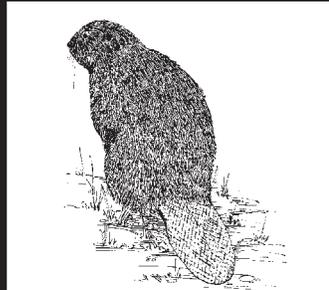
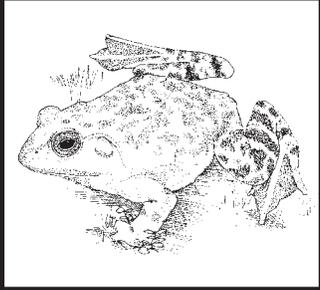
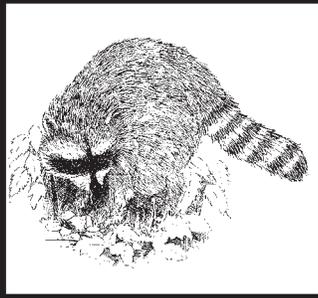
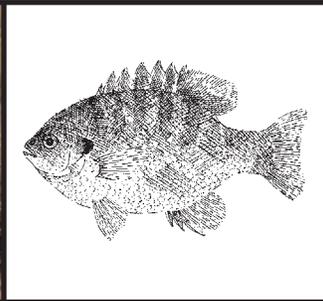
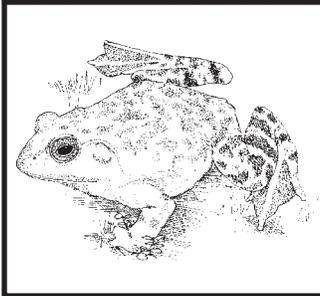
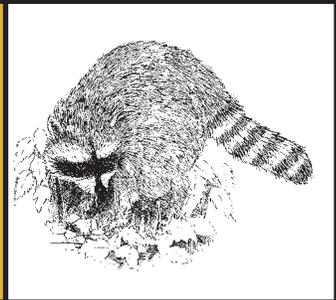
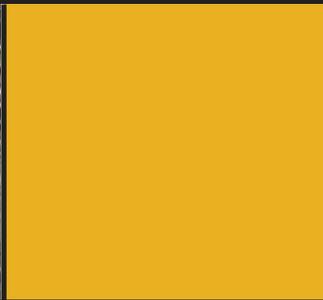


# WILDLIFE SCIENCE 2





# WILDLIFE SCIENCE 2





**NOTE TO 4-H MEMBER**

The 4-H Wildlife Science curriculum is for youth who enjoy studying wildlife. Level 2 activities help you use your basic knowledge of wildlife from Level 1 to explore more complex wildlife topics. Activities are presented by wildlife groups, as in the Level 1 manual. Level 3 delves deeper into the study of wildlife and can prepare you to be well informed and to study these topics at a college or university.

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Words defined in the glossary are in **bold** the first time they appear in the text.

**Keep a journal.**

Keep track of all your wildlife observations. You can organize your journal in different ways:

- A section for each month and year of study
- A section for each vertebrate class: mammals, birds, fish, reptiles, and amphibians
- Another method of your choosing

Discuss the Let’s Chat questions with your parent, 4-H leader, or other facilitator after you have completed the activity.

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## PIONEERS IN WILDLIFE CONSERVATION

*Do you know any wildlife conservation pioneers?*

### INTRODUCTION

Many animals' natural **habitat** is lost when we cut forests, drain wetlands, and remove other natural resources from the landscape. Natural resources serve many purposes and are important for economic stability. But we must use them in a sustainable way so they are not depleted.

Using our natural resources wisely also ensures that wildlife have a place to live. Many people over time have recognized the importance of conserving natural environments and protecting wildlife. They have worked to ensure a sustainable natural environment for wildlife. In this activity you will learn more about these wildlife pioneers.

### GEAR

- Pioneers of Wildlife Conservation worksheet
- Pen or computer



### LET'S DO IT

1. Read about the contributions made by the wildlife pioneers listed in the box on this page.



### Wildlife Pioneers

**Theodore Roosevelt** (1858-1919). The 26th U.S. president and an avid naturalist. His efforts have had far-reaching impact on wildlife protection.

**John Muir** (1838-1914). Naturalist and author. His efforts helped promote the protection of forest and wildlife areas. He wrote many books, including *My First Summer in the Sierra*.

**Ansel Adams** (1902-1984). American photographer and environmentalist. He used photography to promote protection of natural areas.

**Rachel Carson** (1907-1964). Marine biologist and environmentalist who wrote about the potential harm to wildlife from chemicals. She is best known as the author of *Silent Spring*.

**Gene Stratton-Porter** (1863-1927). Indiana naturalist and photographer who wrote novels about young people who appreciated nature. Among her books are *Freckles* and *Girl of the Limberlost*.

**Aldo Leopold** (1887-1948). Conservationist whose work greatly impacted forestry and wildlife ecology. His book, *A Sand County Almanac*, is a lesson in ecology.

2. Study one wildlife pioneer. Use information from a library or online.
  - Online resources ending in .edu (education) or .gov (government) are preferred.
  - Use .org (organization) websites only if reputable organizations like museums, zoos, or wildlife or science societies sponsor them.
  - Do not use question-and-answer blogs.
3. Complete the Pioneers of Wildlife Conservation worksheet for the wildlife pioneer you choose.



**LET'S CHAT**

*Share What Happened:* Why did you choose the person you did?

**Apply:** What have you learned that will make you a better advocate for wildlife?

**Generalize to Your Life:** What individual you know has made a positive impact on wildlife?



**LET'S FLY HIGHER**

- Read a book by one of the pioneers of wildlife.
- Search for other pioneers of wildlife.

**PIONEERS OF WILDLIFE CONSERVATION WORKSHEET**

Name of person \_\_\_\_\_

Born: \_\_\_\_\_ Died: \_\_\_\_\_

Early life or background:

\_\_\_\_\_  
\_\_\_\_\_

Summary of career:

\_\_\_\_\_  
\_\_\_\_\_

Important contributions:

\_\_\_\_\_  
\_\_\_\_\_

Impact on wildlife:

\_\_\_\_\_  
\_\_\_\_\_

Other interesting information:

\_\_\_\_\_  
\_\_\_\_\_

Why do you admire this person?

\_\_\_\_\_  
\_\_\_\_\_

Reference(s):

\_\_\_\_\_

# SIGNS OF WILDLIFE

*What evidence of wildlife can you find without actually seeing an animal?*

## INTRODUCTION

You can make observations of wildlife without actually seeing live animals. Many wildlife animals in nearby habitats avoid humans, and some are **nocturnal**. But you can often find evidence of them if you look carefully. You may find tracks, **scat, pellets, rubs, skeletons, feathers, snakeskins, eggshells, browse lines, nests, or dens**. In this activity you will search for signs of wildlife in places you would expect to find it or create an area that encourages wildlife to visit.



## GEAR 1

- Animal field guide or internet
- Camera (optional)
- Binoculars (optional)



## LET'S DO IT 1 WILDLIFE OBSERVATION HIKE

1. Take a one-hour hike looking for signs of wildlife. Possible places include home, a park, nature preserve, woods, or other location where you would expect wildlife to live.



2. Walk quietly. Try to observe all signs of wildlife.  
*Wildlife:* Birds are most commonly seen but if you watch carefully, you might also see squirrels, chipmunks, rabbits, or deer.  
*Signs of wildlife:* animal tracks, scat, pellets, rubs, skeletons, feathers, snakeskins, eggshells, browse lines, nests, or holes for underground tunnels.
  - Pay particular attention in mud near a stream or pond where you might see footprints.
  - Watch for nests in trees or on the ground.
  - Look for animal damage on trees and vegetation:
    - Deer rubs – from antlers scrapping trees
    - Trees that beavers have cut
    - Plants that deer or rabbits have eaten
  - Watch for snakeskins, broken eggs, feathers, and skeletons.



3. Listen for wildlife sounds—noises or calls that wildlife might make.
4. Record what you see and hear in your journal. Include the date, time, and weather conditions. Sketch or take pictures of what you observe.
5. Use identification guides as needed. You can carry small printed guides in a backpack, or use apps on a mobile device during your hike. When you get home or to a library, you can use the internet to learn more about your sketches or pictures.

## GEAR 2

- Play sand, 50 pounds
- Rake
- **Lures** to attract wildlife  
Scent attractants: oil of anise or vanilla  
Food attractants: corn, sunflower seeds, peanut butter, table scraps
- Plaster of Paris
- Gallon of water
- Spray bottle
- Milk jug or plastic cup
- Plastic mixing cup and mixing stick or spoon
- Animal field guide or internet for identification
- Camera (optional)



### LET'S DO IT 2 CAST A TRACK

1. Choose a location for your track trap where you expect animals to walk. You should have permission to use it and be able to check it daily.
2. Make your track trap by removing the turf and vegetation from an area about 4 feet by 4 feet. Rake the ground, and empty a 50-pound bag of sand on the area. Rake the sand smooth, and spray it with water.
3. Check the trap every morning for footprints.
4. Add a lure, if you don't see footprints after a day or two.  
Food lures: Place food on a piece of wood, brick, or other flat surface in the center of the track trap.  
Scent attractant: Use a rubber band or string to attach a cotton ball to a 12- to 18-inch stick. Push the stick into the ground in the center of the track trap. The cotton ball should be about a foot above the sand. Drip or spray several drops of a lure on the cotton.
5. Record your findings in your journal. Include the date, time, and weather conditions. Sketch or take a picture of what you see.
6. Make a plaster cast of a footprint in the sand.
  - Cut the bottom of the plastic cup or, if the print is too large for a cup, cut a strip of plastic from a milk jug to circle the print and hold the plaster.
  - Gently push the form into the ground around a footprint.

- Mix enough Plaster of Paris and water to fill the print and form.
- Pour the plaster into the form to a depth of about 1 inch.
- Allow the plaster to set (become dry and hard).
- After the plaster is hard, remove the cast and brush off any excess dirt.



### LET'S CHAT

**Share What Happened:** What signs of wildlife did you find?

**Apply:** Why is it useful to be able to find evidence of wildlife without seeing wildlife?

**Generalize to Your Life:** How might you tell that people have been on a hiking trail without actually seeing them?



### FLY HIGHER

- Take the same hike at different times of day, and compare your observations.
- Take a hike in different seasons, and compare your observations.
- Make multiple track traps, and compare lures and locations.
- Visit the Purdue Soundscape webpage, <http://ltm.agriculture.purdue.edu/soundscapes.htm>.



# IMPACT OF CLIMATE CHANGE

*What impact does climate change have on wildlife?*

## INTRODUCTION

The burning of fossil fuels—coal, oil, gasoline, and natural gas—powered the **Industrial Revolution** and has significantly increased the amount of carbon dioxide in the air.

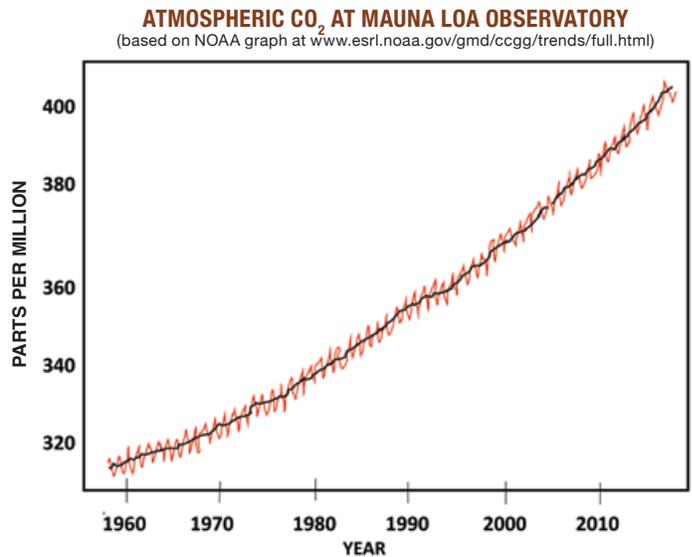
Carbon dioxide is a gas that increases the atmosphere's retention of heat. Carbon dioxide is often called a greenhouse gas because it traps heat like glass in a greenhouse traps the sun's heat. More than 30 billion tons of carbon dioxide is added to the atmosphere every year from burning fossil fuels. Consequently, the earth's atmosphere has been warming much faster than it would have naturally.

The National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA) have been tracking carbon dioxide levels and global temperatures for many years. Both have been increasing over time (see figures 1 and 2).

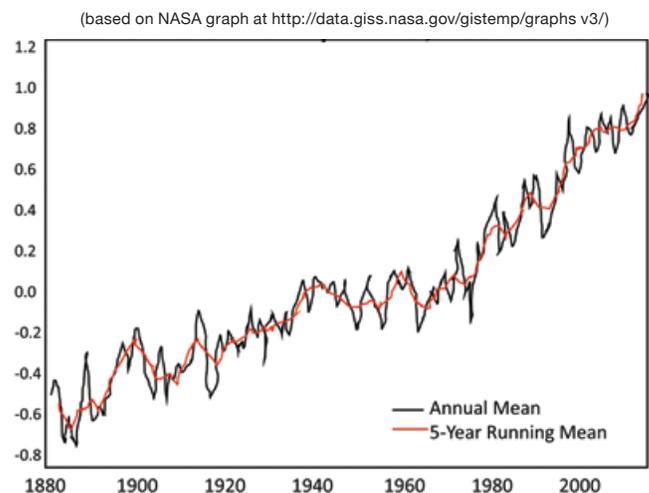
Many people use the phrase **global warming** when talking about **climate change**, because the average global temperature has been rising for so long. This can be confusing, however; although the average global temperature has been rising, some areas have recorded lower average temperatures in recent years. Climate change refers to more than just temperature. It includes changes in weather patterns and, many scientists believe, more storms and more severe storms.



**FIGURE 1.**  
**NOAA CARBON DIOXIDE DATA, 1958-2015**



**FIGURE 2.**  
**MEAN GLOBAL TEMPERATURE, 1880-2010**



Earth's overall warming is changing habitat around the globe. These changes affect wildlife. Wildlife biologists are concerned these changes might decrease or even eliminate wildlife populations. In this activity you will study the possible effects of climate change on one wildlife animal.

**Earth is a biological system, just like your body. Both systems can be harmed by seemingly small changes in temperature.**

## GEAR

- Internet access. Record your source of information with your findings. Internet references must be \*.edu or \*.gov websites. If you find information at other websites, you must confirm it is research-based. Do not use question-and-answer blogs.
- Materials to present results (poster presentation or an electronic presentation)



## LET'S DO IT

1. Choose a wildlife species from this list.

Blue crab	Marsupial frog
Brown pelican	Moose
Burrowing owl	North Atlantic right whale
Common loon	Penguins
Common side-blotched lizard	Pika
Giant panda	Polar bears
Goebel's false brook salamander	Ringed seals
Greater short-horned lizard	Salmon
Harlequin frog	Sea turtles
Lake sturgeon	Timber rattlesnake
	Walleye

2. Take notes while you learn all you can about your subject. You can keep your notes on index cards. Put different topics on each card for easy sorting later; for example, *food and shelter needs, survival temperature range, special reproduction requirements, and range*.
3. Prepare a report of 3-5 pages on the expected environmental impact of climate change on your species.
  - Create an outline before you begin.
  - Arrange the information you found during your research, following your outline.
  - Write your report.
  - Include possible solutions and/or programs to address any problems you learn about.
  - Include pictures, graphs, and/or tables, if you can, to help your reader understand the impact of climate change on the species you researched.
  - List the references you used. *Book references* must include the title, authors, publisher, and date of publication. *Internet references* must include the page title, professional affiliation



(university, government agency, or professional society), web address, and date of access.

*Articles* in professional papers, magazines, or newspapers must include the title, author, source, and date of publication.

4. Prepare a poster exhibit to convey the plight of your subject to the public. A good poster attracts attention. It is simple and clear, interests people in your subject, and does not contain too much information for a casual reader.



## LET'S CHAT

**Share What Happened:** Why did you choose to research this animal?

**Apply:** Are there things you can do to reduce the effects of climate change on wildlife?

**Generalize to your life:** What effect might climate change have on your life?



## LET'S FLY HIGHER

- Study the impact of climate change on another species of wildlife.
- Investigate other issues related to environmental impacts of climate change. You might start by studying the Indiana 4-H Weather and Climate project manual.
- Visit the Purdue Climate Change Research Center, [www.purdue.edu/discoverypark/climate](http://www.purdue.edu/discoverypark/climate), to learn about the research it's doing.
- Visit the United Nations Climate Change webpage, [www.un.org/climatechange](http://www.un.org/climatechange), to find what world leaders are thinking and doing.

# WILDLIFE CAREERS

*Is there a wildlife career for you?*

## INTRODUCTION

Your interest in wildlife could lead to a career. Middle school (grades 6-8) is the perfect time to think about a possible career. No matter what field you wish to pursue, it's important to know what high school courses will help you prepare for college, technical school, or a job.

Youth who plan to get a degree toward a wildlife profession need a good math and science background to prepare for college-level work. If you want a wildlife career, now is a good time to start exploring the possibilities. This activity will help you explore different wildlife careers. Even if you plan on a different career, your interest in wildlife can become an **avocation**.



## GEAR

- Internet access
- Computer or pencil and paper



## LET'S DO IT

1. Visit Purdue University's Department of Forestry and Natural Resources website, [www.ag.purdue.edu/fnr](http://www.ag.purdue.edu/fnr). Click on the Current Students arrow and Career Resources. Read the information and explore the links to possible jobs (FNR Job Board, Career Search Sites, State and Federal Employment).
2. Find three jobs you might be interested in.
3. Create a document (on a computer or by hand) with the following information:
  - Job title/description
  - Pay, benefits (if listed)
  - Employer
  - Job location
  - Education and experience requirements
  - Job duties
  - Required skills
  - Recommended skills

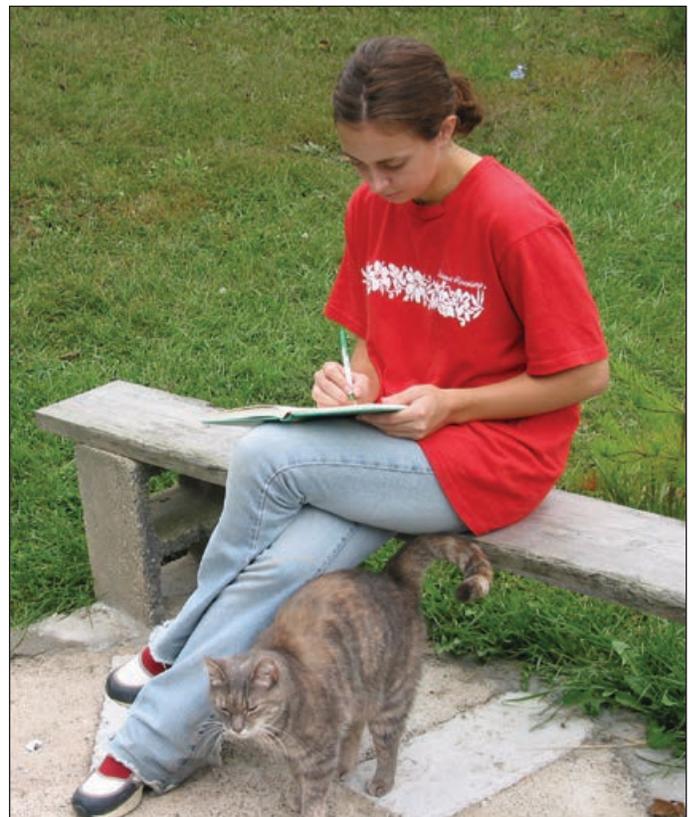


## LET'S CHAT

**Share What Happened:** What type of jobs were you interested in?

**Apply:** What do you need to do during high school to get one of these jobs?

**Generalize to Your Life:** Why do employers require specific skills for a job?



## LET'S FLY HIGHER

- Explore degrees that are available at your favorite universities.
- Talk to a wildlife biologist and find out about his or her career path.

# WILDLIFE REAL ESTATE

*Can you build a home for wildlife living in your neighborhood?*

## INTRODUCTION

Many more species of wildlife are probably in your neighborhood than you are aware of. You can attract some of them to live near you by providing a birdhouse, bat house, or nesting box. By placing the wildlife home near your home, you can observe the species more easily. Attracting species like bats and purple martins can help reduce nuisance insect populations. Building wildlife houses is also fun and creative.



## GEAR

- Resources for building a birdhouse, bat house, bee house, squirrel house, waterfowl platform, or other nest building. Suggestions:
  - Shelves, Houses, and Feeders for Birds and Mammals, North Central Regional Extension Publication No. 338, <http://extension.missouri.edu/p/NCR338>
  - Internet search for online instructions
  - Library books on building wildlife housing
- The materials and tools your project requires



## LET'S DO IT

- Study the wildlife houses you can build, and choose one.
  - Consider what you can afford, the level of woodworking skills it requires, and the species you are likely to attract.



- You'll probably be more successful if you build a house for an animal that's already in your neighborhood.
  - Bluebirds usually find birdhouses that are built for them even if you don't currently see them where you live.
- Follow the directions to build your wildlife house/nest. Ask for adult help with tools.
  - Mount your birdhouse at least 3 feet high.
  - Watch your house without disturbing the inhabitants.
  - Watch your birdhouse daily, and take steps to eliminate any predators, if necessary.
    - For example, raccoons will often raid a bluebird house, but a raccoon guard can keep them out.
    - Space nesting boxes correctly to avoid competition within the species.



## LET'S CHAT

**Share What Happened:** What challenges did you encounter while building the house?

**Apply:** What did you learn about the wildlife species you built the home for?

**Generalize to Your Life:** Why can nesting boxes provide an important habitat for some species?



## LET'S FLY HIGHER

- Build another house for wildlife.
  - Mount your house and observe how animals use it over a season.
- Visit a wildlife refuge. Talk to a wildlife biologist, and ask how they assist a species during nesting.

# TALK TO A PROFESSIONAL

*What does a wildlife professional do?*

## INTRODUCTION

Wildlife professionals fill many different roles—in wildlife management, wildlife control, research, and/or education. Perhaps you have attended a talk or spoken to a wildlife professional at a park or wildlife area. Talking to a wildlife professional is the best way to learn what they do and explore careers in wildlife.



## GEAR

- Resource to help you find a wildlife professional: internet, Extension 4-H youth development educator, adult helper
- Paper and pencil or your wildlife journal



## LET'S DO IT

1. Prepare an interview sheet. Include space for the interviewee's name, organization, and interview date. Write 5-10 questions to ask about a career in wildlife.
2. Find someone who works with wildlife to interview.
  - Use Where to Find a Wildlife Professional or the internet, or ask your Extension 4-H youth development educator for referrals.
3. Contact the wildlife professional, and ask for an interview. Tell them you are considering a wildlife career and would like to ask a few questions.
  - Conduct your interview by phone, Skype, or email, or in person.
  - If you are visiting the wildlife professional, schedule your interview when your parent or guardian can go with you.
4. Interview the wildlife professional, and take notes. If you visit in person, take a picture of you and the interviewee.

## Examples of questions

- Why did you enter this field?*
- What are your main duties?*
- What wildlife species do you work with most?*
- Who do you work with?*
- What do you like about your job?*
- What is your greatest challenge?*
- What is a typical day like?*

- What education did you need for your job?*
- How do you stay informed about new wildlife research?*
- What wildlife issues are important to you?*
- Do you have any concerns about the future of wildlife?*
- Ask follow-up questions for clarification. For example:
  - Why do you think that is true?*
  - Who else might work on that?*

## Where to Find a Wildlife Professional

- Community nature areas – interpreters
- Department of Natural Resources
- Division of Fish and Wildlife / District wildlife biologists
  - Law enforcement / hunter education and conservation officers
  - Nature Conservancy areas – managers
- Private land wildlife preserves – landowners
- Societies like Pheasants Forever and Ducks Unlimited – officers
- State or national parks and forests – biologists, interpreters, managers
- State wildlife refuge areas – managers and interpreters
- State fish and wildlife areas
- Universities – professors, graduate students, and technicians in wildlife research



## LET'S CHAT

**Share What Happened:** What did you learn about a wildlife career?

- Apply:** How might your interview impact your future?
- Generalize to Your Life:** Why is it valuable to interview someone who works in a job that you are considering?



## LET'S FLY HIGHER

- Explore college programs to prepare you for a career in wildlife.
- Explore educational requirements for wildlife positions.
- Interview people in other wildlife jobs.

# WE DON'T LIVE HERE ANYMORE

*What are “degrees of endangerment?”*

## INTRODUCTION

Human activities affect the environment. The Midwest had abundant forests, prairies, and wetlands when Native Americans inhabited it. These habitats supported large populations of many wildlife species. Some of these species became **extinct** or **extirpated** due to loss of habitat or excessive hunting before laws were passed to ensure sustainability. Two species that were extirpated, deer and turkeys, were **reintroduced** in Indiana and now have healthy populations. People and agencies continue to work to provide habitat for native wildlife populations and to encourage some species to return.

Wildlife biologists use four terms to describe species' movement into, or out of, an area. These are called the condition of a species.

The three terms that describe the level of risk to a wildlife species are called **degrees of endangerment**.

A species' condition can change over time. For example, the bald eagle—the symbol of the United States—has been extirpated, endangered, reintroduced, and finally taken off the endangered species list in many states. People influenced both the loss of this species in many areas as well as its return. The success of a species' survival requires proper wildlife management techniques.

### Terms of Species Condition

- **Extirpated** – A species that once lived in an area but no longer survives in the wild.
- **Introduced** – A species that is not native and has been brought to an area, on purpose or by mistake, and has formed a self-sustaining population.
- **Reintroduced** – A species that was extirpated and has been purposefully brought back by an agency and sustained by using wildlife management techniques.
- **Returned** – An extirpated species that has come back to an area on its own.

### Degrees of Endangerment

- **Endangered** – A species in danger of extinction throughout all or a significant portion of its home range.
- **Extinct** – A species that was once on earth but no longer exists (example: passenger pigeon).
- **Threatened** – A species likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

### GEAR

- Pencil



## THE CASE OF THE BALD EAGLE IN INDIANA

Bald eagles once lived in Indiana but had been extirpated for many years.

Before 1897	Bald eagles are observed in Indiana.
1897	The last bald eagle nest is observed in Indiana.
1898	Bald eagle condition: extirpated from Indiana.
1963	An estimated 400 nesting pairs of bald eagles are left in the lower 48 states.
1966	The Endangered Species Preservation Act is signed. It allows for bald eagle protection south of the 40th latitude in the United States.
1973	The Endangered Species Act is signed. It provides protection of species that are endangered or threatened throughout all or part of their range.
1985 to 1989	Seventy-three bald eagle fledglings are released in Monroe County, Indiana. It takes four to five years for bald eagles to mature enough to begin to nest.
1991	The first successful bald eagle nests are reported in Indiana.
2007	The bald eagle is taken off the endangered species list.
2015	Indiana has an estimated 250 nesting sites. There are more than 10,000 nesting pairs of bald eagles in the U.S.



## LET'S DO IT

1. Read the example, The Case of the Bald Eagle in Indiana, and complete the activity to learn more about the condition of some Indiana wildlife species.
2. Use the vertebrates listed in the word bank to complete the Vertebrate Conditions table and the Degrees of Endangerment table.

### WORD BANK

#### Mammals

Badger  
Beaver  
Bison  
Black bear  
Bobcat  
Coyote  
Elk  
Gray bat  
Gray wolf  
Indiana bat  
Mountain lion  
Northern long-eared bat  
Porcupine  
River otter  
White-tailed deer  
Wolverine

#### Birds

Bald eagle  
Carolina parakeet  
European starling  
Heath hen  
Ivory-billed woodpecker  
Osprey  
Passenger pigeon  
Peregrine falcon  
Piping plover  
Ring-necked pheasant  
Sparrow  
Wild turkey

#### Reptiles

Copperbelly water snake  
Massasauga rattlesnake  
Ornate box turtle

#### Amphibians

Ainsworth's salamander  
Eastern hellbender

#### Fish

Asian carp  
Blue walleye  
Coho salmon

- Hyphens and some letters are given as clues.
- Each species may be used only once.

### VERTEBRATE CONDITIONS

EXTIRPATED	REINTRODUCED	RETURNED	INTRODUCED
_____k b_____	_____ver_____	_____oy_____	R____-_____ ____ant
G_____ _____f	_____ _____key	Por_____	_____h____ s_____
_____ine	_____ea_____	_____av_____	Sp_____
_____nta_____	Wh_____-_____ _____		A_____ _____p
_____k		_____ine f_____	Eu_____ _____
_____i_____			

## DEGREES OF ENDANGERMENT

EXTINCT	ENDANGERED	THREATENED
_____keet	G_____t	_____b_____
_____bil_____	_____gp_____	C_____e
_____eng_____	O_____	B_____
_____wo_____ma_____	O_____e	Mass_____
_____ew_____	_____na_____	B_____t
He_____n	E_____n_____be_____	



### LET'S CHAT

**Share What Happened:** Were you surprised to learn the degree of endangerment for any of the wildlife species?

**Apply:** Why do you think wildlife species become endangered?

**Generalize to Your Life:** Do you think it matters if wildlife becomes endangered or extinct?



### LET'S FLY HIGHER

- Investigate how introduced species have affected local wildlife.
- Ask your adult helper to help you get the DVD Everglades of the North: The Story of the Grand Kankakee Marsh at [www.kankakeemarsh.com](http://www.kankakeemarsh.com). Watch it with your family or friends.
- Read about the value of wetlands at [www.epa.gov/wetlands](http://www.epa.gov/wetlands)

## MY NOTES and IDEAS

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## MAMMAL HABITAT

*What makes good habitat for a mammal?*

### INTRODUCTION

Animals live in specific habitats based on their needs. Level 1 introduced the four things a habitat must provide: food, shelter, water, and space.

The way a species adapts to a habitat that provides food, water, and shelter is the result of evolution, which takes a long time. Some mammals must compete for the same resources. Others can live together without competing because they have different needs. For example, both beavers and river otters live in rivers or ponds; but because beavers are herbivores (plant eaters) and river otters are carnivores (meat eaters), they do not compete for food and can occupy the same habitat.

In this activity you will study two mammals that occupy the same area but have different needs and fill a different **niche**. These mammals are commonly found in the Midwest and are identified by where they live, as described here:

**Aquatic** – lives primarily in water

**Fossorial** – lives primarily underground

**Arboreal** – lives primarily in trees

**Terrestrial** – lives primarily on the ground



### GEAR

- Library or internet for research



### LET'S DO IT

1. Choose two mammals from the Animal Neighbors list, one from A and one from B.
2. Study the two mammals to find their needs for food, water, and shelter. If you use the internet, your references must be websites with \*.edu or \*.gov. If you find information at other websites, you must confirm it is research-based.
3. Complete the Habitat Information table for the two mammals you chose.

#### Animal Neighbors

- A** Beaver (aquatic)  
 Raccoon (arboreal)  
 White-footed mouse (fossorial)  
 Eastern mole (fossorial)  
 Eastern white-tailed rabbit (terrestrial)
- B** Groundhog (fossorial)  
 Meadow vole (fossorial)  
 River otter (aquatic)  
 White-tailed deer (terrestrial)  
 Squirrel (arboreal)



## HABITAT INFORMATION

MAMMAL FROM COLUMN A	MAMMAL FROM COLUMN B
Food requirements:	Food requirements:
Water requirements:	Water requirements:
Shelter requirements:	Shelter requirements:
Other habitat information:	Other habitat information:
Sources used:	Sources used:



### LET'S CHAT

**Share What Happened:** What did you learn about the two mammals?

#### Apply

- How does knowing what a mammal needs for food, water, and shelter help you find where that animal might actually live?
- How can you help conserve areas where the two mammals might live?

**Generalize to Your Life:** How might a mammal's habitat requirements change over the year?



### LET'S FLY HIGHER

- Study how the requirements of the two species you chose change from winter to summer.
- Study two other mammals.
- Make a diorama or poster that shows the food, water, and shelter requirements for the animals you studied. Be creative!
 

*Diorama:* Use a shoebox or similar container. Arrange items that show the habitat of the two mammal species you studied. Explain how the habitat provides their needs.

*Poster:* Arrange the poster to describe the habitat of the two mammals you studied. Use pictures and/or sketches. Explain how the habitat provides their needs.

# TO HIBERNATE, OR NOT TO HIBERNATE?

*How do mammals survive cold winters?*

## INTRODUCTION

Mammals need to survive cold winters in the Midwest. Some animals survive by growing a heavier coat of fur or hair. Others hibernate. During **hibernation** an animal enters an inactive state in which its body temperature, breathing, **metabolism**, and heart rate drop below normal. Most mammals do not hibernate, however; they have a variety of ways to survive cold winters. Three examples follow.

### Thirteen-lined ground squirrel

Thirteen-lined ground squirrels can survive with very little food and water for up to six months. By October most ground squirrels have retreated to underground burrows to hibernate. They don't actually sleep but enter a state called **torpor**. Their body temperature lowers to only a few degrees warmer than the burrow—sometimes only a few degrees above freezing. Their breathing slows, and metabolic rates reduce to burn stored body fat very slowly. They must work hard to gain enough weight over the summer to last through the winter. These ground squirrels occasionally awaken for a few hours, warm up to near normal temperature, and then go back into torpor. Ground squirrels arouse from hibernation sometime in March in the Midwest. *Reference:* [www.vetmed.wisc.edu/lab/carey/research](http://www.vetmed.wisc.edu/lab/carey/research)

### White-tailed deer

In the fall, white-tailed deer shed their reddish-brown fur for a grayish-brown fur. Their winter fur has longer hair with hollow shafts that provide insulation. During the fall the deer also store extra fat around their organs and under their skin, providing extra insulation and an energy reserve for cold winter days. Deer also change their habits during the winter. They form larger groups and move into more sheltered wooded areas with thick canopies and, possibly, stands of evergreen trees. They need to be near a water source like a river, pond, or stream. These areas, called deer yards, help protect them from winter winds and thick snow cover. *Reference:* How Deer Survive the Winter by Joe Wiley and Chuck Hulse, [www.maine.gov/ifw/hunting\\_trapping/pdfs/deer\\_yards.pdf](http://www.maine.gov/ifw/hunting_trapping/pdfs/deer_yards.pdf)

### Brazilian free-tailed bat

The Brazilian free-tailed bat, also known as the Mexican free-tailed bat, summers in the U.S., from Texas to Oregon. These bats fly from Mexico and Central America in the spring. In summer they stay almost anywhere with cover—in caves or buildings, or under house eaves or tree bark. They usually form large flocks in October and migrate to Mexico and Central America for the winter. *Reference:* <http://tpwd.texas.gov/huntwild/wild/species/brazilfreetailbat/>

## GEAR

- Pencil or pen
- Online computer and/or mammal guide book
- Materials to present results (poster presentation or an electronic presentation)



## LET'S DO IT

1. Choose two of these mammals, and research how they survive the winter.

Gray squirrel	Elk	Chipmunk
Raccoon	Black bear	Red fox
Beaver	River otter	Skunk
2. Study how the two mammals prepare for and survive cold winters. Record all the sources you use for information. Use websites ending in \*.edu or \*.gov or those from a trusted organization.
3. Record your findings in your journal, on paper, or on a computer.
4. Create a presentation to educate others about how the two mammals survive cold winters.



## LET'S CHAT

**Share What Happened:** How have the animals you studied adapted to survive a cold winter?

**Apply:** Why do people generally see different animals in winter than they see in the summer?

**Generalize to Your Life:** What do mammals that live outside need to survive cold winters?

# SQUIRREL HABITAT GAME

*What resources are required for a successful habitat?*

## INTRODUCTION

Good wildlife **habitat** depends on the resources available in it. A species must have adequate food, water, and shelter to survive. A shortage of any one of these resources makes the habitat unsuitable. The resource in least supply is the **limiting factor**, and it determines how many individuals can survive in the habitat. The number of individuals that can survive in a habitat is called the **carrying capacity**. The Squirrel Habitat Game will help you understand how the limiting factor among the three resources determines a habitat's carrying capacity.



## GEAR

- Pair of dice
- Copy the follow pages on heavy paper, if possible.
  - Dice roll guide (page 20, optional)
  - A habitat game mat for each player (page 21)
  - One copy of the game card sheet (page 22) for two players; or two copies for three or four players. Cut apart the pictures. Place them in separate piles in the center of the game table:
    - > Squirrels
    - > Offspring cards (stork)
    - > Water resource cards (raindrop)
    - > Food resource cards (acorn)
    - > Shelter resource cards (tree)



## LET'S DO IT

Play the Squirrel Habitat Game with friends, family, or at a 4-H club meeting.

**Object of the game:** Learn how luck and limiting factors can affect a squirrel population.

**Setup** (for 2 to 4 players)

Each player starts with two squirrels, five food cards, five water cards, and three shelter cards placed on the shaded spaces of the game mat.

**Playing the game:**

- Players take turns rolling the dice. Add the numbers on top of the dice, and follow the instructions in the dice roll guide for the number you roll.

- Add resources to the matching space of your game mat when you get them.
- You must have all five resources and an offspring (stork) card in a habitat to add a squirrel. When you add a squirrel card to your game mat, you return the offspring card to the stack in the middle of the table. Keep offspring cards in the nursery until a habitat is ready for them.
- You lose a squirrel when a habitat has only three resources left. (A habitat with four resources is poor, but a squirrel can still survive in it.)
- A player who rolls an 8 may steal a resource card from any opponent.
- You may keep extra resource cards after all the spaces are filled for that resource. You may use the extra resources when needed.
- A winner is declared when:
  - One player has five squirrels in a two-player game, or has four squirrels in a three- or four-player game; or
  - Only one player is left with squirrels.



## LET'S CHAT

*Share What Happened*

- Who did you play the Squirrel Habitat Game with?
- As you played, what resource was your limiting factor?
- During the game, how did resources influence carrying capacity?

**Apply**

- When resources are scarce, an animal could choose to move to another area. Can you think of a way to add this idea to the game?
- Could you make a similar game for other animals?
- Consider what the resource cards would look like for frogs, birds, fish, and snakes.

**Generalize to Your Life**

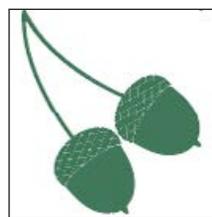
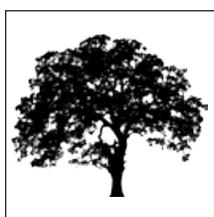
- Limiting factors are not always food, water, and shelter. As a human, what resource could be a limiting factor where you live?

- What are the limiting factors in your neighborhood that keep some animals—for example, raccoons, deer, bears, etc.—from living there?



**LET'S FLY HIGHER**

Make up another game for a different animal.



**Dice Roll Guide**

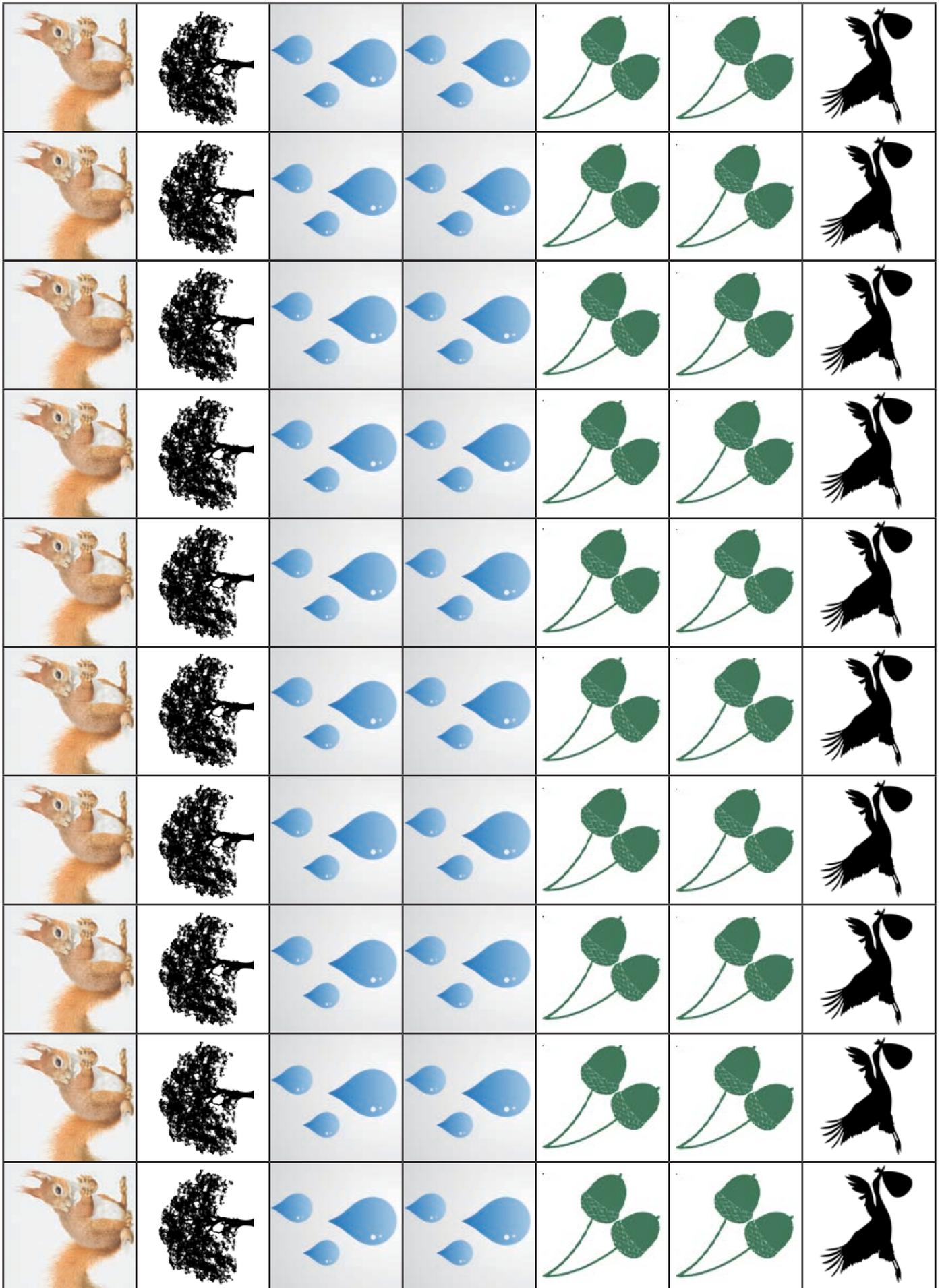
- Roll the dice. Add the two numbers on the tops of the dice for your Sum.
- Read the Event: What happened?
- Take the Action indicated. A minus indicates you lose a resource card (or two). A plus indicates you gain a resource card.

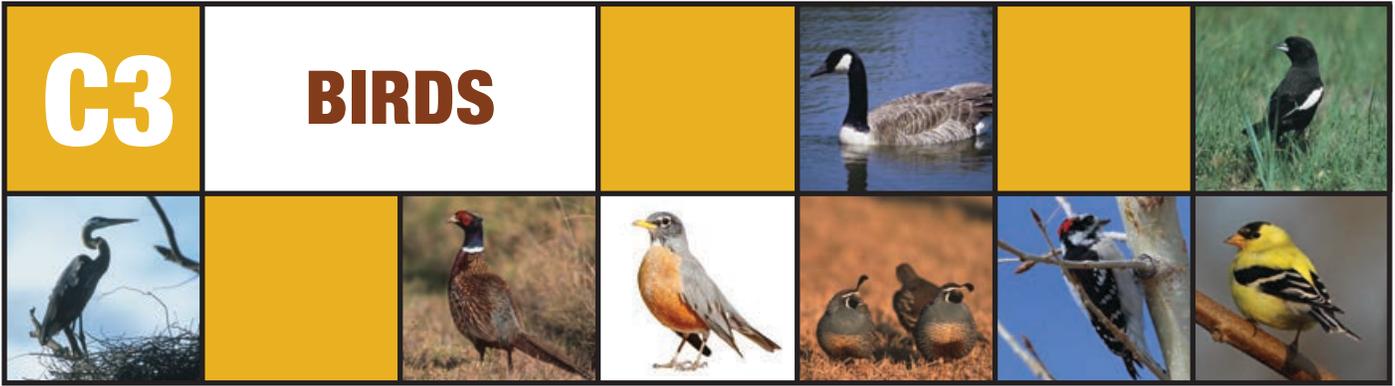
SUM	EVENT	ACTION
2	A predator visits the area.	– Lose a squirrel card
3	A farmer clears a natural area for cropland.	– Lose a shelter card
4	A drought reduces the water supply.	– Lose a water card
5	Family is increasing – birth of squirrel kitten.	+ Add an offspring card*
6	Bumper acorn crop!	+ Add a food card
7	Good luck—choose any one card.	+ Add a card of your choice
8	Survival of the fittest. Steal any resource-card (food, water, or shelter) from an opponent.	+ Add a card of your choice
9	Streams are full.	+ Add a water card
10	A new road is built through the oak woods.	– Lose a food card
11	Landowner plants trees.	+ Add a shelter card
12	A tornado rips through the area.	– Lose a shelter card and a food card

\*Place a squirrel card in your nursery, and use it when there are enough resources to increase the population.

**SQUIRREL GAME MAT**

<b>Squirrel #1 Habitat</b>		<b>Squirrel #2 Habitat</b>		<b>Squirrel #3 Habitat</b>	
Food	Food	Food	Food	Food	Food
Water	Water	Water	Water	Water	Water
Shelter		Shelter		Shelter	
<b>Squirrel #4 Habitat</b>		<b>Squirrel #5 Habitat</b>		Place extra resource cards here.	
Food	Food	Food	Food	<p><b>NURSERY</b></p> <p>Keep stork cards here until a habitat is ready for the next squirrel. A square is ready when it has two food cards, two water cards, and one shelter card. Then, return the stork card to the draw stack.</p>	
Water	Water	Water	Water		
Shelter		Shelter			





## BIRD HABITAT

*How do birds around you satisfy their habitat needs?*

### INTRODUCTION

Birds, like other animals, live where their habitat needs—food, shelter, water, and space—are met. Many species of birds can share same habitat. Few conflicts occur if resources are abundant or if the species have different habitat requirements. For example, both Northern cardinals (**omnivore**) and ruby-throated hummingbirds (**nectarivore**) live in urban areas, but because they have very different food needs, they can occupy the same habitat without conflict.

In this activity you will study two different birds to learn about their habitat needs.



### GEAR

- Library or internet
- Bird book (*The Audubon Society Field Guide to North American Birds* is recommended)



### LET'S DO IT

1. Choose two birds from the Bird Neighbors list, one from A and one from B.
2. Study the two species to learn their requirements for food, water, and shelter. Note: Internet references must be websites with \*.edu or \*.gov. If you find information at other websites, you must confirm it is research-based.
3. Complete the habitat information table for the two birds you chose.

#### Bird Neighbors

- A** Northern cardinal (urban)  
Downy woodpecker (forest)  
Cooper's hawk (forest)  
Northern bobwhite (grasslands)
- B** Great-blue heron (wetlands)  
Ruby-throated hummingbird (urban)  
White-breasted nuthatch (forest)  
Tree swallow (forest)  
Grasshopper sparrow (grasslands)  
Belted kingfisher (wetlands)



## HABITAT INFORMATION

BIRD FROM COLUMN A	BIRD FROM COLUMN B
Food requirements:	Food requirements:
Water requirements:	Water requirements:
Shelter requirements:	Shelter requirements:
Other habitat information:	Other habitat information:
Sources used:	Sources used:



### LET'S CHAT

**Share What Happened:** What did you learn about the two birds you studied?

**Apply:** What habitat needs can you provide for birds?

**Generalize to Your Life:** What niche do birds fill?



### LET'S FLY HIGHER

- Learn how bird habitat requirements change from winter to summer.

- Study additional species of birds.
- Study bird flyways, the paths species take to fly north for the summer and south for the winter in the U.S.

- Make a diorama or poster that shows your birds' food, water, and shelter requirements. Be creative!  
*Diorama:* Use a shoebox or similar container. Arrange items that show the habitat of the two bird species you studied. Explain how the habitat provides their needs.  
*Poster:* Arrange the poster to describe the habitat of the two birds you studied. Use pictures and/or sketches. Explain how the habitat provides their needs.

**Booming season: Male grouse (lek) perform displays to attract females in an area called the booming grounds, so named due to the sound the males make.**

# TO MIGRATE, OR NOT TO MIGRATE?

*How do birds survive the winter?*

## INTRODUCTION

Many species of birds have different winter and summer ranges. This allows them to avoid cold temperatures and find food and shelter year round. Birds' general **migration** pattern in the Western Hemisphere is to travel south from the U.S. and Canada to Central and South America in the fall, and fly north in the spring. Each migrating species follows its own **flyway**. Some birds migrate when days become longer or shorter, and others migrate when the weather or food sources change.

Not all birds migrate, however. Some change their habitat, and some stay in the same place all year. The following examples describe how some birds handle cold temperatures.

- The *cardinal* does not migrate or change its habits during the winter. It forages for food and often visits birdfeeders. Cardinals grow downy feathers they can fluff up to help keep their body heat in. They might increase their range to find food but usually do not go far from their home range.



- Some *American robins* migrate to warmer areas in the winter, but most stay in the same place they spent the summer. Those that do not migrate tend to flock together in wooded areas, where they have shelter and can find fruits and berries that provide energy to survive the winter. As long as food is available, they stay all winter. If food becomes scarce, they move to other areas.



- *Canada geese* nest across the U.S. as well as in the northern parts of Canada and Alaska. Canada geese that nest in Canada and Alaska migrate south in the winter. Those that spend the summer in the lower 48 states usually do not migrate if food and open water are available.
- Purple martins fly to South America for the winter and back to North America in the summer. They follow these instinctive patterns year after year. Very few, if any, purple martins are in North America between October and December.

**Some birds can fly up to 600 miles in one day.**

## GEAR 1

- Bird field guide (*The Audubon Society Field Guide to North American Birds* is recommended) or internet
- Pencil or computer



## GEAR 2

- Purple Martin Arrival Dates, 2015
- Map of the Midwest and eastern United States (paper or downloaded to PowerPoint from the internet)
- Colored pencils or markers



**LET'S DO IT 1**

Use the field guide or internet to complete the bird migration table.

**BIRD MIGRATION**

BIRD	SUMMER RANGE	WINTER RANGE	NOTES
			
			
			
			
Mallard 			
Ruby-throated hummingbird 			

**PURPLE MARTIN ARRIVAL DATES, 2015\***

FLORIDA	ALABAMA	GEORGIA
Ft. Myers, January 1 Miami, January 17 Tallahassee, February 3	Huntsville, March 2 Mobile, February 2 Montgomery, February 9	Macon, February 17 Maysville, March 3 Tifton, February 11
TENNESSEE	KENTUCKY	INDIANA
Hartsville, March 2 Knoxville, March 21 Memphis, March 7	London, March 12 Louisville, March 17 Paducah, March 15	Bloomington, April 1 Fort Wayne, April 3 Indianapolis, March 26

\*Source: Purple Martin Conservation Association data reported by citizen scientists, [www.purplemartin.org/research/8/scout-arrival-study](http://www.purplemartin.org/research/8/scout-arrival-study).



**LET'S DO IT 2**

1. Make a purple martin migration map.
2. Use the map and the Purple Martin Arrival Dates table to mark the purple martins' arrival dates in each city. Circle the city and write the date next it.
3. Shade the dates for each month (and the space between) with a different color to show the birds' progress.

*Optional:* Add more data to your purple martin migration chart. Additional data is available at [www.purplemartin.org/research/8/scout-arrival-study](http://www.purplemartin.org/research/8/scout-arrival-study).



**LET'S CHAT**

**Share What Happened:** Which did you enjoy most: research (Do It 1) or the tracking activity (Do It 2)?

**Apply:** What birds do you notice around your neighborhood during the winter?

**Generalize to Your Life:** Why do some people like to spend winter in the South?



**LET'S FLY HIGHER**

- Visit the purple martin website, [www.purplemartin.org](http://www.purplemartin.org), to find out more about these birds and when people reported seeing them this year.
- Join a citizen science program to help track migrating birds.

**MY NOTES and IDEAS**

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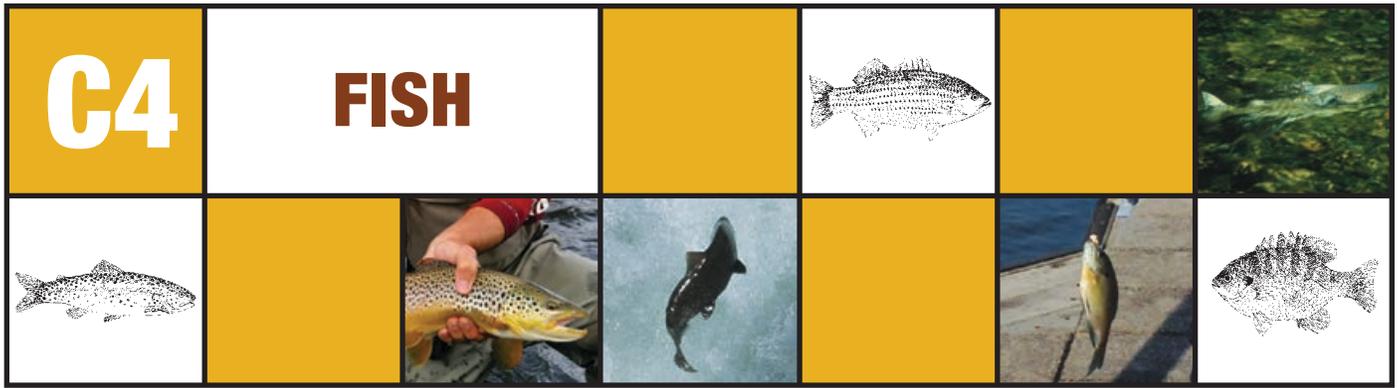
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## FISH HABITAT

*What makes good fish habitat?*

### INTRODUCTION

Fish are aquatic, which means they live in water. Some species live in freshwater lakes, rivers, and streams. Other species live in saltwater, meaning oceans. A few species can tolerate both freshwater and saltwater. Water quality is especially important for fish and determines where they can survive. Fish, like other animals, live where their habitat needs of food, shelter, water, and space are met. Many fish share similar habitats, but they can live together because they have different requirements. For example, largemouth bass, which eat fish, and bluegills, which eat insects, live in lakes. Because their requirements differ, they can occupy the same habitat without conflict.



### GEAR

- Library or internet for research



### LET'S DO IT

1. Choose two fish from the Fish Neighbors list, one from A and one from B.
2. Study the two species to learn their requirements for food, water, and shelter. Internet references must be websites with \*.edu or \*.gov. If you find information at other websites, you must confirm it is research-based.
3. Complete the habitat information table for the two fish you chose.

#### Fish Neighbors

- A** Largemouth bass (lakes) (fish eaters)  
 Greenside darter (streams)  
 Brown trout (streams)  
 Bluntnose minnow (streams)  
 Northern Pike (rivers)
- B** Channel catfish (rivers)  
 Walleye (lakes)  
 Bluegill (lakes)  
 Longnose gar (lakes)  
 Steelcolor shiner (streams)

**Species of the sunfish family are probably the best known and most desired fish for both food and sport. They include the largemouth and smallmouth bass, bluegill, redear, rock bass, and black and white crappie.**

## HABITAT INFORMATION

FISH FROM COLUMN A	FISH FROM COLUMN B
Food requirements:	Food requirements:
Water requirements:	Water requirements:
Shelter requirements:	Shelter requirements:
Other habitat information:	Other habitat information:
Sources used:	Sources used:



### LET'S CHAT

**Share What Happened:** What similarities did you find between the two fish you studied?

**Apply:** Why are fish especially sensitive to polluted water?

**Generalize to Your Life:** How can knowing about preferred fish habitat help an angler?



### LET'S FLY HIGHER

- Study how three different species of fish survive both winter and summer.
- Study the water quality of a local stream using Bioindicators of Water Quality, [www.ydae.purdue.edu/natural\\_resources](http://www.ydae.purdue.edu/natural_resources); click on Teacher Resources, then Educator Resources, and then Bioindicators.

- Make a diorama or poster that shows the food, water, and shelter requirements for the fish you studied. Be creative!

*Diorama:* Use a shoebox or similar container.

Arrange items in the box to show the habitat of the two fish species you studied. Explain how the habitat provides their needs.

*Poster:* Arrange the poster to describe the habitat of the two fish species you studied. Use pictures and/or sketches. Explain how the habitat provides their needs.

**Fish record their birthdays on their scales, like trees form annual rings.**

# LIVING IN A LAKE

*How do fish survive in a pond covered with ice?*

## INTRODUCTION

Fish that live in lakes and ponds can't migrate to warmer water in winter. They can survive under a thick layer of ice as long as the water is deep enough. The unique properties of water and fish adaptations allow them to survive in cold weather. In this activity you will study how water moves in response to changing temperatures.

## GEAR

- Two wide mouth canning jars, baby food jars, or similar. The jars must have the same sized mouth; place one upside-down on top of the other to make sure they match.
- Index card
- Blue and red food coloring
- Hot and cold water from the tap
- Baking pan (to catch spills)
- Small closable plastic bag with ice (crushed ice is best)

## DO IT LET'S DO IT 1

1. Set the baking pan on a counter.
2. Fill one jar with hot tap water. Add one or two drops of red food coloring, and stir to disperse the color evenly. Add more water to fill the jar to the rim.
3. Fill the second jar with cold water. Add one or two drops of blue food coloring, and stir to disperse the color evenly. Add more water to fill the jar to the rim.



4. Place the index card on the top of the jar with the warm water.
  - Press around the edges of the jar to make a seal.

- Place your hand flat on the card and slowly turn over the jar until it is upside down.
- Remove your hand slowly—air pressure will hold the index card in place—and line up the lid over the top of the cold water jar so the rims match.
- The index card acts as a boundary between the red and blue waters.



5. You might need help for this step. Pull out the index card gently while holding both jars to keep the rims lined up. Try to keep any water from spilling. Don't be surprised if you aren't successful on the first try; you might have to practice.
6. Observe what happens.
7. Add some cold tap water (or ice water) to the baking pan to keep the bottom jar cold.
8. Carefully place the bag of crushed ice on top of the upper jar (warm water) to represent a lake's cooling in the fall and winter.
9. Observe what happens. Be patient. This can take an hour or more depending on the size of your jars.
10. Answer these questions.

*What happened to the warm red water in the upper jar?*

*What happened to the cooler blue water in the lower jar?*

*Why do you think this happened?*

## DO IT LET'S DO IT 2

1. Complete the Living in a Lake worksheet.

## CHAT LET'S CHAT

**Share What Happened:** What did the two activities demonstrate?

**Apply:** Why might fish not survive a cold winter in a shallow pond?

**Generalize to Your Life:** How does water temperature affect water movement?

## LIVING IN A LAKE WORKSHEET

Plants use carbon dioxide, water, and the sun's energy to grow. Many animals eat plants and use oxygen to convert the food into energy that sustains life. This process happens underwater, too. The water in lakes, streams, ponds, and oceans contains dissolved carbon dioxide and oxygen so plants and animals can live underwater.

*How do you think aquatic plants and animals like fish survive during the winter when a lake is covered with ice?*

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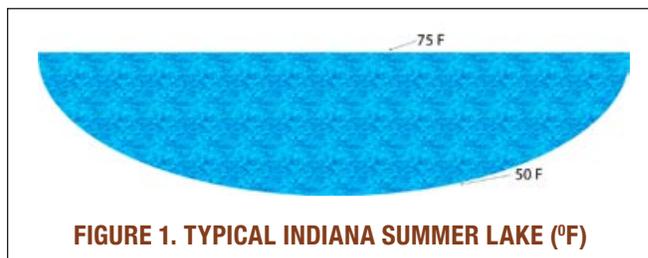
### Spring and summer

As temperatures warm in spring and summer, the air becomes warmer than a lake's water temperature. Warm air heats the lake's surface, and sunlight enters it and warms the water below the surface. This increase in temperature takes time and depends on how clear the water is.

Warm water is less **dense** (lighter) than cooler water. As water warms in the summer, it rises toward the surface; the cooler water, which is denser (heavier), sinks to the bottom. The lake floor (the ground beneath the lake) stays about the same temperature year round, especially if the lake is deep. In summer the lake floor keeps the water near it cool.

The lake eventually stabilizes with warm, less dense water near the surface and cooler, denser water at the bottom (see Figure 1). The floor temperature remains near the temperature of the ground beneath the lake. These temperatures stay relatively stable in an undisturbed lake. Rain, runoff, springs, and streams entering the lake can disturb the balance. However, in most cases the disturbance is temporary, and the lake returns to this stable state fairly quickly.

Plants in the lake use carbon dioxide and release dissolved oxygen into the water. Fish and other animals in the lake use the dissolved oxygen and release dissolved carbon dioxide into the water. Air at the surface of the water allows both carbon dioxide and oxygen to dissolve into the water too.



### Questions (summer lake)

*What effect does the air temperature have on the temperature of a lake during summer?*

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*What effect does the lake floor have on the temperature of a lake during summer?*

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*What effect does sunlight have on the temperature of the lake during summer?*

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*Where would you expect to find the warmest water during the summer?*

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*Where would you expect to find the coolest water during the summer?*

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What natural events can disturb a lake?

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What human caused events might disturb the balance of a lake?

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### Fall and winter

As temperatures drop in the fall, the air cools and falls below the temperature of the lake's surface. The surface water cools, becomes denser, and sinks toward the lake bottom. The lake temperature continues to fall as temperatures get colder.

Water has a unique property. Other matter becomes denser as it cools and freezes, but water reaches its greatest **density** at 39°F. So water sinks to the bottom of the lake when it cools to 39° F. However, when water cools below 39°F, it becomes less dense and begins to rise to the surface. Water at 32°F at the surface freezes (see Figure 2). This is why ice forms

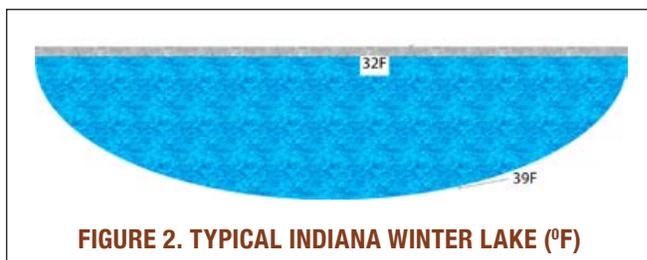


FIGURE 2. TYPICAL INDIANA WINTER LAKE (°F)

at the surface of the lake. As ice forms, the water becomes even less dense, and the ice remains on the surface instead of sinking to the bottom, which would make living in water impossible. The lake water mixes with the warmer water sinking to the bottom and the cold water rising to the surface.

The movement of water in response to changing temperatures is called **lake turnover**.

What causes the surface water to cool in the fall and winter?

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At what temperature does water become most dense?

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Why does water freeze on the surface of a lake?

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### Fish in the winter

Fish have two adaptations that help them survive cold temperatures. They are **cold-blooded**, and their metabolism slows in cold water. Cold-blooded animals can tolerate colder temperatures more easily than **warm-blooded** animals. Fish can survive near the bottom of a lake because it rarely gets colder than 39°F there. Fish metabolism slows as body temperature cools. A fish breathes at a slower rate, its heart slows down, and it doesn't need to eat much. Fish can still find some food such as invertebrates like insect larvae, which can also survive a winter lake.

Why can fish survive in an ice-covered lake?

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### LET'S FLY HIGHER

- Ask someone who has gone ice fishing how it differs from fishing in the summer.
- Research how ocean fish respond to changes in the seasons.
- Study a species of fish that migrates. Salmon are ocean fish that migrate to find **spawning** habitat in rivers and streams.



**Herpetology** is the scientific study of reptiles (snakes, turtles, and lizards) and amphibians (frogs, toads, and salamanders). *Herpien* is a Greek word that means “to creep.” In the field of herpetology the term is often shortened to “herps.” Reptiles and amphibians have very different physical traits but because they are both cold-blooded, they share many of the same habitats.

Some characteristics separate reptiles from amphibians.

- Reptiles are covered with scales, shields, or plates, and their toes have claws. Their young are usually miniature replicas of the parents. The number and arrangement of scales on snakes and lizards, and the horny plates on turtle shells, are important in identification.
- Amphibians have moist, glandular skins, and their toes do not have claws. The young pass through a larval stage (body changes) before reaching adult form. This is called metamorphosis.

The methods that **herptiles** use to survive during stressful conditions are similar. Herps are cold-

blooded animals, so their body temperature is the same as the temperature of the environment they live in. Cold-blooded animals’ metabolism decreases when temperatures fall. This allows a herp to survive on less oxygen and food. A herp can survive as long as it does not freeze. Research suggests that some herps can survive some freezing.

Most herps must find somewhere to hide during the winter—a place that will keep them from freezing. They have two choices. One option is to burrow into the leaf litter or muck on the bottom of a water environment, under the forming ice. As long as the water around the herp doesn’t freeze, the herp doesn’t freeze. Herps that survive this way do not need much oxygen and can absorb the oxygen they need through their skin. Their other option is to burrow into the ground, under thick leaf litter, or under rotting logs. As long as the herp doesn’t freeze, it will survive.

The air can also get too hot or can get too hot or dry for herptiles. When this happens, herps can go into a state called **aestivation**, a dormant stage that helps them survive hot, dry weather.



# HOW HERPTILES SURVIVE

*How do herptiles survive winter cold and summer heat?*

## INTRODUCTION

Herptiles are cold-blooded; their body temperature adjusts to the environmental temperature they live in. So they are particularly sensitive to freezing temperatures because their organs can't survive freezing. Herptiles that live where winter temperatures drop below freezing must figure out how to survive. In this activity you will conduct your own research, either online or using books, to find out more about how herptiles survive freezing temperatures.

## GEAR

- Library or internet access



## LET'S DO IT

1. Learn more about herptiles on your own. Use the internet or library for your research.
  - Internet references should be websites ending in \*.edu or \*.gov.
  - You may use other websites sponsored by reputable organizations like museums, zoos, wildlife or science societies, and state government sites.
  - Do not use question-and-answer blogs.
2. Try to find answers to these questions.
  - *What do painted turtles do in the winter?*
  - *Are there frogs that can survive freezing?*
  - *What is a hibernaculum?*
  - *Do reptiles and amphibians hibernate?*
  - *How do alligators survive the cold weather?*
  - *How do toads survive winter weather?*
  - *Do Eastern box turtles need to hibernate?*
  - *How do amphibians and reptiles survive hot, dry weather?*



## LET'S CHAT

**Share What Happened:** What interesting fact did you learn about a herptile?

**Apply:** How might knowing how herptiles survive cold temperatures help an engineer make a more energy-efficient house?

**Generalize to Your Life:** How would your life change if you were cold-blooded?



## LET'S FLY HIGHER

- Explore more about herptiles on your own.
- Research how to build a hibernaculum. Build one if you have room.
- Learn more about snakes, turtles, and salamanders at The Education Store, [www.edustore.purdue.edu](http://www.edustore.purdue.edu). Enter the species or publication number in the search box.
  - Snakes of Indiana (FNR-173)
  - Snakes of the Central and Northeastern United States (FNR-405)
  - Turtles of Indiana (FNR-243)
  - Salamanders of Indiana (FNR-261)
  - Help the Hellbender, North America's Giant Salamander (FNR-536)



# AMPHIBIAN HABITAT

*What makes good amphibian habitat?*

## INTRODUCTION

Amphibians, like other animals, live where they can meet their habitat needs of food, shelter, water, and space. Amphibians are found in different types of habitats depending on their needs. Water quality is especially important for amphibians and determines where many can survive.

Different species of amphibians live in similar habitats, but because they have different requirements, they can live together. For example, both the American toad and spotted salamander (both **insectivores**) live on the ground in woods, but they have different requirements and can occupy the same habitat.



## GEAR

- Library or internet for research



## LET'S DO IT

1. Choose two amphibians from the Amphibian Neighbors list, one from A and one from B.
2. Study the two species to learn their requirements for food, water, and shelter. Internet references must be websites with \*.edu or \*.gov. If you find information at other websites, you must confirm it is research-based.
3. Complete the habitat information table for the two amphibians you chose.

### Amphibian Neighbors

- A** American toad (terrestrial)  
Marbled salamander (terrestrial)  
Hellbender (aquatic)  
Eastern spadefoot (fossorial)  
Tiger salamander(terrestrial)

- B** Cave salamander (fossorial)  
Cope's gray tree frog (terrestrial)  
Eastern newt (aquatic)  
Northern leopard frog (terrestrial)  
Spring peeper (terrestrial)



## HABITAT INFORMATION

AMPHIBIAN FROM COLUMN A	AMPHIBIAN FROM COLUMN B
Food requirements:	Food requirements:
Water requirements:	Water requirements:
Shelter requirements:	Shelter requirements:
Other habitat information:	Other habitat information:
Sources used:	Sources used:



### LET'S CHAT

**Share What Happened:** What did you learn about the amphibians you studied?

**Apply:** Why are amphibians an important part of a habitat?

**Generalize to Your Life:** Where would you go to find an amphibian?



### LET'S FLY HIGHER

- Study how amphibians' habitat requirements change between summer and winter.
- Learn more about salamanders at The Education Store, [www.edustore.purdue.edu](http://www.edustore.purdue.edu). Enter the species or publication number in the search box.
  - Salamanders of Indiana (FNR-261)
  - Help the Hellbender, North America's Giant Salamander (FNR-536)

# REPTILE HABITAT

*What habitat do reptiles need?*

## INTRODUCTION

Animals live in a specific habitat based on their needs. Level 1 introduced the four things the habitat must provide: food, shelter, water, and space. The way a species adapts to a habitat is the result of evolution, which takes a long time.

Reptiles are found in different areas depending on their habitat requirements. Both the Eastern fence lizard (**insectivore**) and the common box turtle (**herbivore**) live on the ground in woods, but because they have different requirements, they can occupy the same habitat.

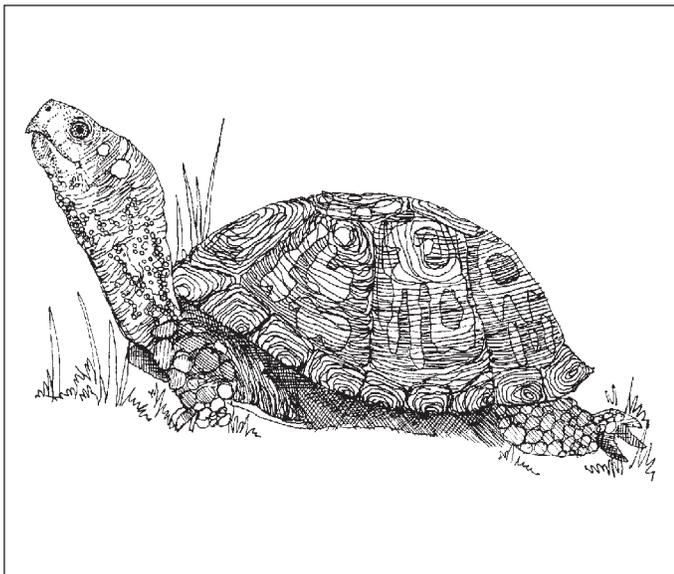


## GEAR

- Library or internet for research

**Snakes of Indiana (FNR-173) is available for purchase from The Education Store, [www.edustore.purdue.edu](http://www.edustore.purdue.edu); search “snakes.”**

**Harmless snakes have eyes with round pupils, and their heads are usually about as wide as their bodies. Venomous snakes’ pupils are vertical slits. Their heads are usually spade-shaped and much wider than their necks.**

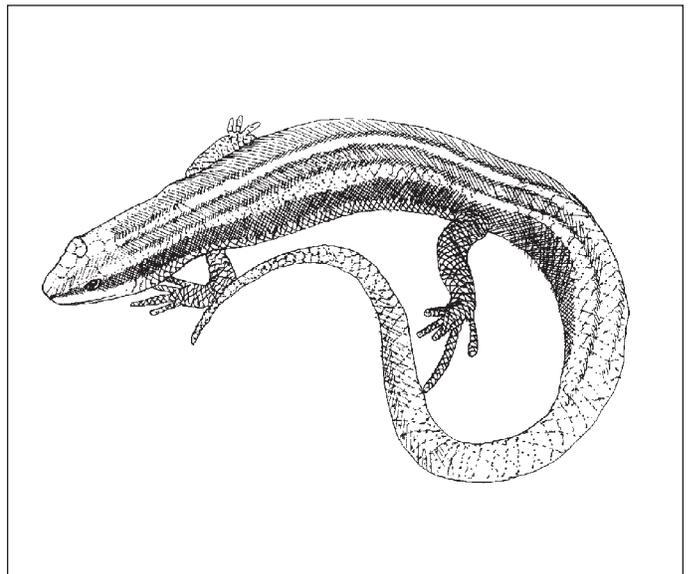


## LET'S DO IT

1. Choose two reptiles from the Reptile Neighbors list, one from A and one from B.
2. Study the two species to find their requirements for food, water, and shelter using any research-based reference.
  - Internet references must be from websites with \*.edu or \*.gov. If you find information at other websites, you must confirm it is research-based.
  - Books might also be good references.
3. Complete the habitat information table for the two reptiles you chose.

### Reptile Neighbors

- A** Eastern fence lizard (terrestrial)  
Eastern worm snake (fossorial)  
Massasauga rattlesnake (aquatic)  
Painted turtle (aquatic)  
Ringneck snake (terrestrial)
- B** Broad-headed skink (terrestrial)  
Smooth greensnake (arboreal)  
Eastern spiny softshell (aquatic)  
Common box turtle (terrestrial)  
Northern water snake (aquatic)



## HABITAT INFORMATION

REPTILE FROM COLUMN A	REPTILE FROM COLUMN B
Food requirements:	Food requirements:
Water requirements:	Water requirements:
Shelter requirements:	Shelter requirements:
Other habitat information:	Other habitat information:
Sources used:	Sources used:



### LET'S CHAT

**Share What Happened:** What are the differences between the two reptiles you studied?

**Apply:** Where would you look for reptiles in your county?

**Generalize to Your Life:** How can people help provide reptile habitat needs?



### LET'S FLY HIGHER

- Study how the requirements of the two reptiles you studied change from winter to summer.
- Study two other reptiles from A and B.
- Learn more about snakes and turtles at The Education Store, [www.edustore.purdue.edu](http://www.edustore.purdue.edu). Enter the species or publication number in the search box.
  - Snakes of Indiana (FNR-173)
  - Snakes of the Central and Northeastern United States (FNR-405)
  - Turtles of Indiana (FNR-243)

## GLOSSARY

**Aestivation:** An animal's prolonged dormancy during hot, dry weather

**Aquatic:** Describes an animal that lives primarily in water

**Arboreal:** Describes an animal that lives primarily in the trees

**Avocation:** A hobby or minor occupation

**Browse lines:** The height below which deer remove all the vegetation they can reach from trees and bushes

**Carrying capacity:** The number of animals an area's resources can support

**Climate:** The average weather in a region over many years (usually based on a 30-year period)

**Climate change:** The change in a region's average weather

**Cold-blooded:** Describes animals whose body temperature is the same as their environment

**Degrees of endangerment:** Terms that describe the level of risk to a wildlife species

**Density:** A measurement of mass (weight) per volume

**Endangered:** A species in danger of extinction throughout all or a significant portion of its range

**Extinct:** A species that was once on earth and no longer exists (example, passenger pigeon)

**Extirpated:** A species that once lived in an area but no longer survives in the wild

**Fossorial:** Describes an animal that lives mostly underground

**Global warming:** The increase of the average temperature of the earth's atmosphere

**Habitat:** The environment that provides what animals need to survive (food, water, and shelter)

**Herpetology:** The study of reptiles and amphibians

**Herptile:** A reptile or amphibian

**Hibernation:** A state of inactivity characterized by low body temperature, slow breathing, a lower heart rate, and low metabolic rate

**Home range (or range):** The geographic area where one would expect to find a particular species

**Industrial Revolution:** The rapid development of industry that took place during the late 1700s and early 1800s, brought about by the introduction of machinery like the power loom and steam engine.

**Insectivore:** Describes an animal that eats mostly insects

**Introduced:** A species that is not native and has been brought to an area, on purpose or by mistake, and has formed a self-sustaining population

**Lake turnover:** The process in which water levels in a lake mix as the water changes density from summer to winter and again from winter to summer

**Limiting factor:** A resource or condition that keeps an animal's population from increasing

**Lure:** Food to attract wildlife

**Metabolism:** The chemical processes by which a plant or an animal uses food, water, etc., to grow, heal, and make energy

**Migration:** The regular movement of animals from one geographical region to another

## **GLOSSARY (Continued)**

**Nectarivore:** Describes an animal that primarily eats the nectar from flowers

**Niche:** An animal's role or function in the environment it lives in; basically the animal's "job"

**Nocturnal:** Active at night

**Omnivore:** Describes an animal that eats plants, animals, and insects

**Pellets:** Regurgitated balls of non-digested materials that owls drop

**Range (or home range):** The geographic area where one would expect to find a particular species

**Reintroduced:** A species that was extirpated and has been purposefully brought back by an agency and sustained using wildlife management techniques

**Returned:** An extirpated species that has come back to an area on its own

**Rubs:** Damage found on trees and fence posts where animals, especially deer, have rubbed up against them

**Scat:** Animals' fecal droppings

**Spawn:** To produce or lay eggs in water, such as by fish and amphibians

**Terrestrial:** Describes an animal that lives primarily on the ground

**Threatened:** A species that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range

**Torpor:** A state of decreased activity in an animal, usually by reduced breathing, body temperature, and metabolic rate

**Warm-blooded:** Describes animals that keep their body temperature at a consistent value

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