Habitat is a Home

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Program Purpose:
The purpose of this program is to introduce students to the components of habitat and the limiting factors that influence the carrying capacity of populations.

Length of Program:
1½ - 2 hours

Age:
Grades 2nd – 8th
* The first three activities are appropriate for younger students; the fourth for students 4th grade and above*

Maximum Number of Participants:
25

Objectives:
After completion of all activities, students will be able to:
- Define habitat and identify its four components: food, water, shelter and space.
- Define the terms population, carrying capacity and limiting factor.
- Describe the dynamic nature of populations.
- Explain how limiting factors, predation and natural or human caused disturbances can combine to determine the carrying capacity of a population in a particular environment.
- Describe how both the quantity and quality of habitat determine the survival of individuals in populations.

Preparation:
Before the class arrives:
- Obtain the "A Habitat Is Home" kit and materials listed below from the storage room.

Basic Outline:
I. Introduction *(10 minutes)*
II. "A Habitat Is Home" song *(5 minutes)*
III. "Habitat Lap Sit" *(20 minutes)*
IV. "Oh Deer!" *(40 minutes)*
V. "How Many Bears Can Live In This Forest?" *(30 minutes)*
VI. Habitats in Wisconsin (*20 minutes-optional*)
VII. Who Shrunk the Jar? *(10 minutes-optional)*
VIII. Conclusion *(15 minutes)*

Materials:
Large dry erase board and several colored markers
25 envelopes
Five colors of 2" X 2" construction paper
1 blindfold
8 calculators
For optional activities:
- Crayons or markers
- Large sheets of paper
- Large and small balls (e.g. ping pong and tennis)
- Small and large jars
- Laminated animal and habitat pictures

Introduction:
Introduce yourself and the class. Explain that this class will focus on the concept of habitat. The students will learn the four components of habitat, and how the presence or absence of these components lead to changes in populations in nature.
Ask the students to define "habitat."

- *A **habitat** is the natural home of a plant or animal.*

Ask the students what is included in a plant or animal's habitat. All habitats must contain the following four elements to support life: food, water, shelter and space. Ask students to give examples of the four components for a given animal, such as deer or rabbits, and for a given plant, such as a white pine tree or raspberry shrub.

A Habitat Is Home:
To help the students remember the four components, teach them the following song, sung to the tune of "The Farmer in the Dell." Tell the students they will need to remember the song for the next activity.

"A habitat is home,
A habitat is home.
Food, water, shelter, space
A habitat is home."

"Habitat Lap Sit":

This activity, adapted from Project WILD, demonstrates how all four components of habitat must be present in order to support life. While animals do have adaptations (internal and external structures) that function to support survival, growth, behavior, and reproduction, they still need a habitat to live in (4-LS1-1). In addition, all four components of a habitat must be present for the species to be sustained. In this activity, students will each become components of habitat and form a lap sit circle, demonstrating how each component of habitat contributes to supporting the survival of a species. To do so, follow these steps:

1. Form a circle standing shoulder to shoulder. Count off by "food" "water" "shelter" "space".

2. Have everyone turn to their right and take one step towards the center of the circle.
3. Place your hands on the shoulders of the person in front of you. On the count of three they should all sit down, keeping their knees together to support the person in front of them.

The habitat lap sit circle is complete when the students can sing "A Habitat Is Home" without anyone falling. After successfully completing the lap sit circle, give examples of scenarios where habitat components could be missing (pollution of water supply, urban sprawl limiting availability of all components, soil erosion impacting food and water) and pull out students representing those components. Watch what happens to the lap sit circle when these components are missing.

"**Oh Deer!":**
This activity, also adapted from Project WILD, builds upon the last by demonstrating how the absence of one or more components of habitat can cause population fluctuations in a herd of deer. Consider taking this activity outside if weather and time allow.
Ask the students to define the term population, as it refers to wildlife.

- *A **population** is a group of individual plants or animals living in one area.*

Ask the students what happens to a population of animals or plants if some of the necessary components of habitat are missing. The missing component of habitat is called a "limiting factor."

- *A **limiting factor** is something that limits how large a plant or animal's population can become by its absence.*

A limiting factor usually provides a "ceiling" (or highest number) that a population cannot rise above. Any component of habitat can become a limiting factor.
In the next activity, some students will represent components of habitat and others will become deer. The deer must collect components of habitat. If they are successful, the 'habitat' students become deer. If the deer does not collect the habitat component it is looking for, it dies and becomes a habitat component for the next round. This represents the cycling of matter and energy that naturally occurs. Meanwhile, one individual will graph the deer population after each round.

To begin, count off by 4's: 1's represent deer and should go to one side of the room. 2, 3, 4's represent food, water, and shelter and should go to the other side of the room. The activity assumes there is enough space (the fourth habitat component) for all and it is not represented. Teach the students the different hand signals (everyone will need to know all) and explain how the game will be played:

- Food – hands over stomach
- Water – hands over mouth
- Shelter – hands over head

1. Have the deer students and habitat students stand on opposite sides of the room with their backs to each other. All students should pick a sign: habitat students pick what component they want to be and deer students pick which component they want to get. Hold up the appropriate sign. Students must keep the same sign the entire round.
2. On the count of three turn around. Deer run over, holding their sign, to the matching habitat component and return with it back to their side. Habitat components must accept being selected. Remind the students that each deer can only select one habitat component.
3. If a deer successfully gets the component they need, they survive and the chosen component also becomes a deer. If a deer doesn't get the component they need (e.g. if there are not enough of that component), they die and become a habitat component. Habitat components that are not chosen remain habitat.
4. **Keep track of how many deer you start with and how many you end with after each round.** This should be done by creating a graph: each round (which represents one year) is graphed on the x-axis and the number of deer is graphed on the y-axis. The deer population should fluctuate each round just as would happen in nature. If there are not enough components/resources, the deer population will decrease; if there are sufficient components/resources, deer population size will increase.
5. After five rounds select a student to act as a predator, such as a mountain lion or wolf. They start on the side of the room in their own area and have to hop or skip. They can only catch deer as they're going for the habitat, not on the return. If they catch a deer it is eaten and becomes a wolf. If they don't catch a deer they die and become a habitat component. Continue to graph by changing the y-axis of the graph to number of animals and create two lines on the graph (one labeled deer and the other predator).
6. After another five rounds add in a natural or human caused disaster to represent further changes to the ecosystem (MS-LS2-4). A good example is altering interactions between the hydrosphere (composed of all the water on earth) and the biosphere (composed of all the living things on earth) (5-ESS2-1). This could include a terrible drought: whisper to the habitat students that no one can represent water. Or perhaps a dam was built on a stream, flooding a large wooded area: whisper to the habitat students that they should only represent the water. Continue to graph the deer and predator population.

At the end of 15 rounds gather students and discuss the graph. Ask questions like:

- Can you tell when the predator and disaster was added? How was the population of deer affected by these ecosystem changes (MS-LS2-4)?
- Over time, what was happening to the population of deer?
- What happened to the population of deer when a predator was introduced?
- What effect did the natural and human caused disasters have on the population of deer?

Introduce the term carrying capacity to the students.

- *The **carrying capacity** is the number of plants or animals that a given habitat can support indefinitely.*

Ask the students to look at the graph and guess the carrying capacities of the habitat at different times. Discuss the relationship between habitat availability and the deer density (MS-LS2-1). How many deer (on average) could the habitat support before the wolf was introduced? After? How many deer could the disturbed habitat support?

For older students, expand on the activity by including broader conclusion questions:

- What behaviors would make some deer more successful than other deer at finding optimal habitat components? Would deer with these behaviors be more or less successful at producing and raising offspring? Why? (MS-LS1-4)
- How would controlled hunting affect the overall population the deer? Considering the impact deer can have on the landscape, would hunting protect the Earth's resources and environment? Would this help or hinder habitat restoration efforts? Why? (5-ESS3-1)

"How Many Bears Can Live In This Forest?":
This final activity, also adapted from Project WILD, demonstrates how both the quality and the quantity of habitat determine the carrying capacity of a habitat at a given time. If a habitat has a large supply of low quality food for a particular animal, a large amount of land may still be required to support even a small population of that animal. In addition, individual animals within a population have different needs. Some animals may be injured or have young to support, increasing the amount of habitat necessary to meet their needs.

In this activity, all students will become black bears. Their challenge is to collect enough food to survive for ten days (80lbs). Black bears eat a variety of things, including nuts, insects, plants, meat, and berries. Each student must forage through the central area to collect different colored pieces of paper. The different colors represent different types of food. Assign each student a den: an envelope with a number on it. Have the students memorize their den numbers and place the envelopes in a common area away from the central foraging space. Explain that not all black bears are alike and assign the following special roles: one bear got in a territory dispute and now has an injured broken leg (this student must forage while hopping on one leg), one bear was recently blinded by getting too close to a porcupine (this student must forage blindfolded), and a final bear has to care for her two cubs (this student must gather twice as much food). Next, spread out the appropriate number and type of colored pieces of paper on the ground in a central location (follow the chart in Appendix A to determine the appropriate number of each color). Do not tell the students what the colors, initials, or numbers on the paper represent. Simply explain the papers represent different foods and they must collect them to survive. Explain that the students must walk **one** piece of food at a time back to their den. After you have explained the rules, gather all the students to a starting point and let them begin "walking into the forest."

End the game once all of the food has been collected, and explain what the colors, letters and numbers represent. Have the students add up the total pounds they collected based on the numbers written on the pieces of paper. How many of the students collected the 80lbs needed to survive? How many would have survived if the food had been split evenly between all bears? If time permits and the students are old enough, have the students then calculate the percentage of each food type in their diets. See Appendix A to determine the necessary amount of each food type a bear requires for a ten day period. Did the students have high or low quality diets? Have the students add up how many total pounds of food were in their habitat, and divide that number by the survival food weight (80 lbs) to find the carrying capacity of their habitat (MP.4). How many bears could this habitat support indefinitely?

Ask the students what this activity taught them about the importance of quality of habitat for survival. This is also an appropriate time for a discussion of a food web. Discuss how bears play a role in the facilitation of energy and matter flow by consuming food. Discuss the ultimate source of energy from food (the sun) and describe different roles including decomposers, consumers, and predators, and their interactions (5-PS3-1, 5-LS2-1, MS-LS2-3).

NOTE: See Appendix B for additional activities to be used if time allows, for outreach programs, to meet additional standards, or for Wisconsin-specific information.

Conclusion:
Review with the students the definitions of the four vocabulary words and the four components of habitat. Ask the students to describe populations in nature. Ask the students to describe how limiting factors, predation

and natural or human caused disturbances can combine to determine the carrying capacity of a population in a particular environment. Ask what effect the quality of habitat has on the survival of individuals within a population.

References

"Habitat Lap Sit", "Oh Deer!" and "How Many Bears Can Live In This Forest," *Project WILD K-12 Activity Guide,* Council for Environmental Education, 1992.

The Illustrated Dictionary of Ecology and Plant Life, Merilyn Holme, ed. 1993, ISBN 1-85737-002-3.

Appendix A

Charts for "How Many Bears Can Live in the Forest"

Color	**Label**	**Represents**	**Number of student in group**						
			10-15	**16-20**	**21-25**	**26-30**	**31-35**	**36-40**	**41-45**
			Number of Cards						
Orange	N-20	Nuts, 20 lbs	2	3	3	4	5	6	7
Orange	N-10	Nuts, 10 lbs	8	13	17	21	25	29	33
Blue	B-20	Berries, 20 lbs	2	3	3	4	5	6	7
Blue	B-10	Berries, 10 lbs	8	13	17	21	25	29	33
Yellow	I-12	Insects, 12 lbs	2	3	3	4	5	6	7
Yellow	I-6	Insects, 6 lbs	8	13	17	21	25	29	33
Red	M-8	Meat, 8 lbs	2	3	3	4	5	6	7
Red	M-4	Meat, 4 lbs	8	13	17	21	25	29	33
Green	P-20	Plants, 20 lbs	2	3	3	4	5	6	7
Green	P-10	Plants, 10 lbs	8	13	17	21	25	29	33
Total lbs. in habitat			480	760	920	1160	1400	1640	1880
# of Bears survive			6	9	11	14	17	20	23

Healthy bear diet for ten days		
Nuts	20 lbs	25%
Berries/Fruit	20 lbs	25%
Meat	8 lbs	10%
Plants	20 lbs	15%
Insects	12 lbs	25%

Appendix B
Additional Information and Activities

To be used if time allows, for outreach programs, to meet additional standards, or for Wisconsin-specific information

Habitats in Wisconsin Activity
Explain to the students that Wisconsin is home to a variety of different types of habitats. Most abundant are the forests, wetlands, barrens, and grasslands. The students will be playing a game to learn more about each type. Listed below is information about each type. As the educator, read through the content but you do not necessarily need to present all of the information to the class. Simply explain that the students will be brainstorming what makes up and defines each type.

Break the class up into four groups. If the class size is large, instead break up into eight groups. Give each group one piece of large paper and crayons or markers. Assign each group one of the four types on habitats. You may need to provide a little background on what a barren is if the students are unfamiliar. Then allow the students to draw or collage pictures, words, or symbols that they think represents or makes up their habitat. Encourage the students to express their own ideas as well as build on others' ideas (SL.8.1). Give the students five to 15 minutes depending on time.

Have each group present their habitat collage or picture to the rest of the class. Encourage coherent presentations that include explaining the group's choice of pictures, words, and symbols (SL.5.5, SL.8.4). At this time, allow other groups to contribute additional information. Provide the students with any additional information as necessary from the content below (SL.8.1). Once all the groups have presented, hand out the animal cards found in the program box. Have the students put the animals on the habitat collage that best suits the animal's needs. Have the students explain their choice of habitat for the animal. Present any final information about the habitat types.

For older students, conclude with a discussion of human impacts on Wisconsin habitats: Can the students think of ways that humans impact each of the four types? Can they think of methods to monitor and minimize human impacts on each? (MS-ESS3-3) How do increases in human population and consumption of natural resources impact the earth? What do they predict will be the impact on each type of habitat? (MS-ESS3-4)

Background Information on Wisconsin Habitats
A. Forests
A forest is a highly complex, constantly changing environment made up of a variety of living things (wildlife, trees, shrubs, wildflowers, ferns, mosses, lichens, fungi and microscopic soil organisms) and non-living things (water, nutrients, rocks, sunlight and air). Trees are the biggest part of this complex community. Due to the tree canopies, much of the forest floor is shaded year round. In Wisconsin, we have many different kinds of forests, each named based on the most abundant tree.

B. Wetlands
A wetland is a place where there is shallow water or very soggy soil at least part of the time. In fact, some wetlands are only covered completely for a couple of weeks each year. All plants receive the materials they need for growth chiefly from air and water (5-LS1-1), but many wetland plants are unique because they prefer to have exceptionally wet roots. Are lakes and rivers wetlands? No, but their edges can be considered wetlands. More than half of all wetlands in the United States have been destroyed. However, the remaining wetlands are very important for animals.

More than one-third of the endangered and threatened animals and plants in the United States depend on wetlands in some way. These species may die out if more of their wet places are destroyed. These species include whooping cranes, red wolves, Florida panthers, mission blue butterflies, and green pitcher plants. Before settlers moved to Wisconsin, about 1/3 of the state was covered in wetlands. Since then, nearly half of those wetlands have been lost. The coastal counties that border Lake Superior and Lake Michigan have the most remaining wetlands in the state.

C. Barrens
A barren is a plain with coarse grasses and scattered tree growth. The flat, sandy areas resemble dry prairies but contain actively moving sand dunes, stabilized by a thin forest cover. Due to the lack of competition between trees, the few existing trees have lower branches that can spread out, resulting in larger, shorter trees. In addition, the combination of both shade and sun allow for a mixture of plants to be grown. The pine barrens community occurs on landforms that include outwash plains, glacial lake plains, and broad sandy terraces that flank some of the major rivers of southern Wisconsin. Soils are almost always dry and sandy, with low nutritional content.

D. Grasslands
Grasslands are characterized by a lack of trees and tall shrubs and are dominated by grasses, sedges and forbs. The term grassland is the common term that refers to prairies, and thus the terms can be used interchangeably. Prairies are located mostly in the southern and western parts of the state and are

divided into six different types. Over 400 species of native vascular plants are characteristic of Wisconsin prairies, and most are restricted to prairie community types. In addition to a varied plant community, prairies have a diverse and specialized fauna, especially among prairie invertebrates, prairie and grassland herps and grassland birds.

Historically, native grasslands were maintained primarily by frequent fires, either started by lightning strikes or by Native Americans who burned large areas to produce food for game or to aid in hunting and gathering activities. On most soil types and moisture regimes in Wisconsin's climate, grasslands in the absence of fire, mowing or grazing will succeed to woody species over time. Less than 1% of the grasslands that existed before settlers moved to Wisconsin still exist today.

Who Shrunk the Jar?:
After finishing the Habitats in Wisconsin activity, the discussion of which animals belong to which habitats can lead to a discussion of specialists versus generalists. A **specialist** is a species with a narrow niche. It survives on a fairly limited diet (e.g. koalas, which feed almost exclusively on certain species of eucalyptus leaves) or is restricted to a particular locality (such as the tuatara of New Zealand, a species found in only a few offshore islands of the country). **Generalists** are species with much broader niches. They can survive in a wide variety of habitats, or feed on a range of different foods. A great example of a generalist in Wisconsin is the red-tailed hawk.

Due to the small niche that specialists occupy, they have an extremely difficult time adapting when conditions change and may experience much stronger competition for resources. On the other hand, generalists will thrive even under changing conditions. These patterns of interaction generally remain consistent for all generalists and specialists across multiple ecosystems (MS-LS2-2). As a result, when the environment changes due to human or natural reasons, many species of specialists are threatened.

A great way to help students visualize this idea is with "Who Shrunk the Jar?" Two different types of balls are used for this- a larger ball and a smaller ball. Hand out several of the larger balls to some students, and hand the remaining smaller balls to everyone else. The large balls represent specialists. Since they have a specialized diet, their territory is often larger for foraging and hunting. Generalists will eat whatever they can find within their small territory. Bring out a large jar. Have each student place their ball inside the jar. All of the generalists and specialists should fit inside this jar. Next, ask the students why the jar (habitat) might shrink. This could be due to a lot of reasons- climate changes, human development, spread of disease, etc. If the habitat shrinks, who is most likely to die off? To represent this new habitat, bring out a second, smaller jar. Try to put the specialists into this second jar. Only some of them will fit. Next try to put the generalists in. Most will fit in around the specialists. This represents the generalists' ability to adapt to changing conditions.

Appendix C
Standards Alignment

Wisconsin's Model Academic Standards:
Environmental:
A.4.4
A.8.4
B.4.1
B.8.8
Science:
F.8.2
F.8.5
F.8.8
F.8.9

Next Generation Science Standards
4-LS1-1
5-PS3-1
5-LS1-1
5-LS2-1
5-ESS2-1
5-ESS3-1
MS-LS1-4
MS-LS2-1
MS-LS2-2
MS-LS2-3
MS-LS2-4
MS-ESS3-3
MS-ESS3-4

Common Core State Standards
SL.5.5
SL.8.1
SL.8.4
MP.4