Learning Guide

Community Science

We hope you enjoyed listening to our interview with Zoe Wadkins-Daniels and Annie Montes from the Bosque Ecosystem Monitoring Program (BEMP)! Extend your learning with this print-ready Learning Guide!

What's in this Learning Guide?

Get Set to Listen: Check your knowledge before and after listening to the episode by determining if statements are TRUE or FALSE.

What is Community Science?

Data Analysis: The Water Under Our Feet:
NGSS: 2-ESS2-3; 5-ESS2-2; MS-ESS2-4; MS-ESS3-3; MS-LS2-1; MS-LS2-4 & HS-ESS3-1

Data Analysis: Cottonwood Litter Fall
NGSS: 2-ESS2-3; 5-ESS2-2; MS-ESS2-4; MS-ESS3-3; MS-LS2-1; MS-LS2-4 & HS-ESS3-1

Square Foot Science Observation
NGSS: 5-LS2-1; LS2.A; SL.5.5; MP.2, MP.4; MS-LS2;

Botany Count
NGSS: 5-LS2-1; LS2.A; SL.5.5; MP.2, MP.4; MS-LS2;

Telling Stories: Ways of Knowing
CCSS.ELA-Literacy.W.3.8; CCSS.ELA-Literacy.W.6.3; CCSS.ELA-Literacy.SL.4.4

Observe with Your Senses
NMPED SEL: Intentional Development of Skills, Mindsets, and Habits

Vocabulary

Discussion Questions and Strategies

Additional Resources and Book List

The Children's Hour
kids public radio

https://www.childrenshour.org/community-science/

Get set to listen.

1. Before listening!

Read each statement and write TRUE or FALSE based on what you already know.

2. After listening!

Based on what the experts said in the episode, write TRUE or FALSE.

Before Listening	TRUE or FALSE?	After Listening
	1. **Bosque** is a forest that grows along a river.	
	2. Data that can be collected by students include **precipitation, groundwater, litter fall**, and **arthropods**.	
	3. **Precipitation** is rainfall, snow, and sleet.	
	4. **Litter fall** is the amount of human-made trash found in nature.	
	5**. Arthropods** are bees, snails, and earthworms.	
	6. The number of plant species and the density of plants along the Rio Grande is pretty much the same in all the sites being monitored.	
	7. Data collected by BEMP is shared with projects on water policy, climate change analysis, and the health of the native cottonwood trees.	
	8. Anyone can collect **data** like a scientist.	

What did you learn?

_____

_____

_____

Get set to listen.

Answer key

1. TRUE
2. TRUE
3. TRUE
4. FALSE: Litter fall is the amount of fallen leaves and other plant material
5. FALSE: Arthropods are invertibrates, such as spiders, scorpions, ants, and other insects.
6. FALSE: There is a lot of variation in plant type and density along the Rio Grande.
7. TRUE
8. TRUE

What Is Community Science?

Community Science is when a group of people in a community uses science and technology to answer important questions that affect them. The goal is to find solutions that can help improve their community and the environment around them. These solutions might include ideas, plans, or rules that local organizations or governments can use to make things better.

A **community** is a group of people who are connected by something they have in common, like where they live, their culture, or shared interests and goals.

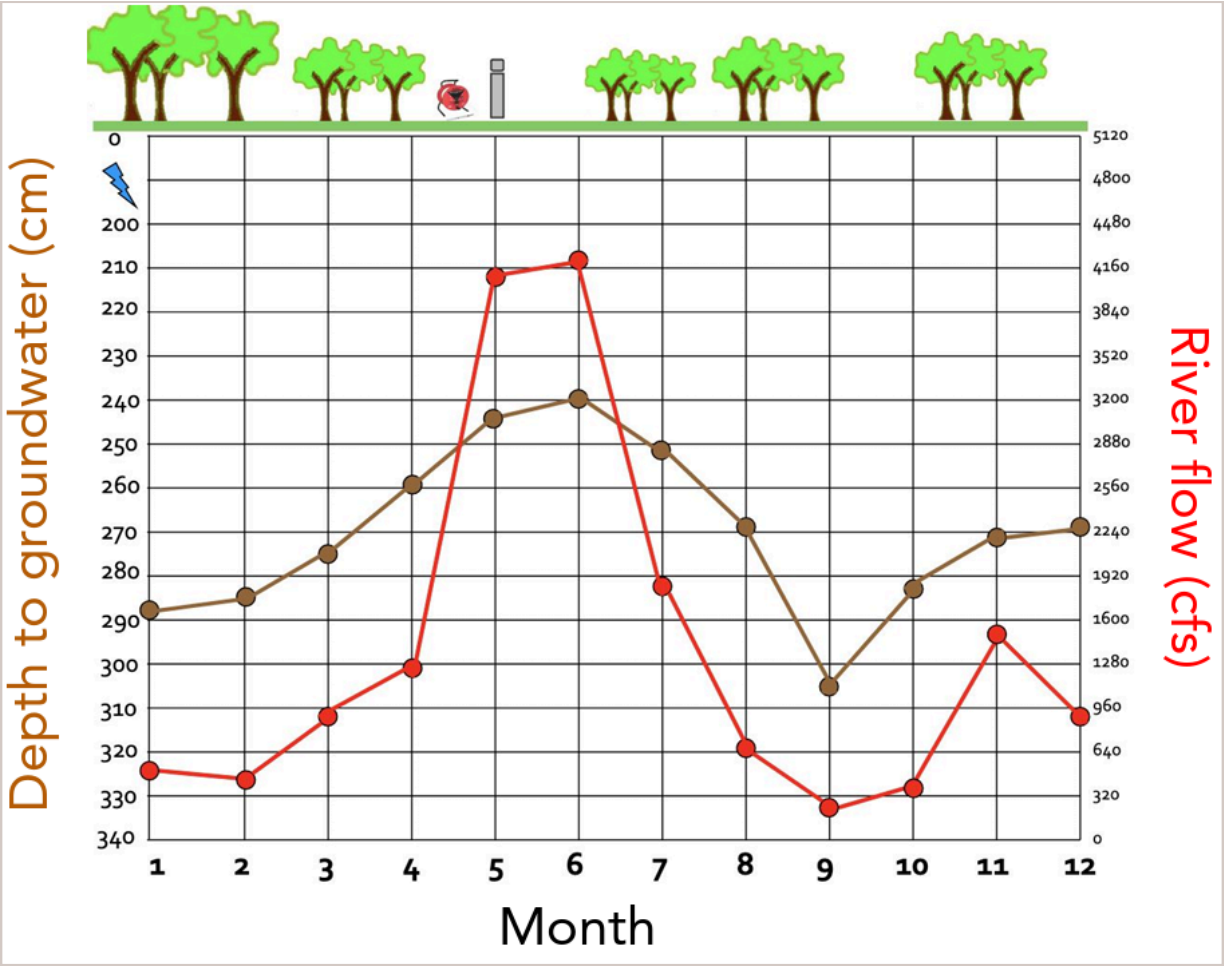
In **Community Science**, science includes everything from studying nature to using technology and math. People in the community get involved by collecting **data**, taking notes, and observing things around them. When they analyze this information, it can help answer questions and bring about positive changes in their community.

Sometimes, this is called **Citizen Science**.

image credit: Climate Resilience Project

Data Analysis: The Water Under Our Feet

The line graph below represents the river flow (cfs - cubic feet per second) and the groundwater levels (centimeters) collected at one of our BEMP sites, Lemitar, during the year 2018.



Based on the data collected, answer the following questions. Remember water can move freely between surface and groundwater carrying minerals, pollutants, and other materials.

1. Do you see any patterns (increase/decrease) in the groundwater levels or river flow data over the months? Specify which specific months you see these patterns and why you think this might be. *Hint: When do we get the most rain in New Mexico?*

_____

_____

_____

Use the data collected and shown on line graph on the first page to answer the following questions:

2. How are these two datasets (depth to groundwater and river flow) connected?

_____

_____

2. Is there any month where the cottonwoods in the bosque didn't have enough water for that year? *Note: Remember that cottonwood roots can only reach as far down as 10 feet or 300 centimeters.* _____

3. If pollutants that a storm event has washed away get into the river, what impact (if any) do you think this will have on groundwater quality? _____

_____

4. What would happen to groundwater levels if a large amount of water were removed from the river for human use (drinking, showering, etc.)? Would it be able to refill? Think of a solution to this problem. _____

_____

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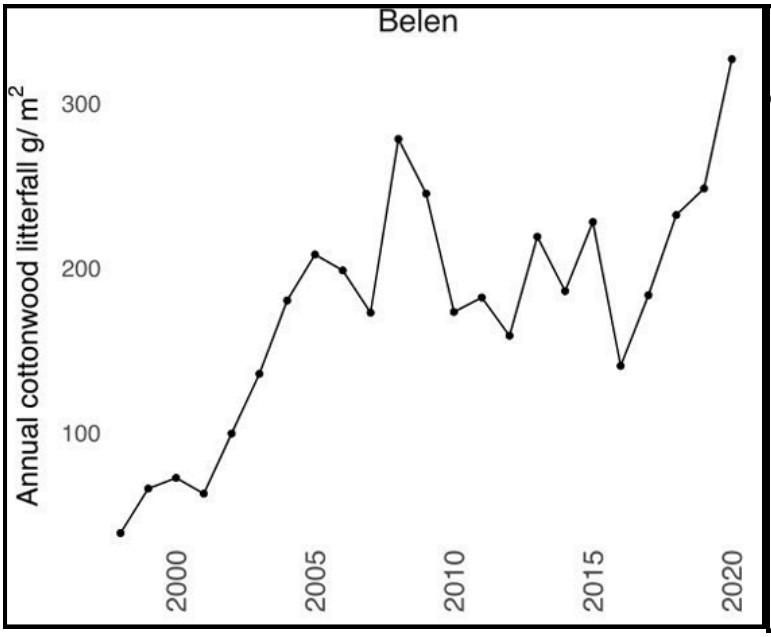
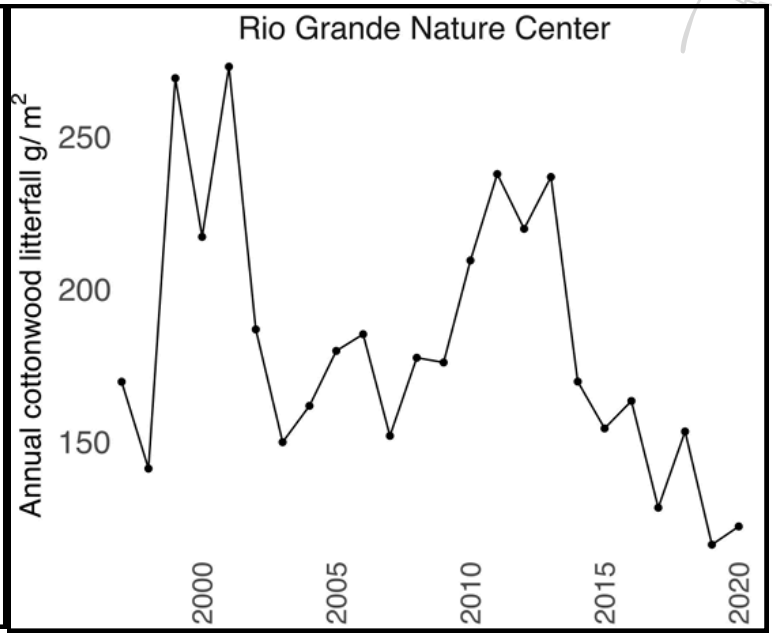
Activity adapted from BEMP's learning module "The Water Under Our Feet" Full learning module available for download from *The Children's Hour* "Community Science Learning Guide" webpage or BEMP's website.

Note: Check out BEMP's Dabbling in Data lesson if you want to learn more about groundwater and river water. https://bemp.org/education-outreach/education-resources/monthly-monitoring/

Data Analysis: Cottonwood Litter Fall

The two graphs below represent the annual cottonwood litterfall trends for the years 2000-2020 in two of BEMP's 33 sites: Belen (South; closer to river) and the Rio Grande Nature Center (North; further from river).





Use the line graphs above to answer the following questions:

1. What is the general trend for each of these graphs? Does litterfall increase or decrease over the years? Why do you think this might be? _____

_____

_____

2. What impact does the location (closer or further from the river) or the orientation (north, south) of the site have on the data collected? _____

_____

_____

Activity adapted from BEMP's learning module "Ways of Knowing" Full learning module available for download from *The Children's Hour* "Community Science Learning Guide" webpage or BEMP's website.

Square Foot Science Observation

Go outside! Mark off a square foot sample area.
Identify and count *everything* you observe there.

What is it?	Draw it	Amount (tally mark for each one you saw)

What did you find? **Graph** your results.
Compare your results to another sample area a mile away, 10 miles away, 100 miles away! How do your results vary in different settings (urban park vs. Bosque vs. Sandia foothills)? Try going back to the same spot every month for a year. What changes do you expect to find?
Compare the number of different species as well as total number of specimens in each species. Why do you think there was greater/less variety in one sample area than another? Why do you think there were more/fewer bugs/plants/etc. in one sample area compared to another? What does this tell you about the different sample areas?

Botany Count

Go outside!

Use the **Bosque-Whitfield Plant Identification Guide** from the **Sandia Mountain Natural History Center** to identify and count how many of each species of plant you find in your sample area.

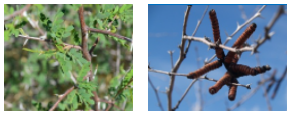
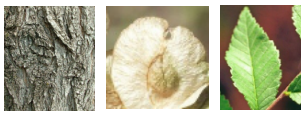
Native Flowers, Trees, & Shrubs		
What it looks like	**Name**	**How many?**
	Prairie Bundleflower	
	Salt Grass	
	Silverleaf Nightshade	
	Yerba Mansa	
	Willow	
	Sunflower	
	Rio Grande Cottonwood	
	Tornilla Mesquite (or Screw Bean Mesquite)	

Photo and plant list credits: Sandia Mountain Natural History Center Bosque-Whitfield Plant Identification Guide : www.nmnaturalhistory.org/smnhc

Invasive Plants		
What it looks like	**Name**	**How many?**
	Russian Olive	
	Siberian Elm	
	English Plantain	
	Salt Cedar	

Analyze your data:

Look at the data you collected and use it to answer the following questions. Discuss your findings with your fellow community scientists. Did they get similar results?

Which plant did you see the most of? _____

Did you see more invasive plants or native plants? _____

What does that tell you about the sample area where you observed? What effect do you think it has on the plants and animals that live in that area?_____

_____

_____

_____

What changes do you think you would observe if you were to come back to the same place every month for a year? _____

_____

Photo and plant list credits: Sandia Mountain Natural History Center Bosque-Whitfield Plant Identification Guide : www.nmnaturalhistory.org/smnhc

Telling Stories: Ways of Knowing

In the *BEMP Ways of Knowing* guide, it talks about the different ways we learn about the world around us. One way is by collecting data, like measuring and writing down what we see in nature. Another important way is by sharing stories. People in a community can pass down what they know about the land, animals, and seasons by telling stories to younger generations. This helps us understand our environment in a special and meaningful way.

Discuss

How do we learn about our environment?

Interview

Ask your community members to share stories about the environment. Write them down and share with others.

Write

Write your own story or poem about your environment.

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Activity adapted from BEMP's learning module "Ways of Knowing" Full learning module available for download from *The Children's Hour* "Community Science Learning Guide" webpage or BEMP's website.

Telling Stories: Ways of Knowing

Read the following story to get some ideas:

The Star in the Cottonwood Tree

A long time ago… up in the sky, were many stars. Amongst them was this little star, who was very interested and curious. One day this little star came down to earth. It traveled all around the earth looking at… everything that was alive. One day it came near this village. There was a sound coming from this village that was so beautiful and so wonderful. It had never heard anything so beautiful in all the heavens and all the places it had visited around the earth. So, it stayed close to this village. It listened, and listened, and couldn't get enough of hearing that beautiful sound. One day it got to thinking, "I am a star, and I am supposed to be up in the sky with the other stars. I had better go back." So it went back up into the sky with the other stars. But it began to think about the beautiful sound it had heard coming from that village, and thought "I would like to go back and hear it some more." Then the little star began to feel very lonesome and sad. So… the little star asked them if it could go back and live near that village. The stars said "No. You are a star and you belong up here in the sky." It tried to be involved in all the things that stars do, such as shining up in the sky, and moving here and there. But it got so lonely it went back to the other stars again and said, "I am so lonesome and I feel so bad. I want go and stay near that village forever to hear that sound." The other stars said, "You cannot do that because those are people. They have things that they must do to stay alive. They have work to do… And if you move close to them, shining around, they will all be looking at you. You will disturb their lives. And they will not get along." So, the little star thought and thought. And finally, it asked the other stars, "If I can find a way to be close to that village without them seeing me, can I stay there?" And the other stars said "Yes". So, the little star went close to that village and looked around and saw a cottonwood tree growing close to the village. The star said, "I will stay inside that tree, where I can hear that beautiful sound that comes from that village." That sound was the sound of the people…laughing, and saying good words to each other. Today the star is still in that cottonwood tree, hoping hear those beautiful sounds. *

**Shortened by BEMP and transcribed with minor clarifications from the audio story, "The Star in the Cottonwood Tree," as presented in the CD, "My Relatives Say" featuring Mary Louise Defender Wilson

Activity adapted from BEMP's learning module "Ways of Knowing" Full learning module available for download from *The Children's Hour* "Community Science Learning Guide" webpage or BEMP's website.

Observe with Your Senses

Play the song "We Know the Air is There"
by Cathy Fink & Marcy Marxer

How do we know what is around us? We use our senses!

Spend 1 minute observing the world around you using one of your five senses at a time. For each of the senses other than sight, close your eyes to allow you to more easily focus.

Sight: Notice the colors, light, and shapes that you see

Hearing: Can you identify all the different sounds you hear? Do you notice some sooner than others?

Touch: Pay attention to the feel of the air on your skin, the temperature, your clothing, and the pressure of the chair you're sitting in.

Smell: Take a deep breath and inhale the smells around you. Observe the thoughts, emotions, and feelings that surface. Do the smells bring back any particular memories? This can be done either with whatever smells are around you or with specific, intentional fragrances.

Taste: Eat something and really pay attention to flavors. Do they change as you chew?

Vocabulary

BEMP:	Bosque Ecosystem Monitoring Project
ecosystem:	all the living and non-living things that are in one place together
litter fall:	pieces of plants that fall to the ground
community science (sometimes called **citizen science**):	when people come together without necessarily being experts themselves to help gather information that contributes to the field of scientific research
arthropods:	animals without a backbone that have a hard outer shell (exoskeleton) and jointed legs. They are the most diverse group of animals on Earth and include insects, spiders, crabs, and centipedes. Think of them as animals with "hard bodies" and "jointed feet".
data:	collected information, like facts, numbers, or descriptions, that can be sorted and used to understand things. Think of it as information we can use to learn about the world around us.
precipitation:	any weather that falls out of the sky, such as rain, snow, and sleet
Bosque:	the forest area around a river in the high desert of the Southwest
monitoring:	watching something for changes over time

Discussion Questions

1. How does a person start “doing science”?

2. What are some of the benefits of science we live with daily?

3. What does it mean to be a scientist?

4. How can you tell if something is science or not science?

5. Do scientific facts ever change?

6. What do you think about everyday people participating in science?

7. What could be a challenge or problem with having the public contribute to scientific research?

8. How do you think it might feel to participate in a global scientific endeavor?

9. What research would you do if you could?

Group Discussion Strategies

Think Pair Share:
1. Individually, student writes down their answer to a question.
2. Students pair up and tell each other their answers.
3. Teacher calls for volunteers to share with the whole class their answer (and/or their partner’s answer). Teacher notes key words/phrases on board.

Round Robin:
1. Teacher poses one question (written on top of a large page) to students, who are assembled into small groups of 3 or 4.
2. Students take turns brainstorming the answers. The recorder of the group writes down all answers.
3. The leader reads the group’s ideas to the entire class. Teacher moderates.

Additional Resources

Incredible Journey (by Project WET): Play a water game where you become a water droplet that travels through the water cycle

Bosque-Whitfield Plant Identification Guide:

BEMP Learning Modules: Find many activities for the Bosque ecosystem, including a guide on how to Build Your Own Monitoring Site

Women in STEM coloring pages:

Science Journals for Kids and Teens:
Find hundreds of scientific journals written for kids and approved by scientists. Searchable by reading level, including comprehension questions, answer keys, and NGSS-aligned lesson plans.

More Citizen Science Projects

National Geographic citizen science projects

The Great Sunflower Project: Help collect data on pollinators in your yard, school, or neighborhood park by counting and types of pollinators visiting plants (especially sunflowers!)

Citizen Science at NOAA: Check out these crowdsourcing opportunities to contribute to research and outreach.

Citizen Science at NASA:

The Cornell Lab of Ornithology: Help with a variety of community science bird projects

Nature's Notebook: Discover and document changes in nature near you!

The National Park Service offers many opportunities to get involved in Citizen Science:

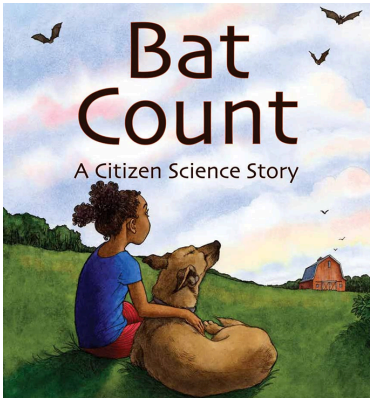
20 Citizen Science projects:

SciStarter: Find a Community Science project

Videos

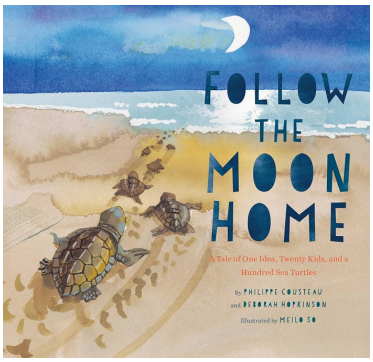
This video describes what BEMP does

This video gives an overview of citizen science



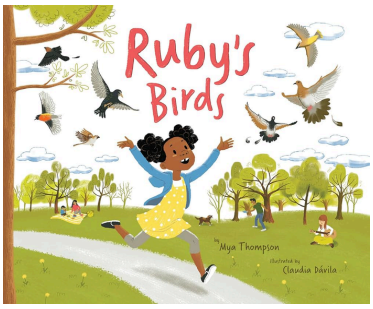
Bat Count: A Citizen Science Story by Anna Forrester

Jojo and her family count bats for a citizen science project, showing how the importance of community involvement in scientific research and wildlife conservation.



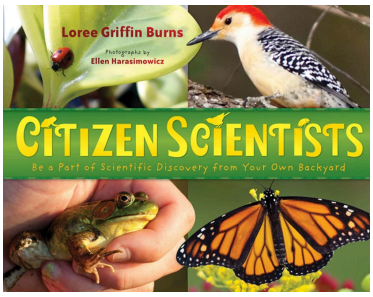
Follow the Moon Home: A Tale of One Idea, Twenty Kids, and A Hundred Sea Turtles by Phillipe Cousteau

Viv and her classmates work together to protect baby sea turtles, showing how one idea and teamwork can spark real environmental change.



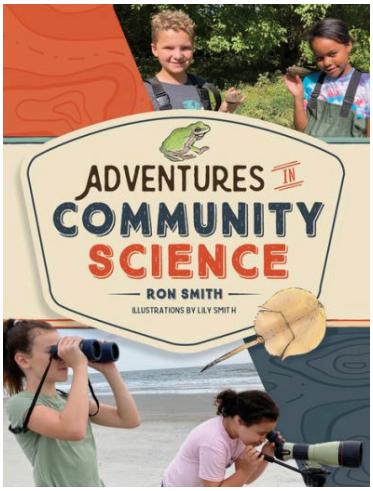
Ruby's Birds by Mya Thompson

A spirited young girl named Ruby discovers the joy of birdwatching and quietly observing nature with her neighbor and inspires her family to join in the adventure.



Citizen Scientists: Be a Part of Scientific Discovery from Your Own Backyard by Loree Griffin Burns

Kids learn how they can help real science by observing nature through fun, seasonal projects like tracking butterflies and counting birds.



Adventures in Community Science: Notes from the Field and a How-To Guide for Saving Species and Protecting Biodiversity by Ron Smith

Learn about real-life projects and simple steps kids can take to help protect wildlife and biodiversity in their own communities.