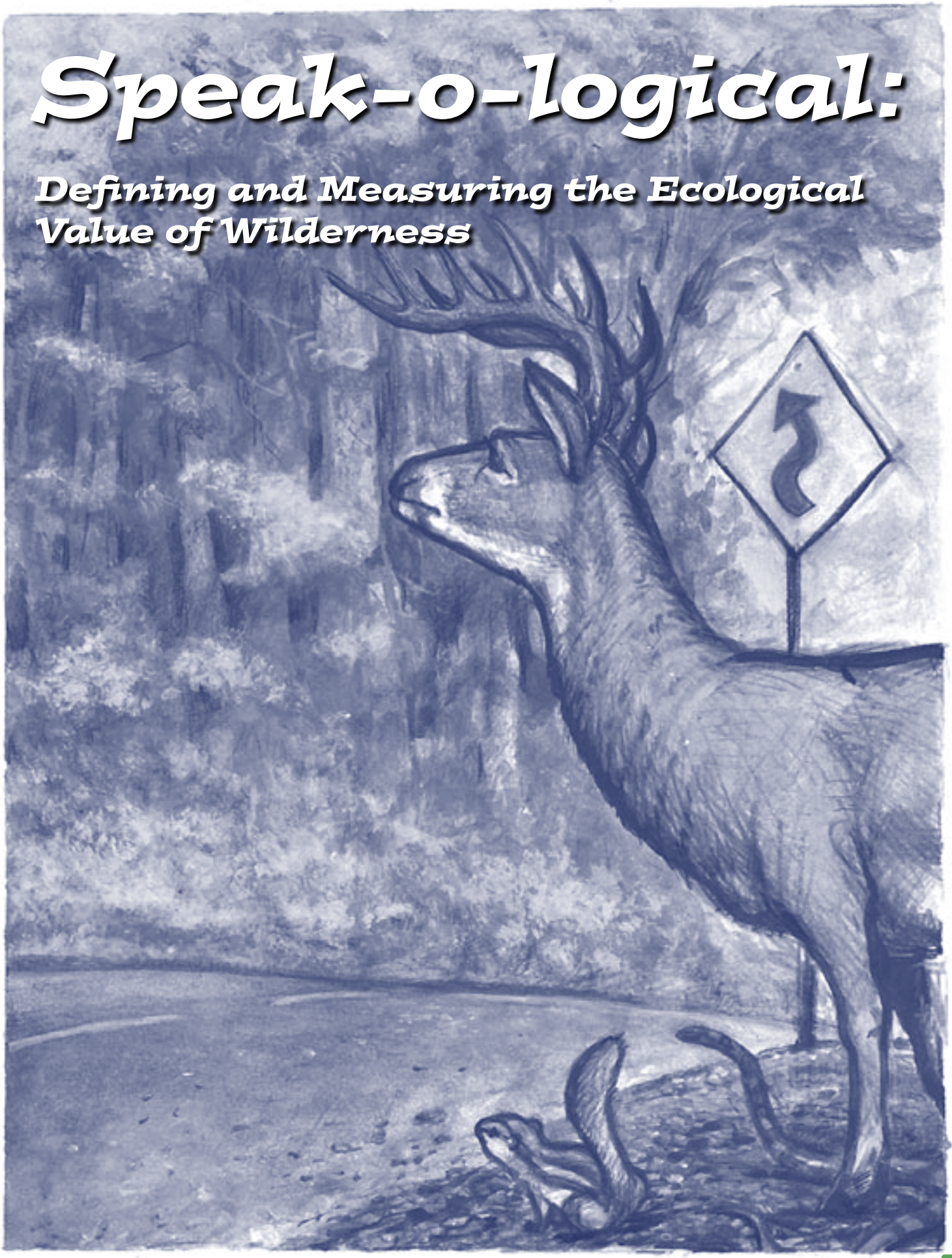
Speak-o-logical:

Defining and Measuring the Ecological Value of Wilderness



Meet the Scientists

▲ Dr. Cordell:
One of my favorite science experiences happened when I was a young scientist. Like all scientists, I spent a lot of time reading articles in scientific journals that were written by other scientists. The first time one of my articles was published in a scientific journal was exciting. It is really fun to finally see your name in print in a scientific journal!

▲ Ms. Murphy:
My favorite science experiment was going out on a boat to collect little bugs that live in the water called zooplankton. We wanted to see if the bugs would eat harmful algae that was killing fish and act as a biological control. The bugs did eat the algae and experiments are still being done to see if they can be used for this purpose.

▲ Dr. Riitters:
My favorite science experience was the discovery of a new computer method to measure forest *fragmentation* from global *satellite imagery*. Can you identify the character on my T-shirt? You can find the answer at http://en.wikipedia.org/wiki/The_Lorax.

▲ Mr. Harvard:
My favorite science experience was visiting and doing research in Iceland. You can see me here floating on a small iceberg in front of part of the Myrdalsjokull glacier in Iceland. Iceland has a variety of geological, geographical, and biological mysteries to experience and study. These include glaciers, volcanoes, geysers, waterfalls, hot springs, tectonic plates and earthquakes, Viking ruins, wild blueberries, Icelandic horses, and Icelandic sheep.

Thinking About Science

To answer a question or solve a problem, scientists must clearly define what they are going to study. In this research, the scientists were interested in exploring a possible difference between wilderness and lands that are not wilderness. Wilderness is *legally designated* land that is protected from most human activities. The scientists wanted to know if wilderness has greater *ecological* value than nonwilderness. To answer their research question, the scientists had to find a way to define what is meant by the ecological value of a natural area.

Glossary

fragmentation (**frag** men **ta** shun): The act or process of breaking apart or detaching.

satellite imagery (**sa** tel lit **im** uh jre): Photographs and other images of Earth taken from satellites orbiting Earth.

legally (**le** guh le): Of or pertaining to law.

designate (**dez** ig nat): To choose or appoint; to give a name to.

ecological (**e** ko **law** juh kul): Having to do with ecology. Ecology is the study of organisms and their relationship to their environment.

speculate (**spek** u lat): To think about or make guesses.

sustain (suh **stan**): To keep up or maintain.

concept (**kän** sept): A general idea of what a thing or a class of things is.

represent (rep re **zent**): To be an example of.

reservoir (**rez** ür vwor): A place where something, especially water, is collected and stored for use.

shrub (shrub): A woody plant that is smaller than a tree, usually with many stems. A bush.

barren (**bear** en): Not producing crops, fruit, or many trees.

microclimate (**mi** kro **kli** met): The climate of a small, specific place within a larger area.

Pronunciation Guide

a	as in ape
ä	as in car
e	as in me
i	as in ice
o	as in go
ô	as in for
u	as in use
ü	as in fur
oo	as in tool
ng	as in sing

Accented syllables are in **bold.**

Thinking About the Environment

The scientists in this study decided that the ecological value of an area is related to two things. Those things are how natural the area is and the area's ability to support life. Think about the word "natural." What does that word mean to you? Think about a parking lot, a soccer field, and a path through a forest. Which seems the most natural to you? What makes one area more natural than the other? What makes one area less natural than the other? Which of these areas can best support life? Which one is least able to support life?

Introduction

When a society decides to set aside areas of land as wilderness, it makes a choice about the value of those lands. In the United States, people have decided that some lands are more valuable without human development. Wilderness is an example of this type of area. Unlike many other natural areas, wilderness is protected from almost all human activities and development. People cannot take machines into wilderness. They cannot change the natural character of wilderness (**figures 1 and 2**).

Figure 1. Camping in a wilderness. The platforms are necessary because this wilderness is a large freshwater swamp.

Figure 2. Camping in a developed camp site.

One of the values of wilderness is its ecological value. The scientists in this study speculated that wilderness has a greater ecological value than other natural lands and than lands with roads, buildings, and other types of development. The scientists decided to compare wilderness with other lands. They wanted to know whether wilderness has greater ecological value than all other types of land.

Reflection Section

- What do you think is meant by the term "ecological value"? A value is the quality of a thing that makes people want to have it. Think about the values, or desirable qualities, that you might find in a natural area. You may also want to reread "Thinking About the Environment."
- To compare the ecological value of wilderness and nonwilderness lands, the scientists had to be able to measure the different areas' ecological value. They needed to use numbers to make their comparison. Think about your answer to the first reflection question. Can you think of a way to measure ecological value, or desirable qualities, using your definition? How would you do that?

Method

The scientists began their study by doing research in the library and on the World Wide Web. They wanted to find out how others had defined the term "ecological value." They found that many scientists had defined ecological value by how well an area could naturally *sustain* itself. The scientists decided to use the concept of naturalness as their measure of the ecological value of an area. The more natural an area was found to be, the greater its ecological value, and the greater its ability to support both human and nonhuman life.

The scientists' next step was to define what they meant by the term "natural." If you read "Thinking About the Environment," you have already thought about what is meant by the term "natural." The scientists used four *concepts* that could be measured and that when taken together, would *represent* the naturalness of an area. In this article, two of the concepts used will be presented (**figure 3**).

After deciding to use these concepts, the scientists did more library research. They looked for sources of information that had measured at least one of these concepts. They collected this information for wilderness and nonwilderness lands. Finally, they put all of the information together.

Reflection Section

- Do you think that the naturalness of an area is a good measure of its ecological value? Why or why not? Remember that naturalness was defined by the two concepts in figure 3.
- Have you ever done any research in which you used some of the same methods as these scientists? If so, describe what you did.

Concept	Description	Measurement
Natural land cover	All land that is not developed, meaning all land that is not urban or being used for buildings, roads, or agriculture.	Examination of a national map showing land cover. Land cover is a description of what is on the land. Examples include forests, natural lakes, *reservoirs*, houses, roads, agricultural land, etc. The scientists identified each type of land cover as natural or developed (covered with man-made development). The percentage of wilderness and nonwilderness with natural land cover was calculated.
Distance from roads	How much land area is a certain distance from a road (**figure 4**).	Examination of a national map showing land cover and a road map showing all roads in the United States. The scientists calculated how much land in wildernesses and nonwildernesses was within 127 meters, 382 meters, and 5,000 meters of a road. (Multiply the number of meters by 1.09 to calculate the number of yards.)

Figure 3. Two concepts that represent the naturalness of an area.

Findings

Land Cover

In all areas of the United States except the West, over 95 percent of wilderness is in natural land cover. In the West, over 90 percent of wilderness is in natural cover. The actual percentage of natural cover in the West might be higher than 90 percent. However, because much of the land in the West is desert and *shrub* land, the scientists could not say for sure if the land was naturally barren, or *barren* because of human activity. Scientists will usually be more cautious when they cannot be sure of their findings. **Figures 5a and 5b** summarize the percentage of wilderness land and all land with either natural land cover

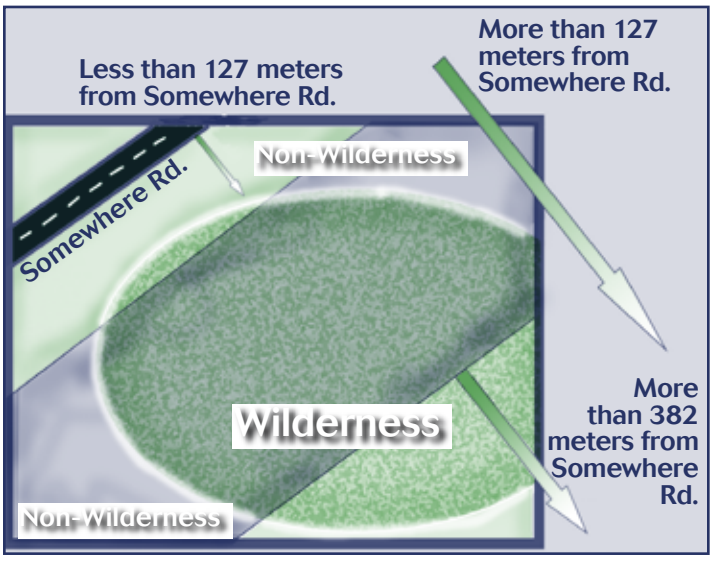


Figure 4. Example of wilderness and nonwilderness that is at least 127 meters and at least 382 meters from a road.

or developed land (land covered with man-made development).

Distance From Roads

When a road is located beside a natural area, it can disrupt the natural area up to hundreds of meters into the area. Roads can disrupt wildlife, pollute water, change the *microclimate*, and raise noise levels. The scientists found that across the United States, 97 percent of wilderness land area is at least 127 meters from a road. In comparison, 80 percent of all land in the United States is at least 127 meters from a road.

Number Crunches

How many feet is 127 meters? Multiply 127 by 3.27 to find out.

When the scientists looked at the percentage of land area at least 382 meters from a road, their results were different. East of the Mississippi River, 90 percent of wilderness is at least 382 meters from a road. West of the Mississippi River, 95 percent of wilderness is at least 382 meters from a road (**table 1**). In comparison, only about 50 percent of all land in the United States is at least 382 meters from a road.

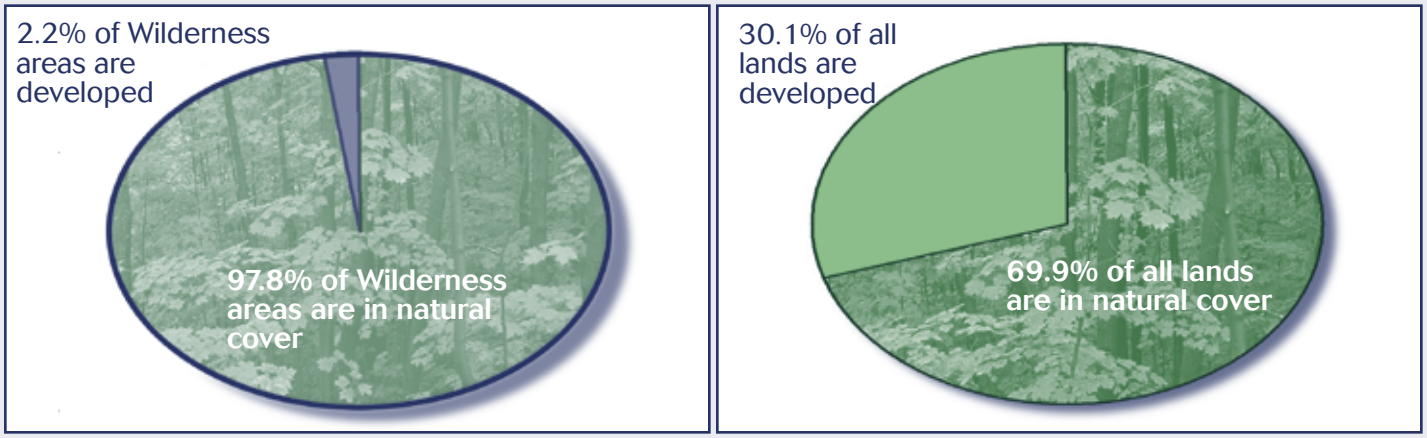
Number Crunches

How many feet is 382 meters?

When the scientists looked at the percentage of land area at least 5,000 meters from a road, they found something different again. In the East, 47 percent of wilderness is at least 5,000 meters from a road. In the West, 60 percent of wilderness is at least that far from a road. In comparison, only 3 percent of all land in the United States is at least 5,000 meters from a road (**table 2**).

Number Crunches

How many feet is 5,000 meters? Once you have that figure, divide it by 5,280 to find out how many miles this is.



Figures 5a and 5b. Percentage of land in natural cover and in developed land for wilderness and for all land in the United States. The pie chart on the left shows the percentage of natural and developed land within wilderness. The pie chart on the right shows the percentage of natural and developed land for all lands in the United States.

Table 1. Percentages of wilderness in the East and West and of all lands across the United States that are at least 382 meters from a road.

Location of land			
	Wilderness east of Mississippi River	Wilderness west of Mississippi River	All land in the United States
Percent of land at least 382 meters from a road	90	95	50

Table 2. Percentages of wilderness in the East and West and of all lands across the United States that are at least 5,000 meters from a road.

Location of land			
	Wilderness east of Mississippi River	Wilderness west of Mississippi River	All land in the United States
Percent of land at least 5,000 meters from a road	47	60	3

Reflection Section

- Now that you have read the "Findings," would you say that wilderness is more natural than land that is not wilderness? Why or why not?
- The scientists assumed that the more natural an area is, the greater its ecological value. This is because the more natural an area is, the greater is its ability to support human and nonhuman life. Would you agree that taken together, wilderness has greater ecological value than land that is not wilderness? Why or why not?

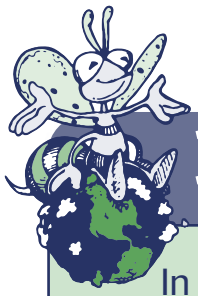
Discussion

The scientists decided that using four measures of naturalness was the best way to determine the ecological value of wilderness. In this article, two of those concepts were presented. The scientists used existing information to discover that wilderness has more natural cover than other lands in the United States. Wilderness is also less affected by roads than other lands. The scientists concluded that wilderness has a greater ability than nonwilderness to support both human and nonhuman life.

Reflection Section

- Reread the last sentence in "Discussion." Do you agree that wilderness has a greater ability than nonwilderness to support both human and nonhuman life? Why or why not?

From: Cordell, H. K, Murphy, D., Riitters, K., and Harvard, J. (2005). The natural ecological value of Wilderness. In: Cordell, H. Ken, Bergstrom, John C., and Bowker, J.M. (2005). *The Multiple Values of Wilderness*. State College, PA: Venture Publishing.



Wondering about Wilderness

In the United States, there are 677 wildernesses. The smallest is a 5-acre wilderness in Florida, and the largest is in Alaska, with 9 million acres. The largest combined area of wildernesses is also in Alaska. This includes Noatak Wilderness and Gates of the Arctic National Park and Preserve, which is introduced in this journal on page 6 ("It's Elemental, My Dear!"). In the lower 48 States, the largest combined area of wilderness is Gospel-Hump Wilderness and Frank Church - River of No Return Wilderness. You can read about a scientific study done in Frank Church - River of No Return Wilderness on page 25 ("As the Frog Hops").

For more information about wilderness, read page 5 in this journal or visit http://www.wilderness.net.

FACTivity

One of the measures of naturalness used by the scientists is distance from roads. In this FACTivity, you will use your experience and imagination to explore whether you agree with the scientists' conclusion (To refresh your memory, reread the last sentence in "Discussion" on page 63). You will write a story about going home from the viewpoint of an animal who makes his or her home in the forest.

First, select an animal from this list or come up with your own animal. Your story will be told from this animal's point of view.

Frog

Skunk

Deer

Snake

Rabbit

Your story will be four paragraphs long. Each of the paragraphs will describe a part of the animal's journey home. Use the four photographs on page 65 as a guide, one for each paragraph. In each paragraph, consider the following:

1. Is there a difference between the number and size of trees your animal finds and its closeness to the road? What is the difference?
2. Is there a difference between the amount of traffic noise and closeness to the road? Do you think that the traffic and traffic noise is disruptive to your animal? Why or why not? Describe how your animal feels as he or she travels across the road and into the forest.
3. Is there a difference between the types of ground cover your animal crosses and closeness to the road? If so, what is the difference? Are areas away from the road more natural, less natural, or about the same? Describe your animal's journey across the

land, paying attention to the surface. How does the surface feel, sound, and smell?

4. Is there a difference between the number and type of other animals that your animal met as he or she traveled away from the road toward home? Did he or she find more or fewer animals or evidence of animals farther from the road? If there are differences, what are they?
5. Is there a difference in the number and types of plants that your animal found as she or he traveled home? What is the difference? Does the difference have anything to do with the distance from the road?

As a class, share your stories and pictures. Based on your stories, do you agree that the farther away from a road one travels, the more natural the area is? Based on your stories, do you agree with the scientists that wilderness has a greater ability to support human and nonhuman life? Why or why not?

If you are a Project Learning Tree-trained educator, you may use PLT Activity #88, "Life On the Edge," as an additional activity resource.

You may also draw pictures to help tell your animal's story.