

A black and white photograph of a rattlesnake coiled around a log in a grassy field. The snake's head is raised, and its body is tightly wound around the log. The background is a field of tall grass.

Snake, Rattle, and Roll:

Photo courtesy of Forest Service, North Central Research Station Archive, <http://Bugwood.org>.

Investigating the Snakes That Live in the Bosque Along the Middle Rio Grande

Meet the Scientists



◀ Dr. Heather Bateman, Ecologist, Wildlife Biologist, **Herpetologist, Ornithologist**: My favorite science experience has always been

working with wildlife. I have enjoyed banding long-eared owls in the Great Basin in Utah and enjoyed capturing lava lizards on the Galapagos (gə-'lä-pə-gəs) Islands of Ecuador. I enjoy watching wildlife, especially on the rare occasions where you see them before they know you are there. For example, this summer I saw a bobcat kitten with its mother near a stream in Nevada.

Dr. Deborah Finch, Research Wildlife Biologist: My favorite science experience was collecting bird and small mammal data on the Wallowa-Whitman National Forest in Oregon and Idaho. While I was there I lived in a trailer in the middle of a **wilderness**, surrounded by beautiful landscapes, and woke up each morning to singing by songbirds. ▶



▶ Dr. Alice Chung-MacCoubrey, Research Wildlife Biologist: My favorite science

experience was exploring the use of dogs to locate tree-roosting bats. In 2006, I conducted field tests to determine whether dogs could sniff out ground-dwelling or tree-roosting bats in **pinyon-juniper woodlands**. Dogs have a keen sense of smell and can alert their handlers to specific odors.

I worked with two wildlife detection dogs to see if they could locate bat scat (guano) in and around trees. I examined how the amount, distribution, and height of the guano in the tree affected the dogs' ability to detect the guano. I loved this project

because it combined my love for dogs with my work studying bat roost behavior. The idea for this project came to me when my dog, Chelsea, who accompanied me in the field, would sniff the area of the tree where the bats were roosting.



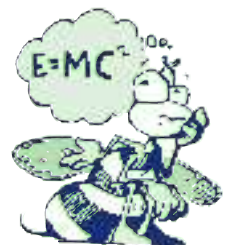
Thinking About Science

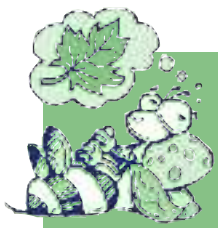
When scientists choose to conduct research on a certain topic, it is usually because the topic they want to research has not been completely studied. Scientists know this because they read to keep up with current research and information about the topic they are interested in studying.

Because science often focuses on solving problems or answering questions, a research topic can be thought of as a puzzle. Think of the last

time you completed a puzzle. There are many pieces to a puzzle to begin with. When you put all the pieces together you are able to see the whole picture.

When scientists notice a piece of a research puzzle that is missing, they conduct a study to find out about that piece. When they find new information, they place it in the puzzle. The scientists in this study were interested in how snakes fit into the land **restoration** puzzle.





Thinking About the Environment

The **riparian** forest land along the Rio Grande is locally referred to as the Bosque (Spanish word for forest) (**figure 1**). Riparian habitat occurs along streams where the water meets the land. The Rio Grande is a river whose **headwaters** are in Colorado. It runs through New Mexico and forms the border between Texas and Mexico. Flooding is a natural disturbance to which the Bosque is well suited.

Another natural disturbance of many areas is fire. However, the Bosque probably did not experience many fires in the past. Its **ecosystem**, therefore, is not well suited to fire. Today, most of the fires in the Bosque are started by humans. Because the Bosque is close to human communities who live near the Rio Grande, **forest managers** take action to discourage fires. After a fire occurs, they work to restore the Bosque to its natural condition. In this way, managers take action to reduce the chance for another wildfire to get started and spread in the Bosque and into nearby human communities.

Managers take two main actions to discourage wildfires in the Bosque. One action is to remove plants that are not **native**. The other is to remove downed and dead trees from areas that have not decayed with the help of natural floods. One way to maintain the important Bosque habitat is to reduce fires, which can kill native cottonwood trees.



Figure 1. The Bosque is a riparian forested strip along the Rio Grande.

Introduction

After an area has been changed by human or natural disturbances, forest managers often engage in restoration activities. In the Bosque, fire is both a human and a natural disturbance. This is because most fires in the Bosque are started by humans. Restoration activities are things that forest managers do to the land to help an area resemble how it functioned in the past (**figure 2**).

Restoration is sort of like reconditioning an old car or historic home. Some examples of these activities are clearing out nonnative plants, getting rid of piles of downed trees and logs, and planting native plants. Clearing out piles of downed trees and logs helps to reduce the risk of wildfire because wildfires use the downed wood as fuel to keep burning.

Restoration activities have an impact on many different things like animals, plants, and soil. In this study, the scientists wanted to know how the restoration activities affected snake populations. Snakes are important to the ecosystem because they are predators of different **vertebrates** and **invertebrates**. The scientists also wanted to find out what types of snakes were in the Bosque and what type of trap was better for catching snakes.



Figure 2. Scientists clearing an area of non-native species.

Reflection Section



- What are the questions the scientists wanted to answer?
- If there were fewer snakes in the ecosystem, what do you think would happen to the populations of vertebrates and invertebrates?

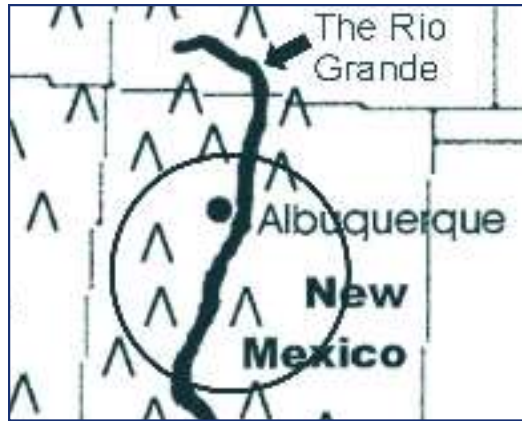


Figure 4. The location of the areas studied by the scientists.

Methods

The scientists examined the Bosque near the Middle Rio Grande in New Mexico (**figure 3**). The **climate** in this area ranges from **arid** to semiarid. The scientists monitored the snakes at 12 sites in this area from 2000 to 2006. They studied four sites in each of three different regions (**figure 4**). One site in every region was used as a **control**. In the control sites, no restoration activities were conducted. In the other sites, crews removed nonnative plants, burned piles of slash, and planted native shrubs (**figure 5**). Slash is the leftover tree and shrub parts from forest management activities such as thinning, **pruning**, and harvesting. The areas where downed wood, logs, and nonnative plants were removed were more open (**figure 6**).



Figure 5. An area filled with native plants. Photo by Arthur E. Miller, Forest Service, courtesy of <http://Bugwood.org>.



Figure 3. The Middle Rio Grande runs through New Mexico.



Figure 6. This southeastern forest is open along the forest floor.



Figure 7. A pitfall trap can be a 5-gallon bucket placed into the ground so that animals fall into it.

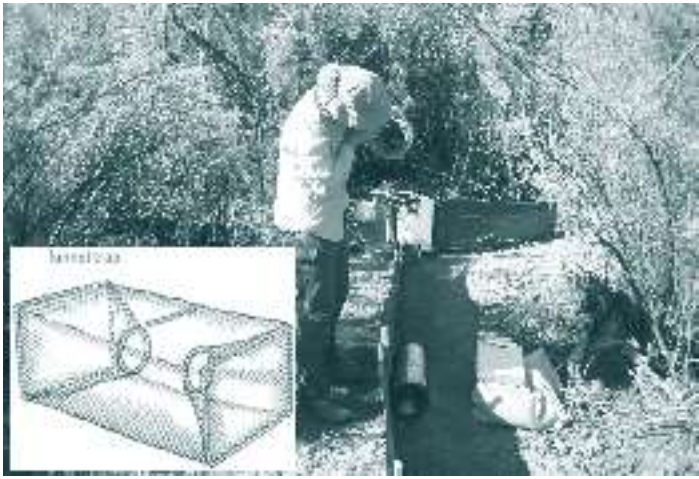


Figure 8. Dr. Heather Bateman checks a funnel trap near drift fences for snakes. Drift fences help to direct animals toward the traps.

To discover how snake populations were by affected these activities, the scientists used drift fences, pitfall traps, and funnel traps to capture the snakes (**figures 7-8**). The traps were used from June through mid-September every year. After the snakes were captured, counted, and identified, they were released back into the environment.

Reflection Section

- Look at figures 7 and 8. Which trap do you think would work best for capturing snakes? Why?
- Why do you think scientists had a control area in every region?

Findings

The scientists captured and released a total of 158 snakes from 2000 through 2006. The top five snakes caught are shown in the chart below (**figure 9**). The Common King snake was the most frequently captured snake (**figure 10**).

Snake Type	2000	2001	2002	2003	2004	2005	2006	Total
Common King snake	5	11	1	6	7	10	7	47
Gopher snake	0	4	0	9	5	10	1	29
Plains Black-headed snake	1	3	0	0	6	6	5	21
Plain hog-nosed snake	2	3	1	3	2	2	1	14
Common Garter snake	2	2	0	1	1	4	3	13

Figure 9. The total number of each type of snake captured each year.



Figure 10. The Common King snake, *Lampropeltis getula*, is often found on the ground but is an excellent climber and swimmer as well.

The scientists found that restoration activities did not have an effect on the number of snakes captured. They also found that more snakes were captured with funnel traps than with pitfall traps. More than half of all snakes captured were captured in funnel traps. Larger snakes like the Coachwhips and Gopher snakes were also captured more often in funnel traps (**figure 11**). The smallest snake species in this study, the Plains Black-headed Snake, was found most often in pitfall traps (**figure 12**).



Figure 11. Coachwhip snakes can be very long. Some of these snakes can be 8 feet in length. Photo by John (J.D.) Willson.



Figure 12. The Plains Black-headed Snake is a secretive snake, so the exact distribution of this snake is not known. However, it has been found in Kansas, Wyoming, Colorado, New Mexico, and Arizona.

Number Crunches

- How many total snakes do the top five snakes captured account for?

Reflection Section



- Look at the pictures of the funnel traps and pitfall traps (figure 7 and 8). Why do you think that funnel traps captured more snakes?
- Do you think it is important for the scientists to use pitfall traps? Why or why not?

Discussion

This study examined the effect of restoration activities on snake populations. Scientists found that restoration activities did not affect how many snakes were captured. However, the snakes captured did change depending on the time period and region in the Middle Rio Grande. Some summers were drier summers, which may have had an effect on the number of snakes captured.

The scientists noted that their results need to be **interpreted** carefully because the overall number of snakes captured was low. The **native** habitat may not have been fully restored yet, and the weather could have affected the number of snakes captured.

The scientists also found that funnel traps were more effective than pitfall traps in capturing snakes. Additionally, they found that funnel traps were better able to capture larger snakes. Therefore, populations of large snakes could be underestimated if scientists use only pitfall traps. The scientists recommended using both types of traps with drift fencing in future studies.

Reflection Section



Based on the scientists' findings, do you think this study should be done again at a later date? Why or why not?

Based on the results of this study, do you think that restoration activity to reduce the chance of wildfire in the Bosque is a good thing for snakes? Why or why not?

Glossary



Arid ('er-əd): An area that is extremely dry with little rainfall.

Bosque ('bäsk): Wooded areas near water or wetland areas.

Climate ('kli-mət): The average condition of the weather over large areas, over a long time, or both.

Conserve (kən-'sərv): To avoid wasteful or destructive use of something.

Control (kən-'trōl): A control is something used for comparison when checking the results of an experiment.

Ecosystem (ē-kō-sis-təm): Community of plant and animal species interacting with one another and with the nonliving environment.

Forest manager ('fōr-əst 'ma-ni-jər): Skilled individual who takes care of natural resources.

Headwaters ('hed-'wō-tərs): The source of a stream or river.

Herpetologist (hər-pə-'tä-lə-jist): A person who studies reptiles and amphibians.

Interpret (in-'tər-prət): To help explain something.

Invertebrate ((,)in-'vər-tə-brət): An animal lacking a backbone.

Native ('nā-tiv): Naturally occurring in an area.

Ornithologist (ōr-nə-'thä-lə-jist): A person who studies birds.

Pinyon-juniper woodland ('pin-'yōn 'jū-nə-pər 'wud-lənd): An area higher in elevation than the Bosque where pinyon pine trees and juniper flourish. Pinyon pine and juniper are well adapted to drought conditions and cold. For more information visit <http://cpluhna.nau.edu/Biota/pinyon-juniper.htm>.

Prune ('prün): To cut away or cut back parts of a plant to promote growth or better shape.

Restoration (res-tə-'rā-shən): Bringing back to a former condition.

Riparian (rə-'per-ē-ən): Areas along streams and rivers.

Vertebrate ('vər-tə-brət): An animal with a backbone. Examples include mammals, birds, reptiles, and fish.

Wilderness ('wil-dər-nəs): Area designated by Congress to be preserved in a wild and natural condition as part of the National Wilderness Preservation System.

Accented syllables are in **bold**. Marks taken from Merriam-Webster Pronunciation Guide.

This article is adapted from Bateman, H.; Chung-MacCoubrey, A.; Snell, H.; and Finch, D. (2009). Abundance and species richness of snakes along the Middle Rio Grande riparian forest in New Mexico. *Herpetological Conservation and Biology*. 4(1): 1–8.

Time needed:

Three class periods

Materials needed:

16-ounce plastic cups, landscape fabric (or some type of thin material that can be used to make the drift fence)

The question you will answer in this FACTivity is: What types of insects live on the grounds of our school?

Procedure:

You will do an experiment similar to what the scientists did in this article, except you will be studying insects on the ground instead of snakes. First, your teacher will break your class into small groups of three or four students. Each group will take a section of the schoolyard to monitor for ground-level insects. Once students have divided up the schoolyard into sections for each group, the groups will make two pitfall traps and two drift fences.

To make the pitfall traps, use two 16-ounce cups. Dig a hole and place each cup into the hole so that the lip of the cup is level with the ground. After the two cups are in the ground, use the material to make a drift fence toward the cup. Each drift fence should be 2 feet long and 1 foot high. Check the traps several times a day and

record the number of insects in the trap and what kind of insect it is or a general description of the insect. NOTE: Make sure that no one hurts the insects or touches them. Use eyes only to observe the insects. After recording, empty the cup of insects in another part of the schoolyard.

Following a day's worth of observation, compare results with the class and discuss. Some questions to help guide the discussion are:

1. What types of insects did you see the most? Was this surprising? Why or why not?
2. What is the problem with this type of trap and obtaining information about insects?
3. Was it easy or hard to make the traps and then monitor them? What challenges did you have?
4. If you were to make this experiment better, what kind of experiment would you design to find out what insects live on the grounds of your school?



Teachers: If you are a PLT-trained educator, you may use Activity #81, "Living With Fire," and #22, "Trees As Habitats," as additional resources.

Additional Web Resources

Joint Fire Sciences Program: Fuels Reduction and Restoration in the Bosque of the Middle Rio Grande
http://www.firescience.gov/projects/01-1-3-19/supdocs/01-1-3-19_01-1-3-19_FSbrief7.pdf

Fire in the Bosque

http://www.nmnaturalhistory.org/BEG/ActivityPages/Ch6_FireintheBosque.pdf

Bosque Restoration Projects (U.S. Army Corps of Engineers)

<http://www.bosquerevive.com/index.htm>

Middle Rio Grande Bosque Initiative

<http://www.fws.gov/southwest/mrgbi/index.html>

Middle Rio Grande Endangered Species Collaborative Program

<http://www.middleriogrande.com>

Common Kingsnake Information

http://animaldiversity.ummz.umich.edu/site/accounts/information/Lampropeltis_getula.html

University of Nebraska Coachwhip Snake page

<http://snr.unl.edu/herpneb/snake/Coachwhip.html>

Gopher snake information

<http://imnh.isu.edu/digitalatlas/bio/reptile/serp/pica/picafram.htm>

National Science Education Standards addressed in this article:

Science as Inquiry:

- Abilities To Do Scientific Inquiry;
- Understandings About Scientific Inquiry

Life Science:

- Populations and Ecosystems

Science in Personal and

Social Perspectives:

- Populations, Resources, and Environments;
- Natural Hazards;
- Risks and Benefits

History and Nature of Science:

- Science as a Human Endeavor;
- Nature of Science