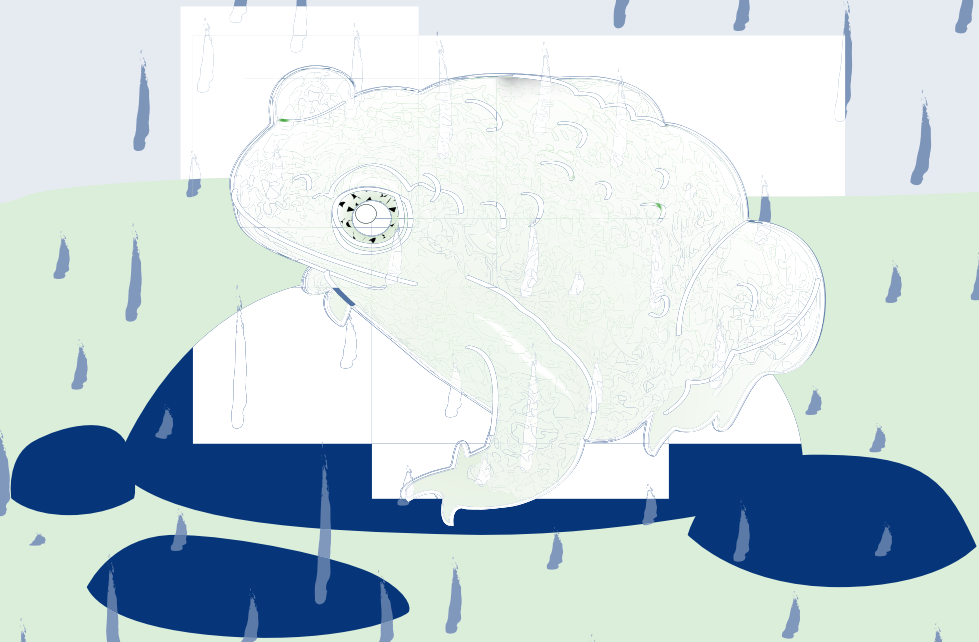


# Toad-ally Awesome!



Investigating the Relationship Between  
Flooding, Summer Rains, and  
Toad Reproduction Along the Rio Grande

# Meet the Scientists

**Dr. Heather Bateman:** My favorite science experience has always been working with wildlife. I enjoyed placing leg bands on long-eared owls in the United States Great Basin. I also enjoyed tagging lava lizards on the Galapagos (ga **lop** uh gos) Islands. One day, I spent over 12 hours measuring and weighing hundreds of toadlets, or small toads. They had been laid as eggs in pools of water in a riparian (ri **pair** e an) forest after a spring flood. A riparian forest is a forest located next to a body of water. Later, the frogs underwent **metamorphosis**, developing from tadpoles to toadlets. They fell into traps that we used to count and release them. The toadlets were about the size of my thumbnail.



**Dr. Mary Harner:** My favorite science experiences are conducting field research along rivers and in the tropics. Recently, I have had the fortune to study the ecology of bats on the island of Trinidad, located off the coast of Venezuela, as well as the ecology of plants along rivers in North America and in Europe. I enjoy being outdoors, studying organisms in their natural environments, and working with groups of scientists who have a broad knowledge of nature.





**Dr. Alice Chung-MacCoubrey:** My favorite science experience was a research project that allowed me to combine two of my biggest interests, dogs and bats. Dogs have a superb sense of smell that can be used in wildlife research. My dog used to accompany me in the field while I was radiotracking bats to find their tree roosts, and it was clear that she could smell the bats. In summer 2006, I tested my hypothesis that dogs could be used to locate bat roosts and conducted field tests using professionally trained scent detection dogs to locate bat tree roosts (by finding guano piles which are piles of bat poop). The dogs sniff out the guano. When they find the guano they sit by the tree and are rewarded with a short game of fetch.

### Glossary

**metamorphosis** (met uh môr fuh sis):

The process of changing in form, for some animals, from an immature stage to an adult stage.

**migratory** (mī gruh tôr ē):

Having a characteristic of moving from one place to another on a periodic basis.

**regulation** (reg ū **l**a shun):

Bringing under control of law or some authority.

**flood plain** (fluhd pl**an**):

Flat land area next to a stream or river.

**headwaters** (hed wa **t**ürs):

The upper streams that contribute water to another source of water such as a river.

**semi-arid** (sem **i** air id):

An area that receives very little rainfall.

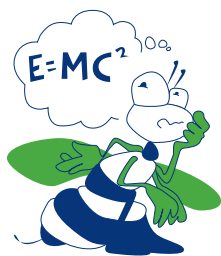
### Pronunciation Guide

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

Accented syllables  
are in bold.





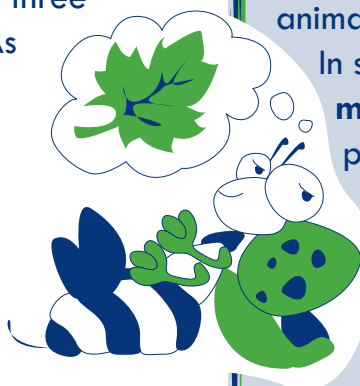


## Thinking About Science

Taking measurements is a common practice in everyday life. Most scientific experiments involve units of measurement. Units of measurement are things like inches or centimeters, miles or kilometers per hour, ounces or grams, or frequency. A scientist may want to know, for example, how many times a Screech owl visits a particular Red Oak tree during the summer. In that case, the unit of measurement is frequency. Think of three things you have measured today. As you read the “Introduction” section of the article, make a guess as to what the scientist will measure in the research. Identify what unit of measurement was used.

## Thinking About the Environment

Think about what it takes for you to survive everyday. Aside from food and water, humans need clothing and shelter. If adults are raising a family, they must provide for their families as well. Animals must also have certain things to survive. They need a place to live, things to eat, and a place to reproduce. The environment in which a species lives is called its habitat. In the study you are about to read, scientists wanted to learn about the best habitat for toads to reproduce. While reading the article, identify how humans impact the habitat of toads. Remember that humans have both positive and negative effects on an animal's habitat.



## Floods – Friend or Foe?

When you hear about flooding in the news, it seems as if flooding is not a good thing. Floods, however, can be beneficial to many types of animals and plants. Rivers carry sediment and nutrients in their waters. When flooding occurs, the sediment and nutrients are deposited on the land next to the river. The flooding helps to enrich the soil. The nutrient-rich soil is a good thing for the plants that live there. If plants benefit from flooding, the animals that live there will benefit also.

In some places, flooding is a signal for **migratory** fish to migrate. Flooding provides a way for separate bodies of water to connect for a while, which provides an opportunity for native animals and plants to move to new environments.

Flooding is also a natural way of helping some plant and animal species reproduce and survive. For example, frogs and toads are tadpoles before they develop into adult frogs and toads. To develop into adults, tadpoles require water. In fact, frogs and toads must also have water to lay their eggs. In this study, the scientists were interested in how flooding might provide a place for toads to reproduce in a dry region of the Southwestern United States. As you can see, flooding can be beneficial to plants and animals that live along a river's banks.



# Introduction

Most rivers in the United States are now regulated. A regulated river is one whose flow is controlled by dams. For people, the **regulation** of rivers provides protection from flooding, as well as reliable sources of water for drinking and cooking, farming, and industry. The regulation of rivers, however, alters the relationship between rivers and their **floodplains**. When a floodplain floods, the water provides a needed habitat for some animal and plant species. Floodplains may also flood after rains occur downstream from the dam. When dams are built in river systems, however, wet floodplain habitats are less available.

The scientists in this study were interested in studying how toads reproduce in the floodplains along the Rio Grande. The Rio Grande is a river that flows from its **headwaters** in southern Colorado for 1,865 miles to the Gulf of Mexico near Brownsville, Texas (**figures 1 and 2**). The Rio Grande is regulated by four dams that control the river's flow (**figure 3**). The scientists studied a section of the Rio Grande in a **semi-arid** area in New Mexico that could occasionally flood. The question the scientists wanted to answer was this: How does flooding affect the reproduction of toads in the forests, or the bosque, along the Rio Grande?

Figure 3. One of the dams on the Rio Grande. The lake created by the dam is on the right. The Rio Grande is on the left.

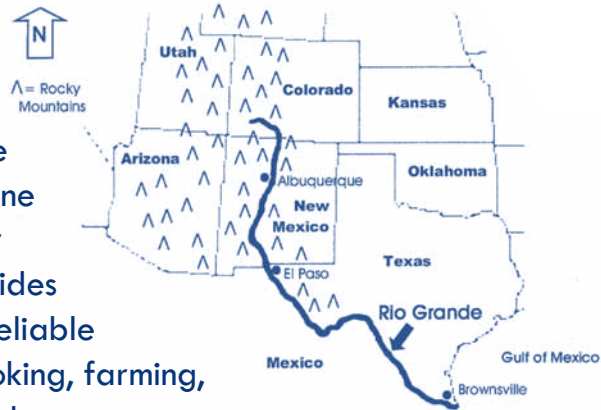


Figure 1. The Rio Grande from southern Colorado to the Gulf of Mexico. The Rio Grande is the border between the State of Texas and country of Mexico.



Figure 2. The Rio Grande. The United States is on the right and the country of Mexico is on the left. In some areas, the Rio Grande still occasionally floods. Notice the strip of green vegetation along the river banks. This is the Rio Grande's forested floodplain. Along the Rio Grande, the forested floodplain is called the bosque (bosk or bos-key).





## Reflection section

- What was the question the scientists wanted to answer?
- How do you think flooding affects the reproduction of toads?

## Method

The scientists collected data from June through September 2000 to 2006. They monitored 12 sites in the bosque along 140 km of the Rio Grande in New Mexico (see **figure 1**). The scientists used pitfall traps (**figure 4**) and drift fences (**figure 5**) to capture toads at each site. They counted and weighed the toads and then released them.

The scientists also measured other things at each of the 12 sites. They recorded the amount of rainfall over the 7 years. They measured the amount of water flow in the Rio Grande. They also measured the level of the groundwater in the bosque.

Figure 4. Pitfall trap

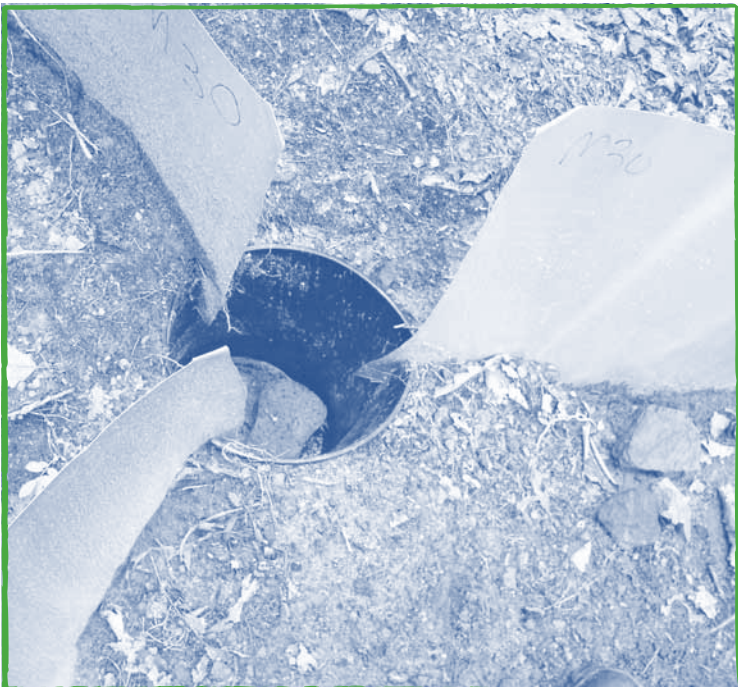


Figure 5. Drift Fence

## Number Crunches

How many miles is 140 km? (km is an abbreviation for kilometers) To find out Multiply 140 km by .621.

## Reflection section

- Why did the scientists also measure the amount of rainfall and the amount of water flow at each of the sites?
- Why do you think the scientists conducted their experiment from June through September of each year?



# Findings

The scientists found that rainfall varied over the 7 years. In some years there was little rainfall, while in others there was a lot of rainfall. For most of the years, the scientists did not capture many toads. In 2005, however, two of the sites flooded. At those sites, the scientists captured many more toads (**figure 6**). Most of the toads captured in 2005 were small (compare **figures 7** and **8**). This told the scientists that there were many young toads at the two flooded sites.

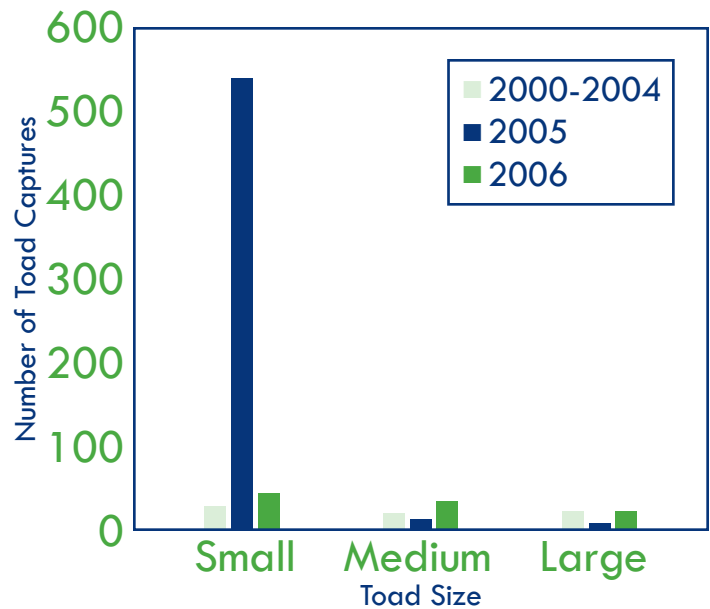


Figure 6. The average number of toads captured each month at all sites over 7 years.



Figure 7. Small Woodhouse's toad



Figure 8. Adult Woodhouse's toad

## Reflection Section

- Look at figure 6. Do you think flooding affected the reproduction of toads? Why or why not?
- What other living things do you think might be affected by flooding? Why?



# Toad-ally Awesome Word Search

- Do you think it would be a good idea to purposely flood the bosque periodically? Why or why not?
- Would people benefit from flooding that would enable the toads to reproduce? Why or why not?

U R D L  
O Y H G M Q Q J  
H G H E A D W A T E R S Q P  
K F L O X W C F C Q T J D R C  
Z U J P L N R E G U L A T I O N  
H Y R Y R O T A R G I M F R I I  
O X Q C T P H G I K R O E A L  
M O G S J U Z V W K A R L - N  
G U I D Y L N F A P M I  
Z J A B E T Y F D H G M V  
G R D G P D G V O J O L E D C  
E D B E C W M O O G S D S O Z  
U I J B T D L M O I F A Q D  
H Q P Z F T S O R P  
P R J F A Y

1. Flat land area next to a stream or river.
2. The upper streams that contribute water to another source of water such as a river.
3. The process of changing in form, for some animals, from an immature stage to an adult stage.
4. Having a characteristic of moving from one place to another on a periodic basis.
5. Bringing under control of law or some authority.
6. An area that receives very little rainfall.





# FACTivity

Teachers may use the lesson plan at the back of this journal to guide student reading of the article.

**Time Needed:** Two class periods.

**Materials Needed:**

- “Toad-ally Awesome” article
- “Swimming Upstream Without a Ladder” article (You may download and print this article or order it from the *Natural Inquirer* Web site <http://www.naturalinquirer.org/Dams-and-Pipes-and-River-Shrimp-Movementsa-11.html>)
- Paper
- Pencils

You learned in this article that flooding can provide a service to the toads living along the Rio Grande in New Mexico. When flooding occurs in the spring, wet areas are created that provide places for toads to reproduce. In this FACTivity, you will answer these two questions:

- 1. What are the similarities of and differences between flooding in the bosque and the flow of mountain streams in Puerto Rico?**
- 2. How do the ecosystem services provided by these two waterways compare?**

The method you will use to answer these questions is:

Following the reading of the article: Make sure that everyone in your class has read and understands the “Toad-ally Awesome” article. In a rapid-fire exercise with the entire class, make a list of as many ecosystem services (or benefits) provided by the bosque as you can. Try to use your imagination to come up with benefits that may not have been discussed in the article. Put this list on the wall where it can be used during the next class period.

Next class period: Following the same procedure used to read “Toad-ally Awesome,” read “Swimming Upstream Without a Ladder.” Organize into groups of 3 to 4 students. Each group of students will compare and contrast the two articles.

Use the list of benefits identified earlier. Record similarities and differences using the chart on the next page.

Each group should share their findings with the class. Hold a discussion about the ecosystem services or benefits provided by waterways. Brainstorm other ecosystem services provided by waterways. Students should put their names on their charts and turn them in to the teacher. The teacher can use these charts as an assessment tool.

Extension: Research waterways in your area and identify how those waterways benefit the plants and animals that live near them.

	Describe (One sentence for each waterway)	Similarities	Differences
The Waterway			
The Land			
The Animal Being Studied			
The Climate			
The Dams			
Benefits Provided by the Waterway			



If you are a Project Learning Tree-trained educator, you may use PLT Activity #94, "By the Rivers of Babylon," PLT Activity #9, "Planet Diversity," and PLT Activity #29, "Rain Reasons" as additional resources.

**Additional Web Resources:**

USGS's Woodhouse's Toad Page

<http://www.npwrc.usgs.gov/resource/herps/amphibid/species/bwood.htm>

National Park Service's Rio Grande Web Page

<http://www.nps.gov/rigr/>

