



Neighborhood Bats – Predicting Species Occurrence

EXPLORATION QUESTIONS

How can I determine which bats live in my neighborhood and what physical and biological requirements they have?

MATERIALS

- Major North American Habitats and Insect Groups Student Worksheet
- Studying Neighborhood Bats Student Reading Pages
- Student Reading Questions, Part I and II
- Map of North America (optional)
- Range Maps for Common North American Bat Species Student Worksheet
- Physical and Biological Habitat Requirements of Common North American Bat Species Instruction Page and Table
- Physical and Biological Requirements of My Local Bat Species Student Worksheet
- PowerPoint of Common Habitat Types (optional)
- Paper and Pencil

OVERVIEW

Students will use range maps to determine which common bat species may live in their area. Students will also assess habitat types and other biological requirements to predict which bat species likely occur in their city or town.

VOCABULARY

Aquatic, biodiversity, biome, ecosystem, habitat, hibernation, insectivorous, nocturnal, pesticide, prey, range, roost, roosting

GROUP SIZE

any

AGE

10 and above

Background

All plants and animals, whether they are wild or domesticated, have the same basic needs. A habitat is the place where an animal or plant lives and gets everything it needs to survive, including food, water, shelter (protection from predators and the environment including sun, rain, snow, etc.) and adequate space to live. If one or more of these necessary components are removed from a plant or animal's habitat, it will not survive.

Within any habitat there are many smaller microhabitats, areas in which conditions vary from the habitat as a whole. For example, a cavity in a tree may be warmer, more humid, and receive less wind than the surface of the tree. Or, a small crack in a cave ceiling may provide cooler and wetter conditions than the rest of the cave.

Habitat includes the entire area that contains the components needed by a plant or animal. While thinking of habitat as a plant or animal's home is a good way to explain habitat, it is really much bigger than just a house. Habitat is the entire neighborhood where an animal gets the food, water, shelter, and space it needs to survive. The amount and quality of these needs varies a great deal from species to species.

There are many different types of habitats including deserts, caves, forests, rivers, wetlands, and grasslands. A deer's habitat might be a combination of forests and fields. A sea turtle's habitat might be the ocean and the beach. A monarch butterfly's habitat might stretch all the way from Canada where it breeds in the summer to Mexico where it spends the winter.

Habitats for Bats

Bats have very complex habitat needs. They use a variety of habitat types depending on the species of bat, the time of year, and what they are doing – hunting for food, raising their babies, or hibernating through the winter. In order to survive, insectivorous bats need insects to eat, water to drink, places to sleep and raise their young in the summer, and places to hibernate or roost in the winter. The place a bat goes to rest or sleep is called its roost. Bats need different roosting conditions at different times of the year and they will often move around to find one or more roosts to meet their needs.

Rivers, streams, ponds, and lakes are all used by bats because many species hunt for insects over water and almost all need to drink daily. Some bats use caves or other natural cavities such as rock outcrops, cliff faces, or even exfoliating bark on trees to roost, hibernate, and raise their young. Bats can even be found roosting in buildings - agricultural buildings (e.g. farmhouses, barns, and outbuildings) of traditional wood, brick, or stone construction and/or with exposed wooden beams are attractive to bats. Buildings and structures with slate roofs, stone walls,

hanging slates, hanging tiles, or weather boarding, are also places where bats might roost. This is especially true when buildings are located near woods and/or water. Bats are also found in other human-made structures such as tunnels, mines, cellars, air raid shelters, bridges, and aqueducts. You just never know where you might find a bat!

Get Ready – Preparation

1. Read the “Studying Neighborhood Bats Student Reading Pages” to become familiar with bats and their habitat needs. Also, review the major North American habitats and the insect groups (aquatic, flying, and ground-dwelling) listed on page 19 of the Teacher’s Answer Pages so that you are familiar with these groupings.
2. Read the “Physical and Biological Habitat Requirements of Common North American Bat Species Instructions Page” so you are familiar with the activity.
3. Make a copy of “Studying Neighborhood Bats Student Reading Pages,” “Student Reading Questions” Part I and II, “Range Maps for Common North American Bat Species Student Worksheet,” “Physical and Biological Habitat Requirements of Common North American Bat Species Instruction Sheet and Table,” and “Physical and Biological Requirements of My Local Bats Student Worksheet” for each student.

Get Set – Exploring Bat Habitats – Hand Out Materials

1. Assess your students’ knowledge of habitat needs by asking questions such as:
 - What do all humans need to survive?
 - Which of these do plants and animals also require?
 - Do all plants and animals live in the same place?
 - Do all animals live in the same place year round?
2. Guide your class in generating a description of habitat characteristic of local habitat types by listing the following major habitats on the blackboard: deserts, grasslands, chaparral and oak woodlands, deciduous forests, and coniferous forests. Ask the class what kind of plants and animals live in these types of habitats. Ask them to describe what these habitats look like and the general region of the United States where these habitats are found (Eastern, Midwest, Southwest, Western, or

Northern/mountains). You can download a PowerPoint presentation with photos of these habitat types to help students describe them at: <https://batslive.pwnet.org/edubat/curriculum.php>.

3. Hand out the “Major North American Habitats and Insect groups Student Worksheet” to students. Ask them to fill in the description for each habitat type. Be sure they also include the general region of the United States where these habitats are found.
4. Ask students what bat species live in your area (many students may not be familiar with bat species that live in your area). Asking this question will help you assess your students’ knowledge. Next, ask the class to think about the habitat needs of bats. Ask questions such as:
 - What do we know about the needs of bats and their habitat requirements?
 - Where do bats have their young?
 - Do bats live in the same places in summer and winter?
 - Do bats hibernate?
5. Provide each student with a copy of the “Studying Neighborhood Bats Student Reading Pages” and “Student Reading Questions – Part I.”
6. Allow students time to complete the reading, and ask students to complete the reading comprehension questions.
7. Discuss the questions and ask students to consider the important factors that affect where a bat lives, including roosts, access to water, the right types of food, and the space needed for bats to survive.

Go! – Analyze Range Maps and Predict Bat Occurrence

1. Hand out copies of the “Range Maps for Common North American Bat Species Student Worksheet” to each student.
2. Provide a copy of the “Physical and Biological Habitat Requirements of Common North American Bat Species Instruction Page and Table” to each student. Students will follow the instructions to narrow down the list of bat species that may occur in their area.
3. Students will begin by marking an “X” on the first range map, showing the approximate location of their town. If needed, show the class the location of the town on a large map. Students will continue to

mark the location of their town on all the remaining range maps.

4. Provide the students with time to work through each of the steps on the instruction page. The last question will ask students to narrow down the list of bat species that might occur in their area.

5. Give each student a copy of the “Physical and Biological Requirements of My Local Bats Student Worksheet.” You may want to assist them in completing this worksheet by asking questions such as:

- Is there food in the area for bats to eat?
- Are there summer or winter roosts?
- Could the bat species live in the area in the summer only? What about winter?

6. Discuss the final list of bats that may occur in your area. You and/or your students can look at pictures and descriptions of your local bats on Bat Conservation International’s website under “Species Profiles” at

<http://www.batcon.org/resources/media-education/species-profiles>.

Go Even Further: Exploring Interactions between the Environment and Bats

1. Provide a copy of the “Student Reading Questions – Part II Critical Thinking” to each student. Give the students time to answer each of the questions.

2. Guide your class in a discussion of how your town or community might have looked prior to being developed by asking questions such as:

- Was there more of a particular habitat present in the past than there is today?
- Were habitat components such as food and water more or less plentiful?
- How might these changes have affected bat populations and even the presence of particular bat species?
- Is it possible that additional or different bat species were found in your area in the past? What about the future?

Discuss how your town might look in the future as a result of a changing climate.

3. Allow students time to explain the range maps they drew for the Gray Bat.

Reflect – Student Evaluation

1. Good descriptions of each of the habitat types listed on the “Major North American Habitats and

Insect Groups Student Worksheet” and additional insects listed.

2. All questions answered correctly and completely on the “Student Reading Questions” pages.

3. Correctly list the bat species that are likely to occur in the student’s area, and correctly transfer information about food and roost options for these bat species on to the “Physical and Biological Requirements of My Local Bats Student Worksheet.”

4. Students participate in discussions on how their town might have looked differently in the past and the changes that might occur in the future. They also discuss how these changes could affect the bat species that live in the area.

Go Even Further! – Additional Activities

1. Individual students or small groups can create maps of the street where they live, working first to draw the main buildings, boundaries, etc. and then adding details/descriptions of the various habitat types using the major North American habitats list as a starting point. As students create or enhance their maps, be sure they draw and label both natural and man-made features, while also labeling the habitat types. Remind students to include a title for their map, and approximate scale (if desired), and the North arrow. Once they have completed their maps, students should identify possible bats roosts, locations that might have a high insect diversity, and water resources. Noting these sites will help them to predict the best places to observe bats. During the late spring or early fall, have students monitor these areas on a regular basis for a week, a month, or a season to record bat sightings in a field journal. Encourage students to summarize their findings in a report, science fair project, or oral presentation.

2. Installing a backyard bat house is a great way to provide a home for bats and to collect real-world data on a bat population. Bat houses are especially important in areas where there are few natural roosting sites such as large trees or caves. There are a variety of designs of bat houses, and you can either make your own or purchase one.

Consider placing a bat house in your community greenspace or encourage students to install one in their own backyard. You could use the maps developed by the students to find the best place for your bat house. One thing is for sure; your bat-tenants will pay you back with some wonderful

benefits. In temperate latitudes, like the United States, the bat species that are most likely to occupy a backyard bat house are insectivores that eat agricultural pests and some of the nasty bugs that harass outdoor gatherings (a.k.a. mosquitoes). Bats are amazing animals that are vital to the health of our environment and economy eating tons of insects nightly.

Your students will enjoy learning more about bats as they watch them come and go from the home you provided. And homes are often in short supply for bats. Their populations are declining around the world, often because of disappearing habitat.

Bats need time to find and explore new homes, so it may take a few years before your bat house has residents. Once they arrive, your students can start a monitoring program to count bats. The Wisconsin Department of Natural Resources has great information about their inventorying program, and this could easily be modified for your home or classroom. Visit: <http://wwwiatri.net/Inventory/bats/Volunteer/roosts/index.cfm>

Further Reading and Resources – Discover More

About Habitats

Dialogue for Kids – <http://idahoptv.org/dialogue4kids/Season10/habitat/facts.cfm>

Habitats – <http://a-z-animals.com/reference/habitats>

What is Habitat – http://happinhabits.pwnet.org/what_is_habitat

What's Your Habitat? – <https://www.nwf.org/pdf/Schoolyard%20Habitats/whatsyourhabitat2.pdf>

About Habitats for Bats

Bat Habitat – <http://www.batworlds.com/bat-habitat>

Where Do Bats Live – http://www.bats.org.uk/Pages/Where_do_bats_live.html

Bat Houses

Bat Week – How to Make a Bat House
<http://www.batweek.org/index.php/past-events/build-a-bathouse-2015/how-to-make-a-bat-house>

Bat Week – Bat House Installation
<http://www.batweek.org/index.php/past-events/build-a-bathouse-2015/how-to-install-a-bat-house>

Organization for Bat Conservation – Why Bat Houses are Important
<http://www.batconservation.org/bat-houses>

Major North American Habitats and Insect Groups Student Worksheet

Name _____

Describe each of the habitat types below. Include a description of the plants that might live in each habitat (grasses versus bushes versus trees). Also list where in the United States these habitats can be found (Eastern, Midwest, Southwest, Western, or Northern/mountains)

Deserts –

Grasslands –

Chaparral and Oak Woodlands

Deciduous Forests –

Coniferous Forests –

Insect that Bats Eat

Add additional insects that bats eat to each of the types listed below.

Aquatic Insects – mosquitoes, caddis flies, mayflies, _____

Flying Insects – moths, beetles, flies, _____

Ground-dwelling Insects – crickets, katydids, _____



Studying Neighborhood Bats – Student Reading Pages

INTRODUCTION

All plants and animals, whether they are wild or domesticated, have the same basic needs. A habitat is the place where an animal or plant lives and gets everything it needs to survive, including food, water, shelter (protection from predators and the environment including sun, rain, snow, etc.) and adequate space to live. If one or more of these necessary components are removed from a plant or animal's habitat, it will not survive.

Within any habitat there are many smaller microhabitats, areas in which conditions vary from the habitat as a whole. For example, a cavity in a tree may be warmer, more humid, and receive less wind than the surface of the tree. Or, a small crack in a cave ceiling may provide cooler and wetter conditions than the rest of the cave. Can you think of a reason this might be important to bats?

Habitat includes the entire area that contains the components needed by a plant or animal. While thinking of habitat as a plant or animal's home is a starting place, habitat is really much bigger than just a house. Habitat is the entire neighborhood where an animal gets the food, water, shelter, and space it needs to survive. The amount and quality of these needs varies a great deal from species to species.

There are many different types of habitats including deserts, caves, forests, rivers, chaparral, and grasslands. A deer's habitat might be a combination of forests and fields. A sea turtle's habitat might be the ocean and the beach. A monarch butterfly's habitat might stretch all the way from Canada where it breeds in the summer to Mexico where it spends the winter.

HABITATS FOR BATS

Bats have very complex habitat needs. They use a variety of habitat types depending on the species of bat, the time of year, and what they are doing. In order to survive, insectivorous bats need insects to eat, water to drink, places to sleep and raise their young in the summer, and places to hibernate or roost in the winter. The place a bat goes to rest or sleep is called its roost. Bats need different roost conditions at different times of the year and they will often move around to find one or more roosts to meet their needs. Bats have summer roosts where they raise their young and winter roosts where they hibernate. Places where bats hunt for insects are called foraging habitats. Bats often travel between roosts and foraging habitats using trails, roads, or wooded streams and rivers.

Rivers, streams, ponds, and lakes are all used by bats because many species hunt for insects over water, and almost all need to drink daily. Some bats use caves or other natural cavities such as rock outcrops, cliff faces, or even exfoliating bark on trees to roost, hibernate, and raise their young. Bats can even be found in buildings! Farm buildings such as farmhouses, barns, and outbuildings of traditional wood, brick, or stone construction and/or with exposed wooden beams, are all places where bats might roost. This is especially true when these buildings are located near woods and/or water. Bats are also found in other human-made structures such as tunnels, mines, cellars, air raid shelters, bridges, and aqueducts. You just never know where you might find a bat!

NEIGHBORHOOD BATS

Have you ever seen bats flying around your house at dusk? You probably have bat neighbors, even if you've never seen them. As they flit through the sky, most bats look alike, but it's possible that you

Studying Neighborhood Bats – Student Reading Pages

may have a dozen different species living in your neighborhood. Forty-seven different species live in the United States and Canada. Any ideas how you might be able to tell which ones live near you?

One step you could take is to study range maps. These are special maps that scientists make to show the geographical area within which a species can be found. A bat's "range" is described as how far north, south, east, and west it is found. Sometimes, a range map will show the entire range of a species. Other times, when a species uses different habitat during different seasons, a range map may contain seasonal information such as summer, winter, or migratory ranges. By studying range maps, you can make a list of the different species of bats that may live in your area.

But remember, just because a range map for a bat species covers your city or town, it doesn't mean that the species lives in your neighborhood. The next thing you must consider is the habitat available in your area. Does the habitat have the kinds of roosts that bats need? Are there warm roosts for raising young and cool roosts for hibernation? Does the habitat support the kinds of insects that bats eat?

WHAT IS YOUR LOCAL HABITAT?

Some bats will live in a variety of habitat types and can adapt to many different local conditions. For example, Big Brown Bats can be found in all major North American habitats including arid deserts, chaparral and oak woodlands, grasslands, and both deciduous and coniferous forests. Red Bats, on the other hand, roost only in deciduous forest habitats. Gray Bats have one of the most restricted ranges of all. They live only in deciduous forest habitats along rivers where there are caves.

Good habitats for bats must contain the roosts, food, water, and space that a bat species needs to survive. Some bats, such as the Gray Bat, roost only in certain kinds of caves. In the summer, they must raise their young in warm caves that are 57° to 80° F (14-27° C). In the winter they have to hibernate in cooler caves that stay at 40° to 49° F (4.5-9.5° C). This is one of our few bat species that use caves year round. Other bats, such as Pallid Bats, will roost in many different places, from caves and old mines to cliffs, buildings, and tree cavities. There are some bats that will roost only in trees. Red Bats and Hoary Bats hang from branches blending in with the leaves. Other bat species roost under tree bark, in tree cavities, or in hollowed out trees.

WHAT'S FOR DINNER?

All but four of our 47 North American bats feed solely on insects. Most of these bats eat a wide variety of insects such as beetles, moths, mosquitoes, and mayflies, but they prefer certain types. Big Brown Bats eat many kinds of insects, but they really love beetles. Red Bats and Mexican Free-tailed Bats prefer moths. Other species, such as the Yuma Myotis and the Little Brown Bat, feed on aquatic insects that they can catch over water, such as tiny flies, mosquitoes, and mayflies. Bats that eat aquatic insects must live near water. So, you would not expect to find the Yuma Myotis and the Little Brown Bat in dry desert habitats that are far away from streams or ponds.

Pallid Bats feed on scorpions and centipedes, as well as a wide variety of large, ground dwelling insects, such as grasshoppers, katydids, and crickets. Instead of catching their prey straight out of the air the way a Mexican Free-tailed Bat does, the Pallid Bat picks its prey off the ground or vegetation. The Pallid Bat is not as dependent upon water for finding insects or for drinking, so it can be found in more extreme desert habitats.

Studying Neighborhood Bats – Student Reading Pages

Some bats eat insects that are common in forests; other bats eat insects that prey on farmers' crops (like corn borer moths and cucumber beetles). Where there are roosts located near lots of insects, bats are likely to be there too. The greater the variety of insects you can find, the greater the variety of bat species.

WHERE CAN I WATCH BATS?

Once you know more about the habitat needs of bats such as the roosts and insects they like, you can predict if your local neighborhood offers a good home for different bat species. Walk around at dusk on a warm evening to see if bats are out catching bugs or swooping low over ponds, lakes, or streams. Some bats might even be drinking out of your backyard swimming pool! If you don't see bats in your neighborhood, it may be because the area does not provide good habitat.

There are many things that can affect the quality of habitat available for bats. Sometimes bats can't live in areas where too many pesticides are sprayed. Pesticides reduce the amount of insects available for food and may even poison the bats. Smoke from fireplaces, campfires, and exhaust from cars may also be driving insects away. New research shows that bats are sensitive to artificial lights due to their nocturnal habits. If there are a lot of lights on in your neighborhood at night, it may cause bats to avoid the area.

Sometimes a habitat might not have enough roosts for bats. Prairies and grasslands usually have few caves or suitable tree roosts. Bats that live in these areas tend to live in buildings or other human made structures. New neighborhoods that only have a few large trees and new buildings with few cracks may also lack roosts for bats. But, if you are a patient and careful observer, and understand bat needs, you should be able to find appropriate bat habitat.

Bats are fun to watch, but you should never try to catch bats or touch those that you find. Any wild animal that can be approached is likely to be sick, and could bite in self-defense. Protect bats and yourself by keeping your distance. Also, never disturb bats where they are roosting. This may make them abandon their roost which could cause the bats or their young to die. When we remember to simply watch from a distance, we can enjoy our awesome bat neighbors.



Student Reading Questions – Part I
Reading Comprehension Questions

Name _____

LITERAL QUESTIONS:

1. What is a habitat? Be specific and use evidence from the text to support your answer.

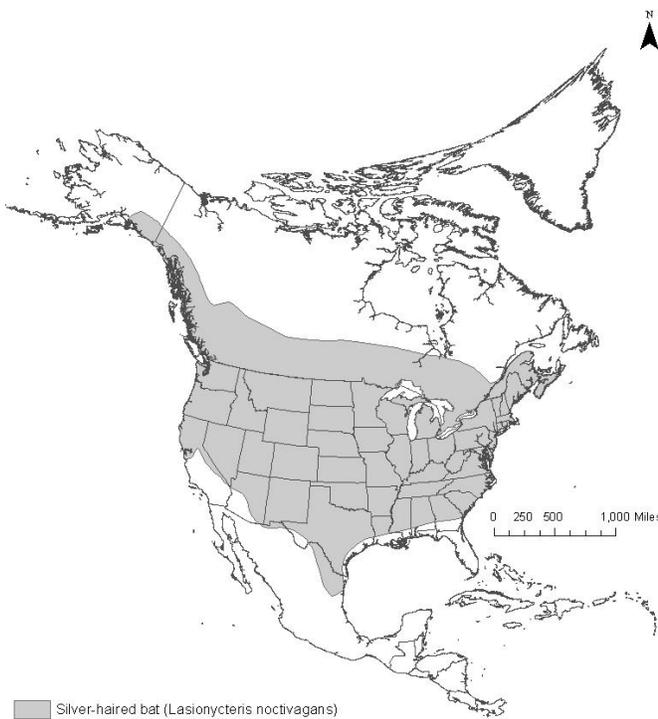
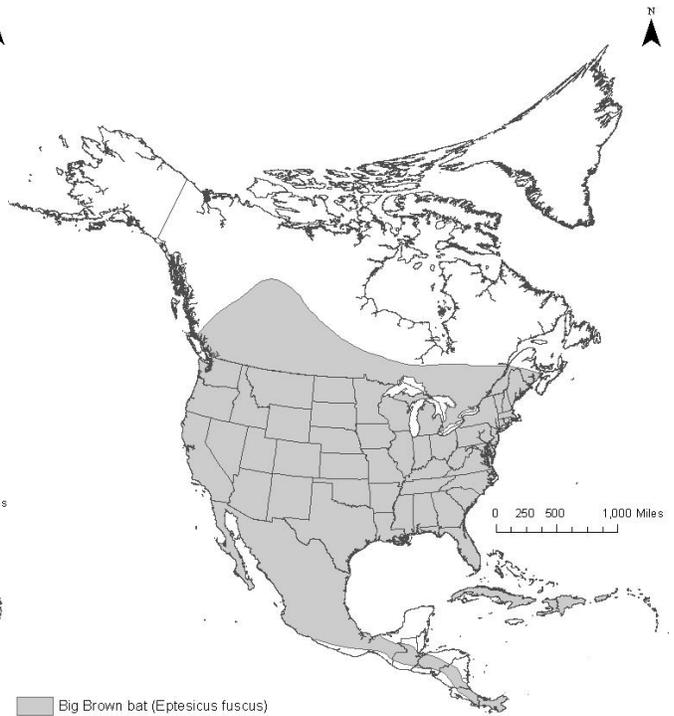
2. Where do bats roost and hibernate?

3. What is a range map?

4. What do bats eat? Where do they find their prey?

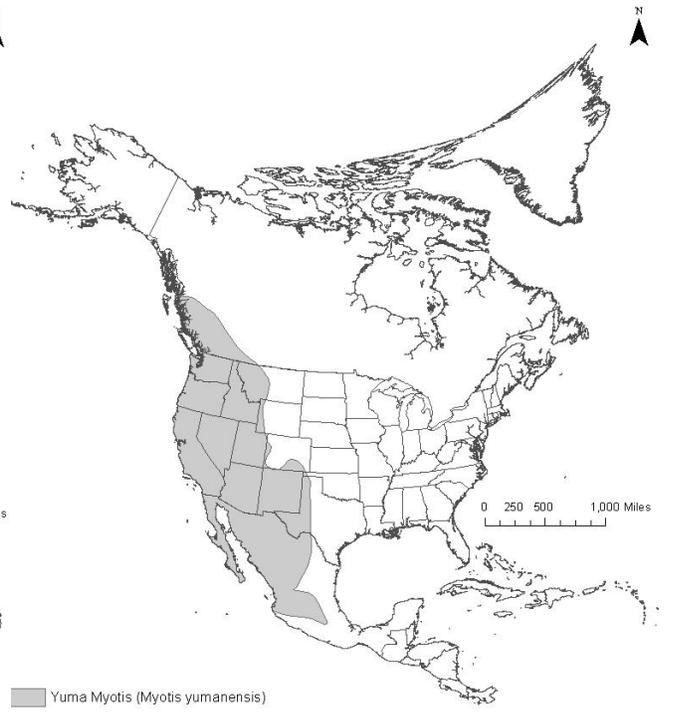
Range Maps for Common North American Bat Species Student Worksheet

Name _____



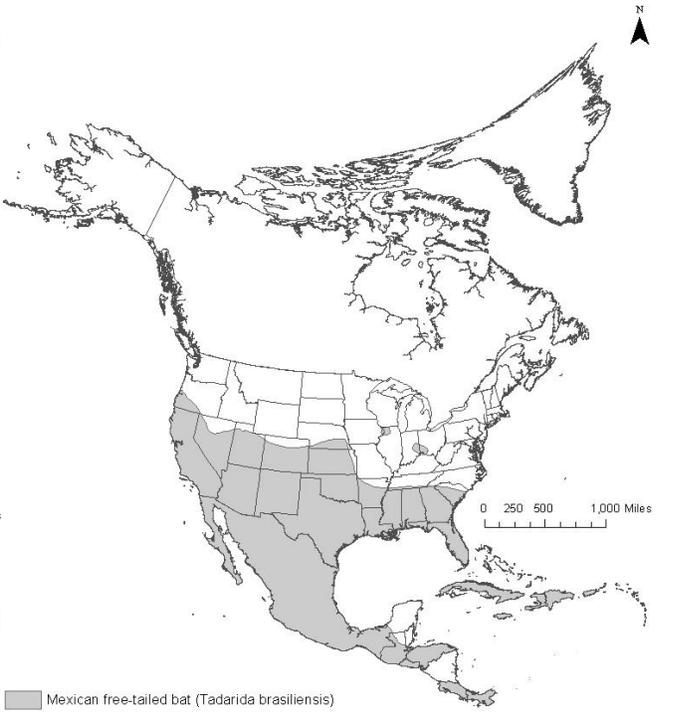
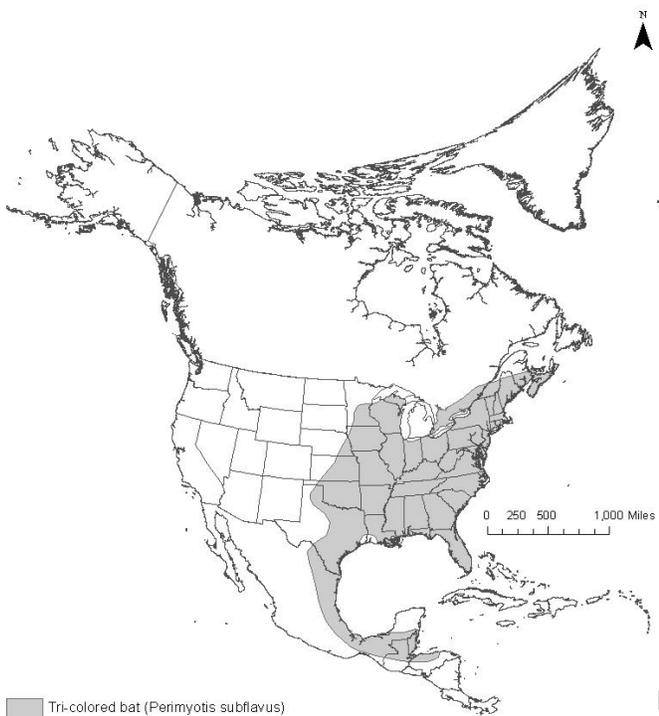
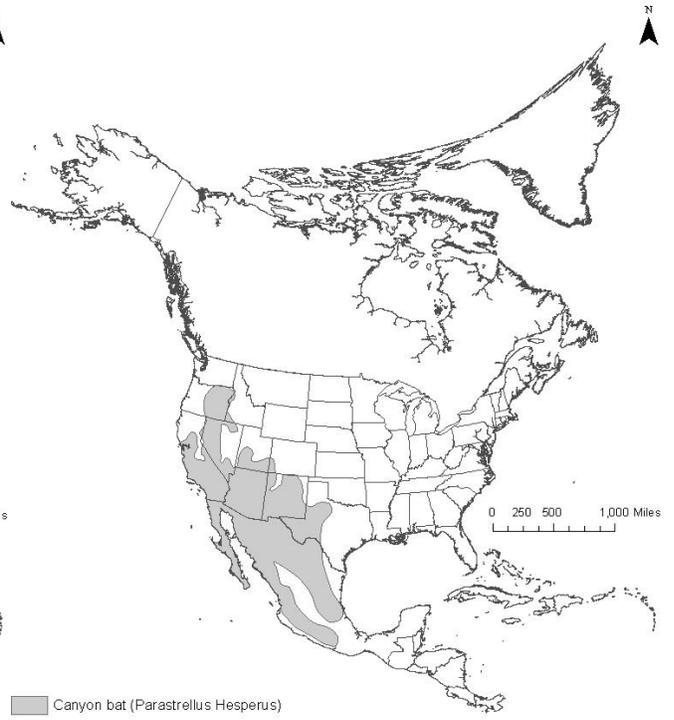
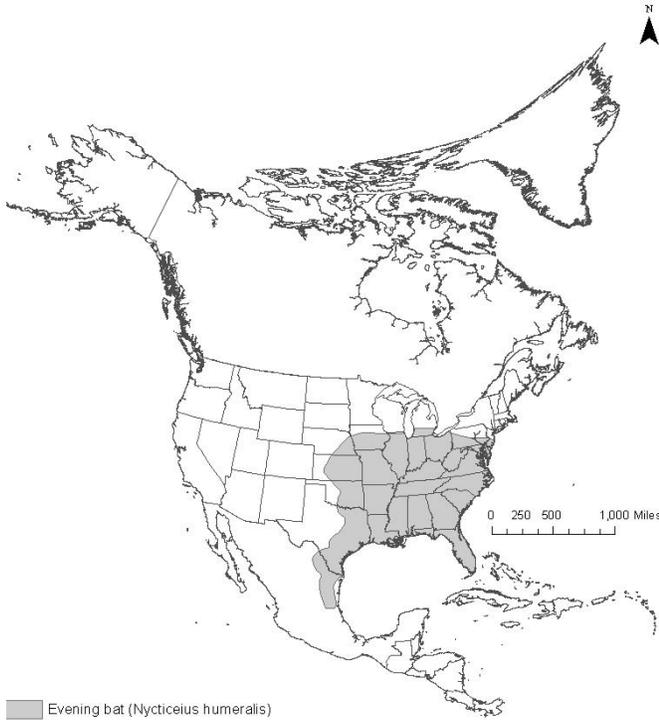
Range Maps for Common North American Bat Species Student Worksheet

Name: _____



Range Maps for Common North American Bat Species Student Worksheet

Name _____



Physical and Biological Habitat Requirements of Common North American Bat Species Instruction Page

Name _____

1. Use the “Range Maps for Common North American Bat Species Student Worksheet” and locate your town on each range map. Place an “X” on the location of your town.
2. Decide if each of the bat species might occur in your area by determining if the “X” that marks your town is inside the range of the bat. In the following table, draw a line through the bat species name and the additional information for all the species that do **NOT** have a range that includes your area.
3. For the remaining bat species, review the habitat types listed in the table. Are there any habitat types that you know do **NOT** occur where you live? If so, lightly cross these habitat types out. You will come back to these habitat types later in this activity, so make sure you can still read the information below your cross out.
4. Review the roost types listed for the remaining bat species. Are there any that do **NOT** occur where you live? If so, cross these bat roost types out lightly in your table.
5. Review the food types for the rest of the bat species. Are there any that do **NOT** occur where you live? If so, cross them out, too.
6. Look over your table. The bat species that have not been crossed out in your table are the common bats species that might be found in your area! Review each of these bat species to determine if the food, summer roost, winter roost, and habitat types for these species are all present in your town. Based on your findings, can you narrow down the list of bat species that might occur in your area? Use evidence to support your findings on your “Physical and Biological Requirements of My Local Bats Student Worksheet.”

Physical and Biological Habitat Requirements of Common North American Bat Species Table

Species	Food	Summer Roost	Winter Roost	Habitat Type
Pallid Bat	walking insects	caves/mines, cliffs, tree hollows, buildings	caves/mines, cliffs	desert, oak woodland and chaparral
Big Brown Bat	flying beetles	buildings, tree cavities	caves	all habitat types
Silver-haired Bat	flying flies	tree foliage or cavities	unknown	deciduous and coniferous forest
Red Bat	flying moths	tree foliage	leaf litter, tree hollows	deciduous forest
Hoary Bat	flying moths	tree foliage	tree trunks and cavities	deciduous and coniferous forest
Little Brown Bat	water insects	buildings, caves	caves/mines	coniferous and deciduous forest, chaparral
Cave Myotis	flying moths	caves	caves	desert, chaparral
Yuma Myotis	water insects	caves/mines, buildings	unknown	desert, grasslands, chaparral
Evening Bat	flying insects	tree cavities, buildings	unknown	deciduous forest
Canyon Bat	flying insects	cliffs, rock crevices	caves	desert, grassland, chaparral, coniferous forest
Tricolored Bat	flying insects	tree cavities	caves	chaparral and deciduous forest
Mexican Free-tailed Bat	flying moths	caves, buildings	caves (migrates to warm areas and doesn't hibernate)	oak woodlands and chaparral, desert

Physical and Biological Requirements of My Local Bats Student Worksheet

Name _____

Based on your findings from the range maps which bats do you predict do **NOT** live in your area? Use evidence to support your finding

Bat Species/Do NOT Occur in Area	Provide Evidence
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Physical and Biological Requirements of My Local Bats Student Worksheet

Based on your findings from the range maps and the habitat components that are present in your town or city, which bats do you predict could live in your area? List these species in the first column. In the second column, write what you think the bat species might eat in your area. In the third column, describe specific summer (S) and winter (W) roosts that bats might use in your area.

Bat Species	Food Options	Roost Options
1.		S: W:
2.		S: W:
3.		S: W:
4.		S: W:
5.		S: W:
6.		S: W:
7.		S: W:

Student Reading Questions – Part II
Critical Thinking

Name _____

CRITICAL THINKING QUESTIONS:

1. Bat populations must have high quality habitat that meets their life requirements. What would happen if summer roosts were no longer available in your area or if they were greatly reduced? Can you think of a natural or human-made action that could reduce the availability of bat roosts in your community?

2. What other resources could become limited for bats in your area? How might this affect bat populations?

3. What do you think your neighborhood was like before it was settled by humans? What might the area have looked like before houses and roads were created? Consider the list of bat species that you predicted may occur in your area. Do you think the area provided better habitat for bats before or after it was settled? Give examples to support your ideas.

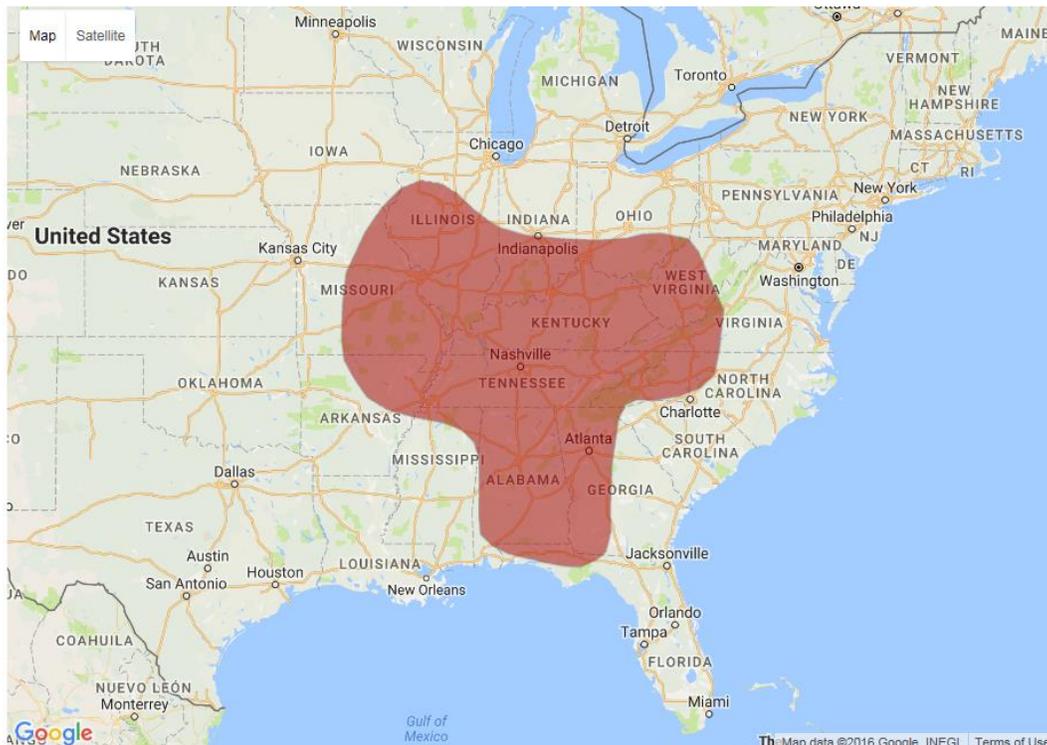
Student Reading Questions – Part II

Critical Thinking (continued)

4. Go back to the “Table of Physical and Biological Habitat Requirements of Common North American Bat Species” and review the bat species that you ruled out because the habitat type did **NOT** occur where you live. Do you think any of these other habitat types occurred in your area before human settlement? If so, what bat species might have occurred in your area in the past? Why?

5. In general, earth is experiencing a changing climate which includes warming temperatures, increased drought, increased flooding, and more intense weather events. If temperatures were to continue to increase, what would you predict would happen to bat populations? Specifically, consider the effects of temperature increases on the Gray Bat. Reread your reading pages for evidence to support your answer.

6. Based on your prediction, redraw the Gray Bat range map below to show how their range might change as a result of a changing climate.





Teacher Answer Pages

Major North American Habitat Types and Locations

Deserts – arid areas; yucca, agave, cacti, thorny bushes; Southwest

Grasslands – prairies and other mostly grassy areas; Midwest

Chaparral and Oak Woodlands – relatively short trees, live oak, evergreen shrubs, juniper, hot and dry; Southwest, Western

Deciduous Forests – tall trees, oak, maple, birch, hickory, lots of precipitation; Eastern,

Coniferous Forests – tall trees, pine, spruce, fir cedar, hemlock; Northern and mountains

Insect that Bats Eat

Aquatic insects – mosquitoes, caddis flies, mayflies, midges, lacewings, and damsel flies

Flying insects – moths, beetles, flies, stinkbugs, and dragonflies

Ground-dwelling insects – crickets, katydids, scorpions, centipedes, and grasshoppers

Student Reading Questions – Part One

1. What is a habitat? Be specific and use evidence from the text to support your answer.

A habitat is the place where an animal or plant lives and gets everything it needs to survive, including food, water, shelter (protection from predators and the environment including sun, rain, snow, etc.) and adequate space to live.

Habitat includes the entire area that contains the components needed by a plant or animal. While thinking of habitat as a plant or animal's home is a good way to explain habitat, it is really much bigger than just a house. Habitat is the entire neighborhood where an animal gets the food, water, shelter, and space it needs to survive.

2. Where do bats roost and hibernate?

Some bats use caves or other natural cavities such as rock outcrops, cliff faces, or even exfoliating bark on trees to roost, hibernate, and raise their young. Bats can even be found in buildings - agricultural buildings (e.g. farmhouses, barns, and outbuildings) of traditional wood, brick, or stone construction and/or with exposed wooden beams. This is especially true when these buildings are located near woods and/or water. Bats are also found in other human-made structures such as tunnels, mines, cellars, air raid shelters, bridge structures, and aqueducts.

3. What is a range map?

These are special maps that scientists make to show which species are found in which areas. A bat's "range" is described as how far north, south, east, and west it is found.

4. What do bats eat? Where do they find their prey?

Nearly all North American bats eat insects. Most eat a wide variety from beetles and moths to mosquitoes and mayflies, but they prefer certain types. Big Brown Bats eat many kinds, but prefer beetles. Red Bats and Mexican Free-tailed Bats prefer moths. Other species, such as the Yuma Myotis and the Little Brown Bat, feed over water on aquatic insects, such as tiny flies, mosquitoes, and mayflies. Bats that eat aquatic insects must live near rivers or lakes.

Pallid Bats feed on scorpions and centipedes as well as a wide variety of large, ground-dwelling insects, such as grasshoppers, katydids, and crickets. Instead of catching their prey straight out of the air the way a Mexican Free-tailed Bat does, the Pallid Bat picks its prey off the ground or vegetation.

Some bats eat insects that are common in forests; other bats eat insects that prey on farmers' crops. Rivers, streams, ponds, and lakes are all used by bats because many species hunt for insects over water.

Student Reading Questions – Part Two

Answers will vary. Students might include the following ideas in their answers:

1. Bat populations must have high quality habitat that meets their life requirements. What would happen if summer roosts were no longer available in your area or if they were greatly reduced? Can you think of a natural or human-made action that could reduce the availability of bat roosts in your community?

Bat populations would significantly decrease or completely disappear.

Human action:

- Climate change as a result of human actions could make summer and/or winter roosts too hot or too wet.
- Invasive species introduced by humans could take over an area where an area that had bat roosts.
- Human development could remove roosts.

Natural action:

- Severe storms with high winds could destroy roosts.
- Lightning strikes could cause wildfires that burn down roosts.

2. What other resources could become limited for bats in your area? How might this affect bat populations?

Prey (insect) populations could decrease, decreasing bat populations.

Water resources could be highly developed or irrigation could remove water sources, making bats less likely to use them, decreasing bat populations.

3. What do you think your neighborhood was like before it was settled by humans? What might the area have looked like before houses and roads were created? Consider the list of bat species that you predicted may occur in your area. Do you think the area provided better habitat for bats before or after it was settled? Give examples to support your ideas.

This answer is very dependent on your local habitat. Students should discuss characteristics of habitats close to your location that have not been developed and relate them to bat species habitats.

4. Go back to the “Table of Physical and Biological Habitat Requirements of Common North American Bat Species” and review the bat species that you ruled out because the habitat type did NOT occur where you live. Do you think any of these other habitat types occurred in your area before human settlement? If so, what bat species might have occurred in your area in the past? Why?

This answer is very dependent on your local habitat. Accept answers that are reasonable for your location and challenge students to support their answers. In general, they should mention that used habitats that have been reduced such as forests and grasslands as a result of human development.

5. In general, earth is experiencing a changing climate which includes warming temperatures, increased drought, increased flooding, and more intense weather events. If temperatures were to continue to increase, what would you predict would happen to bat populations? Specifically, consider the effects of temperature increases on the Gray Bat. Reread your reading pages for evidence to support your answer.

Bat populations would shift their ranges if temperatures increased because bats have specific temperature ranges for summer and winter roosts.

Gray Bats' range would likely move north and also to higher elevations in mountainous areas. The range map that is redrawn for #6 should reflect this change.

Curriculum Connections

Next Generation Science Standards Elementary School Life Science (Grade 3)

3-LS4-3 Biological Evolution: Unity and Diversity Students who demonstrate understanding can: 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Middle School Life Science (Grade 5)

MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Common Core State Standards Literacy: Middle School

CCSS.ELA-LITERACY.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-4)

CCSS.ELA-LITERACY.RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-4)

CCSS.ELA-LITERACY.WHST.6-8.1 Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4)

CCSS.ELA-LITERACY.WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-4)