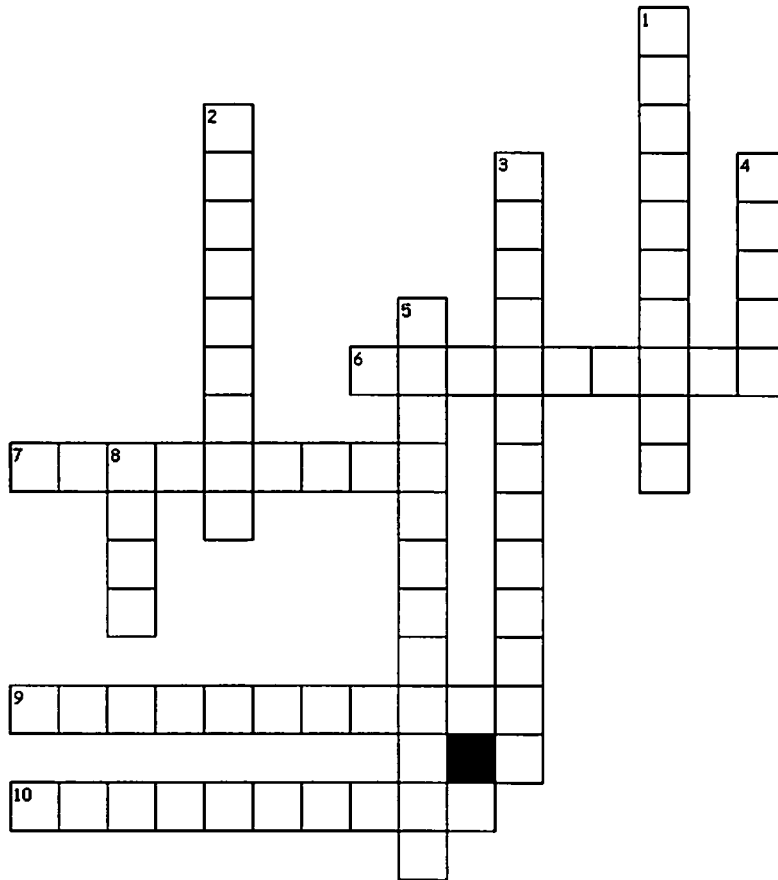
## Across

6. death rate
7. animals that hunt other animals
9. animals with backbones
10. number of animals in an area at a certain time

## Down

1. change in plant community over time
2. well-developed young
3. person who studies birds
4. group of bobwhite
5. wise use of resources
8. where two habitat types meet

# Bobwhite Quail Crossword Puzzle



## Across

- 6. death rate
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- 9. animals with backbones
- 10. number of animals in an area at a certain time

## Down

- 1. change in plant community over time
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The Life and Times of Bobwhite Quail in Mississippi  
A 4-H School Enrichment Program

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