

Activity Guide for Teachers

NEW ENGLAND AQUARIUM



**New England
Aquarium**

Teachers and *Living Links*

In the warm waters of the Caribbean, a sea turtle gently paddles above a coral reef. Farther north, near the edge of a pond in New England, a clump of frog spawn sways rhythmically just below the water's surface. Half a world away from the pond, a school of batfish weaves in and out among the mangrove roots of a Solomon Islands lagoon. Meanwhile, in Boston, Massachusetts, a student sits in a classroom and gazes out, watching the raindrops on the window.

It may not be readily apparent that all of these organisms and ecosystems are interconnected. One of the goals of the new Aquarium exhibit, *Living Links: Choices for Survival*, is to explore how links among species and terrestrial, freshwater and saltwater ecosystems are the keys to survival of all life on earth.

From a teaching perspective, *Living Links* offers many opportunities to reinforce and enhance learning objectives in life science, math, literacy, and social science in grades K-12. In this special section of *Schooling*, we have selected just one of the *Living Links* themes, frogs, to illustrate how inquiry-based activities can integrate the exhibit with classroom learning goals.

***Living Links: Choices for Survival* Opened May 2002**

Learn about the importance of frogs, sea turtles, fish, and diverse ecosystems to our lives. Try the amphibian activities we offer here as well as materials such as videos, books, and kits offered through our Teacher Resource Center: 617-973-6590.

Also visit *Living Links* this summer at:
<www.neaq.org/livinglinks>



Living Links

choices for
survival

Frogs: *Living Links* From Freshwater to Land

Why should we be interested in frogs? Frogs and their close relatives, toads*, salamanders, newts and caecilians (legless amphibians) are incredibly diverse. Scientists have counted more than 4,600 **species of amphibians in habitats all over the world including approximately 4,100 **species of frogs and toads. Frogs and toads capture human imagination with their looks, behavior, and life cycle. From a purely practical standpoint, frogs and toads make our lives more bearable and reduce disease transmission because they consume large numbers of insects. In addition, medical researchers are using the skin secretions of some frogs to develop products to fight human disease.

Frogs: Environmental Town Criers

Scientists have identified another important reason why we should be interested in frogs. Long before there is large-scale loss of animal life and vegetation, or before health threats to human populations are detected, certain sensitive animal species show early warning signs of stress and disruption. These species are known as 'bio-indicators.' Many of the significant bio-indicator species are amphibians. The two-stage life cycle of most amphibians makes them particularly good bio-indicators, because they need both a healthy aquatic environment for reproduction and a healthy land environment for food and shelter. These animals have permeable skin, making them especially sensitive to chemicals and ultra-violet light. Declines in many frog populations worldwide and increases in genetic abnormalities give us cause for concern. Are frogs sounding a warning?

Massachusetts Curriculum Frameworks & *Living Links*

Life Science Frameworks	Grades PreK-2	Grades 3-5	Grades 6-8	Grades 9-12
<i>Adaptations of Living Things</i>		•		
<i>Changes in Ecosystems Over Time</i>	•	•	•	
<i>Characteristics of Living Things</i> <i>Characteristics of Plants & Animals</i>	•	•		
<i>Classification of Organisms</i>			•	
<i>Ecology</i>				•
<i>Energy and Living Things</i>		•	•	
<i>Evolution and Biodiversity</i>	•		•	•
<i>Life Cycles</i>	•	•		
<i>Living Things and Their Environment</i>	•		•	
<i>Reproduction and Heredity</i>			•	

Check out these websites to find out more

Frogs are disappearing! Can you solve the mystery?

Oregon Coast Aquarium
www.aquarium.org/education/spotlight/disappearingfrogs

or
Access Excellence
www.accessexcellence.org/croak

Biodiversity

Commonwealth of Massachusetts:
www.state.ma.us/dfwele

Biodiversity Project
www.biodiverse.org

Massachusetts Audubon Society
www.massaudubon.org

World Wildlife Fund
www.wwf.org

American Museum of Natural History
www.amnh.org

National Wildlife Federation
www.nwf.org

U.S. Fish and Wildlife Service
www.fws.gov

* The shortest answer to the difference is that frogs have moist and slimy skin, long legs and can leap. Toads have drier, bumpy skin and walk more than hop.

** Whitefield Gibbons et al., "The Global Decline of Reptiles, Déjà vu Amphibians," *BioScience*, 50 (8): 653-666, Aug. 2000.



A Frog's Life Story

By Lynn E. Morgenstern and Cindy Lydon

Purpose

To familiarize students with the dramatic body changes that occur in the life cycle of a frog as it moves from being an aquatic tadpole to a semiterrestrial adult.

What You Need

Frog Life Cycle Puzzle*

(included in this section)

Drawings of frog life cycle*

(included in this section)

Tape, Scissors

Books on the frog life cycle

(optional)

Animal Lives The Frog

by Sally Tagholm

Tale of a TADPOLE

by Barbara Ann Porte

Frog

by Angela Royston

Frogs

by Gail Gibbons

Frogs and Toads

by Steve Parker

Climbing Tree Frogs

by Ruth Berman and John Netherton

Amazing Frogs and Toads

by Barry Clarke and Jerry Young

What To Do

1. Read students one of the books listed above or ask students to read selections about frogs.
2. Ask students to state what they know about how frogs are born and how they grow. What does a frog look like when it is born? What does an adult frog look like? What happens in between?
3. Pass out copies of the puzzle/drawing pages. Ask students to cut out each of the circle drawings.
4. Follow the arrows around the ring. Read each stage in the frog life cycle.
5. Choose the drawing to place on each stage of the life cycle.
6. When each drawing has been placed on the correct description, pass out the tape. Ask students to tape the top of each drawing over the appropriate circle so they can flip up the drawing and read the description.

Discussion

- What do you notice about the life cycle of a frog?
- Describe the kind of environment a frog egg needs to grow into a tadpole.
- What about the environment a tadpole needs?
- What about a frog?
- What are important changes from one stage to the next?
- How is water important to the life cycle of a frog?
- What do you think are threats to frog eggs? Tadpoles? Adult frogs?
- How do the threats to eggs and tadpoles relate to the large number of eggs laid by a female frog?
- How do frogs compare to mammals in the number of young they produce?
- What could be some of the reasons why mammals produce fewer offspring?
- Some scientists have data that show the number of frogs is declining worldwide. Can you think of any reasons why this might be happening?

Vocabulary

spawn: n. the mass of eggs deposited by fishes, amphibians, mollusks, crustaceans, etc. v.i. to deposit eggs or sperm directly into the water, as fishes.

metamorphosis: n. a profound change in form from one stage to the next in the life history of an organism.

Webster's Encyclopedic Unabridged Dictionary of the English Language, © 1966 by Random House Value Publishing, Inc.

Note that the frog life cycle shown here is a generalized one. Some frogs, such as tree frogs, do not go through all of the phases shown in the diagram or develop in a different manner.

Massachusetts Curriculum Frameworks & Living Links

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Characteristics of Living Things	●		
Life Cycles	●	●	
Heredity	●	●	
Living Things and Their Environment	●		●
Characteristics of Plants and Animals	●	●	
Reproduction and Heredity			●



More Life Cycle Activities

Tapioca Frog Spawn

- To give your students an idea of what frog eggs look like, make a bowl of tapioca pudding using large pearl tapioca from the market. The good thing about this activity is that when the demonstration is over, it makes a healthy dessert!

Literacy

- Ask students to write about their life as a frog from egg to adult or to write about one stage in the cycle.
- Suggest that students make the biodiversity connection by including the risks that frogs face at each stage of development and by identifying plants and animals they see or interact with at different stages.
- Use the Frog and Toad series by Arnold Lobel to explore the interplay of science and imagination.

Arts & Crafts

- Turn the life cycle pictures here (or those drawn by students) into a mobile.
- Make a flip book using student drawings of the frog life cycle.

Seasonal Migration of the Northern Leopard Frog



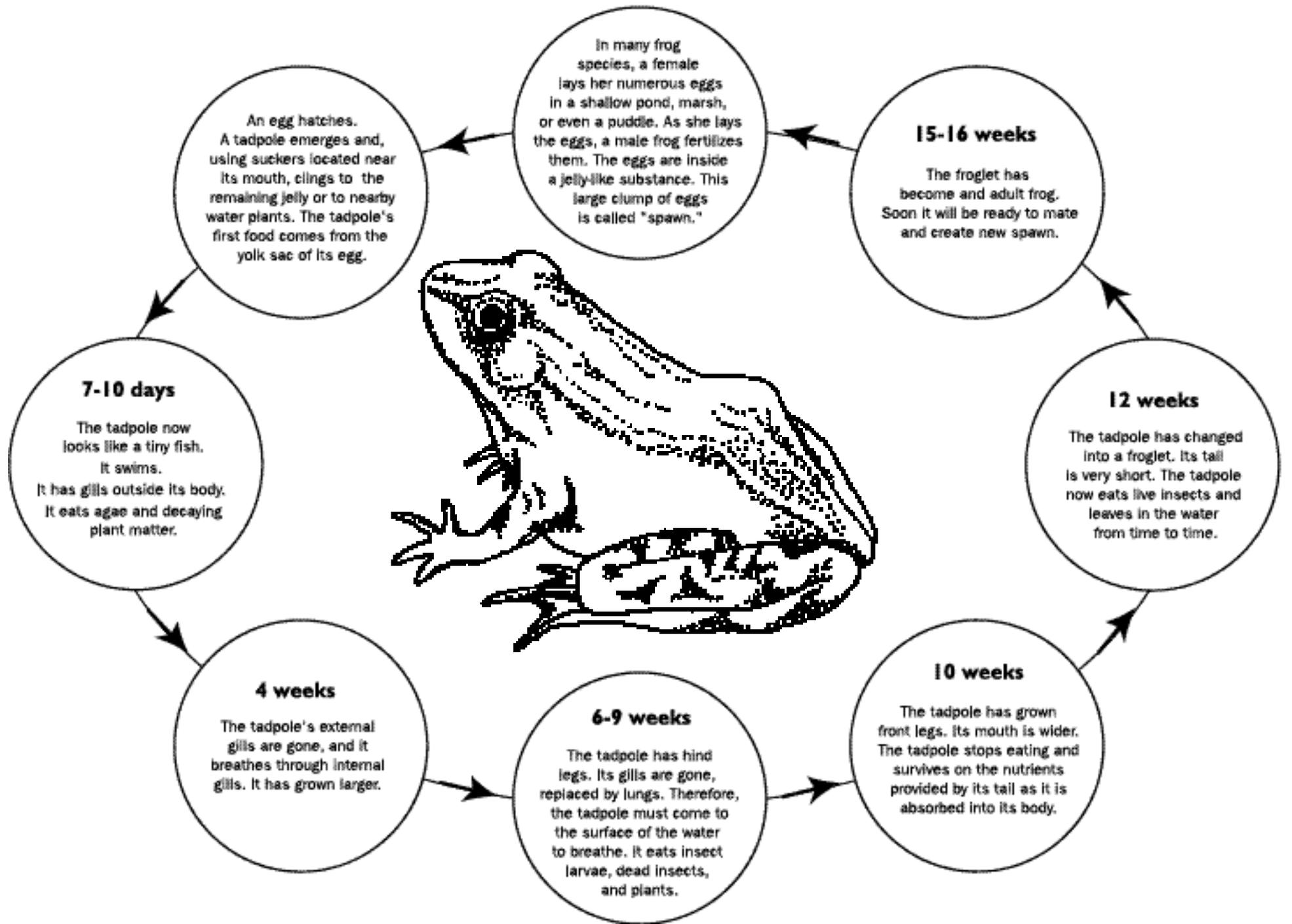
A northern leopard frog spends the spring and summer of its early life stages in shallow water. By fall, it is an adult frog.



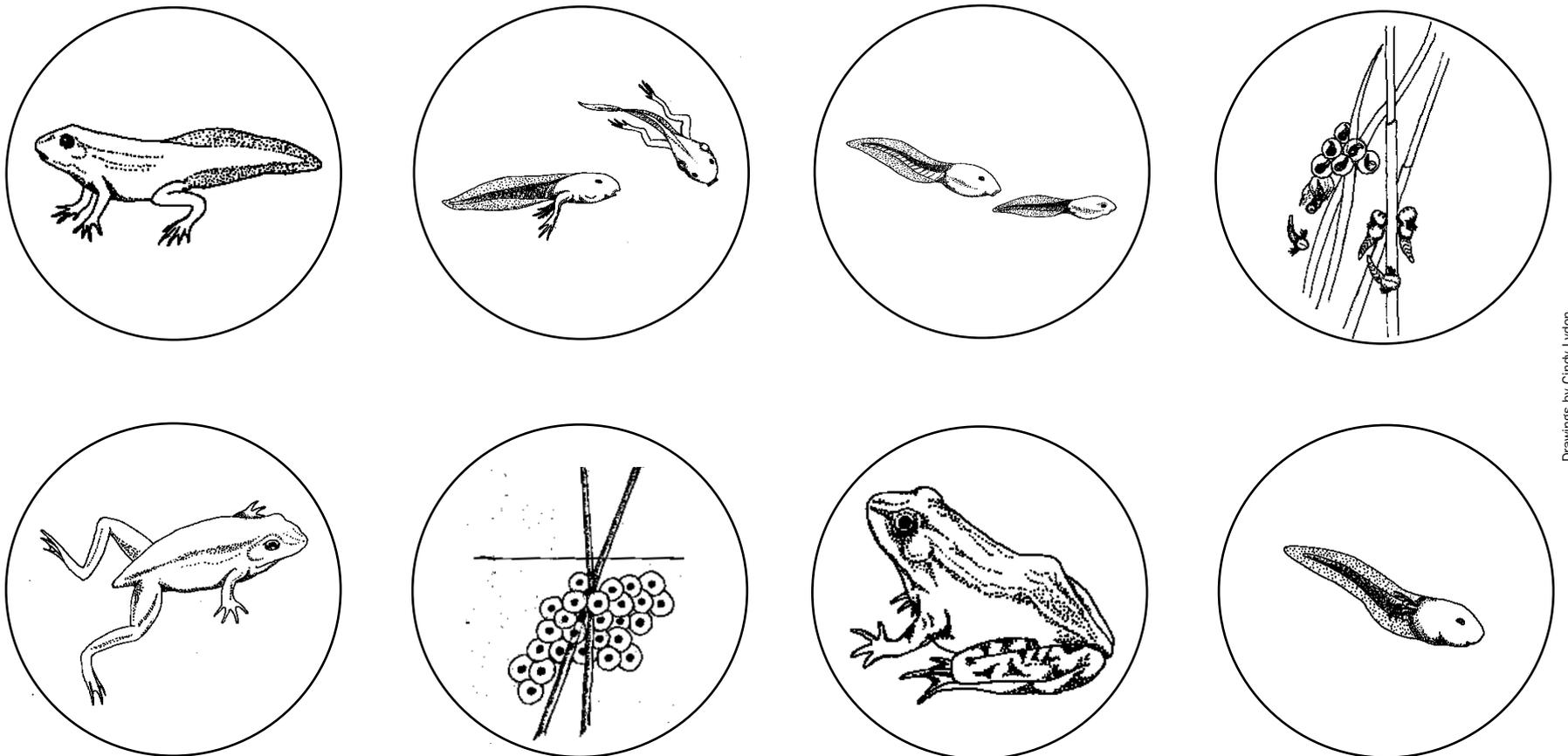
As winter approaches, the adult northern leopard frog moves to deeper water.



Through the winter, the adult frog hibernates in the mud at the bottom of the pond, where the deeper water layer protects it from the cold. In the spring, when it is ready to reproduce, it will move again to shallow water.



Frog Life Cycle Puzzle



Drawings by Cindy Lydon.

Frog-Friendly Habitat

By Lynn E. Morgenstern

Purpose:

To prompt student analysis of how a habitat meets an animal's needs.

What You Need:

Blackboard or poster-size pad of paper

Chalk or marker

Paper

Pencils

A shoebox (with one long side cut away) for each student

Art materials such as colored construction paper, colored tissue paper, blue mylar or shiny wrapping paper, paint, glue, pipe cleaners, Twist ties (for insect bodies and wings), stones, twigs, peat moss

What To Do:

1. Tell the students that they are going to compare what they need to live to what a frog needs.
2. Pass out the paper and pencils.
3. Ask the students to draw a line down the center of the paper. On the left column, they should write the title: "What I need."

4. Tell them to imagine that they have been in a shipwreck and have washed ashore on an island. There are no other survivors or people on the island.

5. In the left-hand column, ask them to list what they would need to survive. They should start with the most important things first. Give them three to five minutes and ask them to stop.

6. Divide the blackboard or paper in half and title the left column: "What people need." Ask students to give you items from their lists. Discuss why these items are important.

7. Ask students to write the title "What frogs need" on top of the right column on their paper. Ask them to write down what they think frogs need to survive. Remind them to think about what they learned about the life cycle of frogs since eggs, tadpoles and adults may each need some different things and a frog-friendly habitat should include them all. Give the students three to five minutes and then ask them to stop.

8. Write the same title on the right side of the board and ask students to give you their ideas. As you write the ideas down, ask why the student thinks this item is important for frogs.

9. Compare the lists and draw lines between items that are the same, similar or related. How many were the same and how many were different?

10. Ask the students to use the materials provided to make a frog-friendly habitat in a shoe box. They should add things that reflect the items on the list they created. They should include shelter, water, and food. They can include other animals and plants that could be found in that habitat. They should make a list of the things they have included in their habitat and attach the list to the outside of the box. OPTIONAL: If you want to study vernal pools, students can do some research and make their habitat a vernal pool.

11. Discuss some of the questions below. Students may want to add items to their habitat based on the discussion.

12. Have a "frog visit" by having students set up a display of their habitat boxes in the classroom. You may want to invite a group of younger students to visit. Your class can put on a short frog skit, read or act out a frog story, or report on what they learned about frogs. You may also want to play a tape of frog sounds while students look

at everyone's habitat boxes.

Make a Toad Abode and certify your school yard as a frog and toad habitat.

For more information check out the National Wildlife Federation website: <www.nwf.org/backyardwildlifehabitat/toadabode.cfm>.

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Characteristics of Plants and Animals	●	●	
Reproduction and Heredity			●

Discussion:

- Why could it be harmful to a frog to pick it up from one area and put it back in some other location?
- What would it be like if you were dropped off in a strange neighborhood and did not know how to find your way home?
- If you introduced fish that ate frog eggs or insect larvae into your habitat how might that change your frog population?
- What could happen to your frog population if a road was constructed through your habitat so that your frogs had to cross it to get to water?
- What if your habitat did not provide any protection from the sun for your frogs and their eggs?
- Why might you want to have frogs living in your backyard? (HINT: Think about what they eat.)

Vocabulary

habitat: n. the area where an animal, plant or microorganism lives and finds the nutrients, water, sunlight, shelter, living space and other essentials it needs to survive. Habitat loss, which includes the destruction, degradation and fragmentation of habitats, is the primary cause of biodiversity loss.

ecosystem: n. a community of plants, animals and micro-organisms that are linked by energy and nutrient flows and that interact with each other and with the physical environment. Rain forests, deserts, coral reefs, grasslands, and a rotting log are all examples of ecosystems.

Definitions from "Windows on the Wild: Biodiversity Basics," © 1999 World Wildlife Fund.

Why Is Biodiversity Important?

"We don't know how many there are, or what kinds of things—new medicines or chemicals—they have to offer. It's like a library of unread books, and we haven't even finished the first chapter." E.O. Wilson, as quoted in National Geographic, February, 1999.

Survival

All life on earth is dependent on what ecosystems and living things provide, such as food production, flood control, water and air purification and carbon storage.

Gene Pools

Genetic diversity within a single species is an insurance policy for that species against disastrous events such as disease and insect infestation. For example, within the naturally occurring corn population may be an individual plant that can withstand the next wave of blight.

Interdependence

When a species disappears from the planet, the food chain and the population sizes of other species can be disrupted with adverse consequences. For example, if bats disappear in the area around a pond, the mosquito

population there might increase, and possibly the incidence of encephalitis.

Medical Products

Animal and plant diversity offers a variety of medicinal options for treatment of disease. More than 25 percent of our medicines come directly or indirectly from the natural world. Currently, scientists have tested only a very limited number of plant and animal substances for medical use.

Economic Development

The world economy is dependent on products derived from the earth's plants and animals, and many more opportunities remain to be explored. For example, one half of all animal phyla live in the sea. Our oceans provide products and services that are essential to human existence, yet scientists have only just begun to study marine ecosystems and the life they support.

Spiritual Value

The earth's living things offer great beauty and provide a sense of peace and tranquility.

Intergenerational Responsibility

Each generation is entrusted with the care of this living legacy to insure it is available to the next generation.

Biological diversity, commonly defined as the diversity of life, is often divided into (1) diversity within species (genetic diversity); (2) diversity among species (species diversity); and (3) diversity among ecosystems. Adapted from Global Marine Biological Diversity, Elliott A. Norse, ed., 1993, Washington, D.C., Island Press.

