Salamander Crossing

Lesson Focus

Students will learn about different kinds of animal crossings engineered to help protect wildlife and the ways civil engineers can take wildlife migration into account when developing in wildlife habitats. They will construct a model of a salamander migration area with a road passing through it and design a crossing to get the salamanders safely to their breeding grounds.

Age Levels

- 5-8

Objectives

Introduce students to:

- Patterns of animal movement and the challenges that can come when roadways and human developments disrupt these movements.
- The challenges faced by civil engineers when designing safe roads and highways, and the need to take wildlife into account.
- Efforts by wildlife experts and environmentalists to improve road safety for animals.

Anticipated Learner Outcomes

Students will be able to

- Design an animal crossing.
- Understand how roadways and wildlife can be in conflict.
- Evaluate, test, and improve upon their design.

Alignment to Curriculum Frameworks

See attached curriculum alignment sheet.

Internet Connections

- Animals Need Infrastructure Too (www.citylab.com/life/2018/07/wildlife-crossings-bridges-tunnels-animals-roads-highways-roadkill/566210/)
- Banff Wildlife Crossing (https://mymodernmet.com/wildlife-crossings/)
- Wildlife crossings stop roadkill. Why aren't there more? (www.youtube.com/watch?v=ND0D3bVbM7Y)
- Salamander Crossing Brigade (www.wmur.com/article/tuesday-may-9th-salamander-crossing-brigade/9604209)
- Salamander Crossing (www.youtube.com/watch?v=VbPIjRb4zc8)
- There Are Teeny Tiny Underpasses for Salamanders in Massachusetts (www.boston.com/cars/news-and-reviews/2015/03/25/there-are-teeny-tiny-underpasses-for-salamanders-in-massachusetts)

Recommended Reading

- Salamander Sky by Katy Farber (ISBN: 978-0999076644)
- Amphibian by Barry Clarke (ISBN: 978-0756613808)
- Salamander Dance by David FitzSimmons (ISBN: 978-1936607006)
- How Do Wildlife Crossings Save Animals? (ISBN: 978-1543541380)

Optional Writing Activity

Think about where you live and the types of wildlife you encounter. Are there areas where these encounters are problematic? Or where natural movements of animals are disrupted? What do you think should be done to help keep humans and animals safe? If you could design a new structure in your community, or change an existing one, what would it be?

For Teachers: Teacher Resource

Anticipated Learner Outcomes

Students will be able to:

- Design an animal crossing.
- Understand how roadways and wildlife can be in conflict.
- Evaluate, test, and improve upon their design.

Materials

- Play dough, in multiple colors (including blue, green, and black)
- Play dough tools (optional, mainly rollers/rolling pins)
- Small drawings or photos of spotted salamanders (should be small enough to fit easily through a paper towel roll.
- Paperclips
- String
- Strips of paper or cardstock
- Scissors
- Paper towel and toilet paper rolls
- Tape
- Trays or small boxes or box tops (optional)
- Natural material (optional), like twigs, pine needles, and leaves, which can be used to represent different natural areas in the model

Procedure

1. Students should read the Student Resource as homework the night before or in class before beginning the activity. This will introduce them to the issue of wildlife crossings and the challenges facing salamanders as they make the springtime migration from their wooded homes to the vernal pools where they breed. Students could also watch the video, *Wildlife crossings stop roadkill. Why aren't there more?* (www.youtube.com/watch?v=ND0D3bVbM7Y), either in class or at home, which provides a good introduction to the issue and shows some examples of successful animal crossings.
2. Students will then cut out a small picture of a spotted salamander and tape it to a paperclip. They will then tie a string to the end of the paperclip.
3. Students will work with playdough to create a model of a salamander crossing zone. This can be done on a table or desk, or in a tray, shallow box, or box top. The model should include a wooded area on one side, a vernal pool on the other side, and a road running in between.
4. The goal of the activity is for students to change the model in order to construct a way for the salamander to get from the woods to the vernal pool without having to cross the road, where it would risk getting hit by a car. To test their design, students will place their salamander in the woods and use the string to pull the salamander across the model and over to the vernal pool. The toilet paper rolls can be used to construct bridges or tunnels, the paper strips can be used as fences or

guides, and the road can be lifted, lowered, or otherwise moved in order to create a solution.

5. Once students have tested their designs, they should consider what worked and what didn't. Students can redesign their crossing if needed. Since salamanders need to stay damp to survive, students should think about and be prepared to explain how their crossing takes this into account.
6. Students will share their salamander crossings with one another.
7. Students will use the Student Worksheet to evaluate how their design worked, what problems they encountered, and what changes they could make to improve their design.

Student Resource:

◆ Why Did the Salamander Cross the Road?

Every spring as temperatures start to rise, on wet, rainy nights, salamanders make the journey from the forests where they live as adults to the vernal pools where they breed, lay their eggs, and the hatched larvae begin their lives living in the water. When these baby salamanders become juveniles, they will make the journey back to the forest until it's time to return to the water as adults to breed and lay their own eggs.

In order to reach these breeding sites, salamanders often have to cross over roads, meaning that many adult salamanders risk being run over by cars. It is estimated that mortality rates for adult salamanders crossing roads can often be as high as 50 to 100%, meaning that local salamander populations can quickly be wiped out. Chemical run-off from cars can also pollute roadside waterways, which can damage eggs and embryo development, meaning fewer salamander eggs are able to successfully hatch baby salamanders.

Conservationists have tried many methods to help salamanders and other amphibians on these migration nights. Some have started Salamander Crossing Brigades made up of volunteers who scan the roads, picking up any amphibians they find and carrying them safely to the other side of the road. During these nights, volunteers also help to collect data that has helped to change policies and save more amphibians. Some conservationists have successfully lobbied to have roads known for busy amphibian crossings closed for the busiest month. Data collected about amphibian migrations has helped to protect land scheduled for development. And in some places, special crossings have been built to provide salamanders with alternative ways to safely access their breeding pools. The first amphibian underpass was built at a busy migration site in Amherst, Massachusetts in 1987.

Other Wildlife Crossings

In addition to salamanders and other amphibians, wildlife of all sorts can come into harm's way when a roadway crosses through its habitat. And that harm reaches humans too. When large animals like moose and bears try to cross roads and highways, they become a danger to drivers as well.

In Banff National Park in Canada, authorities began creating a series of

underpasses and overpasses in known wildlife crossing areas. There had been more than 100 elk-vehicle collisions a year. Now there are less than 6. The crossings are planted with native vegetation, and fences along the highway are used to guide animals toward the crossings. You can view these bridges here: https://mymodernmet.com/wildlife-crossings/

In Florida, underpasses have been designed for black bears and alligators. In Santa Monica, California wildlife corridors have been proposed for animals such as mountain lions, bobcats, and coyotes, which are often hit by cars while trying to cross highways into the Santa Monica Mountains. In Eastern Canada, moose can be a dangerous road hazard. Tall moose fences, which allow moose to exit the highway, but not to return, have been built along large stretches of the Trans-Canada Highway.

In Vermont, the Fish and Wildlife Department and the Agency of Transportation are working with the Nature Conservancy, using game cameras to track if and how animals are navigating developed areas that interrupt blocks of forest. In areas where they have spotted wildlife traffic, they are creating dirt paths over large rocks, adding trees, and making other changes so these pathways are easier to cross.

In Warwick, England people were so concerned about amphibians getting trapped in drains that they installed mesh-covered ladders in drains near known breeding pools. These allow any amphibians that may get washed into drains while crossing the road to climb back out before being trapped for good.

The picture to the right shows an overpass in Thailand that allows animals to walk on the grass and safely cross the road.

The risks to wildlife extend beyond roads, too. Dams can block eel migrations to important upstream habitats where they will feed and mature. To help solve the problem, some dams have installed eel ladders—ramps that eels can push against while slithering upstream, safely moving over the hydroelectric dams.

With climate change, it's expected that animal migration patterns will change and that wildlife will need to migrate further than before in order to survive. This could mean even more issues when it comes to roads and animal movement.

Many people are thinking about animals and how roads can be safer for both humans and wildlife. Wildlife crossings work—protecting animal populations and keeping drivers safe. So why aren't there more wildlife crossings? The main obstacle is cost. But in some places planners and engineers are beginning to include wildlife habitats and migration in their plans from the beginning, making them more cost effective, safer for drivers, and better for animals.

Student Worksheet:

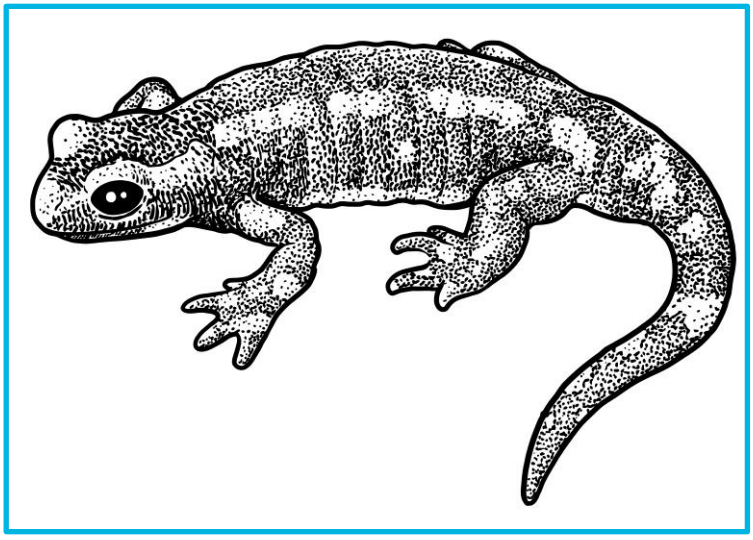
In the springtime, adult salamanders leave their forest homes and return to vernal pools where they breed and lay eggs. If a roadway exists between these two habitats, they have to cross the road to reach this very important destination. In this activity, you will be challenged to create a way to get these salamanders safely from one side of the road to the other.

Making Your Salamander
Cut out the salamander below and tape it to a paperclip. Next, tie the piece of string to the paper clip. This will be the salamander you need to help get from the woods to the vernal pool.

Building Your Habitat
Using playdough, construct a model of a salamander crossing zone. The model should include a wooded area on one side, a vernal pool on the other side, and a road running in between.

The Challenge
Your goal is to change the model into a salamander-friendly habitat by constructing a way for the salamander to get from the woods to the vernal pool without having to cross the road. You can use any of the materials provided to create your salamander crossing. Remember that you may need to build something to help guide salamanders to your crossing as well. Salamanders also have to remain damp in order to survive. Think about how your crossing will allow for this.

The Test
Once you have constructed your salamander crossing, place your salamander in the woods and pull your salamander through the crossing using the string (it can be threaded through tunnels, etc., if necessary). Evaluate how your crossing worked and how it could be improved. If time allows, revise your design and retest it.



Salamander Crossing

Student Worksheet:

◆ Reflection

1. What method did you choose for your salamander crossing? Why? How will your design make sure salamanders can stay damp?

2. How did your crossing work when you tested it? Were there any problems?

3. How do you think you could improve upon your design? What changes would you make to it?

4. What ideas did your classmates come up with that you liked? Are there any ideas you would want to incorporate into your design?

For Teachers: Alignment to Curriculum Frameworks

Note: Lesson plans in this series are aligned to one or more of the following sets of standards:

- U.S. Next Generation Science Standards (www.nextgenscience.org)
- U.S. Common Core State Standards for Mathematics (www.corestandards.org/Math)
- International Technology Education Association's Standards for Technological Literacy (http://www.iteea.org/TAA/PDFs/xstnd.pdf)
- Computer Science Teachers Association K-12 Computer Science Standards (http://csta.acm.org/Curriculum/sub/K12Standards.html)

◆Next Generation Science Standards - Grades K-2 (Ages 5-8)

K-ESS3-1 Earth and Human Activity

- Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

K-ESS3-3 Earth and Human Activity

- Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

K-2-ETS1-1 Engineering Design

- Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-2 Engineering Design

- Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

◆Standards for Technological Literacy - All Ages

The Nature of Technology

- Standard 3. Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.

Technology and Society

- Standard 5. Students will develop an understanding of the effects of technology on the environment.
- Standard 6. Students will develop an understanding of the role of society in the development and use of technology.

Design

- Standard 9: Students will develop an understanding of engineering design.

Abilities for a Technological World

- Standard 13. Students will develop abilities to assess the impact of products and systems.

The Designed World

- Standard 20. Students will develop an understanding of and be able to select and use construction technologies.