3. Naturalist Notebooks

Description: Students learn how to keep notes on their observations and activities in the bosque, and to collect different types of data.

Objective: Students will further develop essential observation and recording skills required of naturalists, scientists, or other nature appreciators.

Materials:

- Naturalist Notebook activity pages
- Pencils
- Nature journal, or hard surface for writing, such as cardboard, notebook, or a clipboard
- Thermometer
- Compass
- Tape measure
- Stop watches or phones with stopwatches (4)
- Field guides for reference back in the classroom

Phenomena: The speed of the river varies; some cottonwood trees are huge and others small; different birds live along the water compared to in the trees.

Lesson Questions:

- *How can I measure the speed of the river? How do I measure cottonwoods? Which birds live near water? In the trees?*

3. Naturalist Notebooks

Grades: 5–12

Time: 30 minutes to one hour

Subjects: science, language arts, mathematics, visual arts

Terms: *circumference, cohort, contour map, diameter at breast height (DBH), keystone species, shape map, speed*

New Mexico STEM Ready! / Next Generation Science Standards
NGSS DCIs
Note: Possible DCI connections will vary. See **NGSS Connections to *Going Out: Field Activities*** at the end of this chapter for more possible field trip NGSS connections and for suggestions using each standard.
NGSS CCCs
Patterns
NGSS SEPs
Planning & Carrying Out Investigations; Analyzing & Interpreting Data; Using Mathematics & Computational Thinking
Common Core Connections
Mathematics
Measurement & Data
5.M.D Represent/Interpret Data
Statistics and Probability

Background:

This activity builds on skills developed using *Bosque Field Journals* and provides prompts for more extensive observations and simple data collection. Notebooks are included for three topics: the Rio Grande, the Rio Grande Cottonwood and Birds of the Bosque. All three notebooks follow the same format—introduction, site description and general observations, directed observation and data collection, and synthesis. Data collection includes verbal descriptions, one or more field sketches, and recording quantitative data. Students are encouraged to reflect on what they have observed and to ask questions for further inquiry. Back in the classroom, students perform simple data analyses, graph their results, and are encouraged to continue their learning using field guides and other resources. The notebooks are designed with four pages focused on a single topic, which may be used in their entirety for older students, or sections may be used individually for younger students. They may be glued into students' nature journals. An additional *Naturalist Notebook: Fire*, is located in Chapter 6

Procedure

- Copy notebook pages as needed.
- Data Collection **(Planning & Carrying Out Investigations; Measurement & Data)**:
  - The **Rio Grande** notebook focuses on the river, with data collected for measuring rates of river flow (speed). This can also be done in a ditch if the river is not accessible.
    Each team will need five sticks, each of similar size and big enough to be seen from shore. Find a location along the bank where you can measure out 20 feet, and put markers (or students) at 0, 5, 10, 15 and 20 feet (this can also be measured in meters, or in steps if they are consistent). Run five replications. An upstream team member tosses the stick into the river. Toss it a bit further upstream than the starting point, then the student at 0 feet yells "Start" when it passes the marked spot; a downstream team member begins timing and stops when it passes 5 feet. Repeat and record

the time to pass 10 feet, repeat for 15 feet and for 20 feet. Then do one additional run, recording the time the same stick passes each distance (at 5, 10, 15 and 20 feet). Back in the classroom, you will talk about how to determine the speed of the river, and how sample distance can affect your measurement.

- The **Rio Grande Cottonwood** notebook includes the determination of **"diameter at breast height"** (or **"DBH"**), a standard measurement used by forest ecologists and others to compare tree sizes. The circumference of a tree is measured using a soft measuring tape at 4.5 feet (1.35 meters) above ground, and the diameter is calculated. Make sure the tape is level and not kinked. Students will measure DBH of trees at two distances from the river and compare.
- The **Birds of the Bosque** notebook compares birds observed in two different habitats. Accurate species identification is not important, but students are encouraged to describe the birds they see, and to count the number of individuals of each species in each habitat. Species can be given a brief description *in lieu* of an identification (e.g., "large, all black" or "smaller than robin, yellow breast."

  Simple bird identification tips:

  - Notice the relative size of the bird. *Is it bigger or smaller than a robin? Bigger or smaller than a sparrow?*
  - Notice the color. *What is the dominant color? Is it all one color, or several? Do you see any patches of color, such as on the wings or tail, under the chin, on its head?*
  - Notice the bill shape. Bill shape tells you much about the bird! *Is it long and thin, short and stubby, dagger-like or fine, wide or narrow?*

Back in the Classroom **(Patterns; Analyzing & Interpreting Data; Using Mathematics & Computational Thinking; Measurement & Data; Statistics & Probability; Represent/ Interpret Data)**

- **Rio Grande**: Students will graph the data collected to create a distance vs time graph, with distance on the y-axis and time on the x-axis. The slope of the graph (rise over run, distance over time) equals **speed** (in feet per second, or other units as appropriate). Graph each of the four distances that were timed separately, and graph the four points that were timed for the single run with a different color or symbol. Here are some points that may be discussed:
  - *The slope of a distance vs time graph represents speed. What is the speed of the river?*
  - The steeper the slope, the greater the speed.
  - *Is the speed (slope) constant among the five samples? Does sampling distance affect the measurement? Does measuring with one stick make a difference in the times?*

- *Do you expect the speed to be constant across the full width of the river? Why or why not? What factors might influence the speed of the river?*
- If you are able to revisit the site at a later date, repeat the data collection. *Does the speed change? What might be influencing the speed of the river at this time?*

- **Rio Grande Cottonwood:** Students will calculate DBH using the equation defining the **circumference** of a circle, $C = \pi \times d$, or to solve for diameter, $d = C \div \pi$ where C = circumference, d = diameter and $\pi = 3.14$. Calculate diameter for each of the 14 trees measured.

  Example: If measured circumference is 150 cm
  then diameter is: 150 cm ÷ 3.14 = 47.8 cm

  Graph the data using box & whisker plots, with one plot for the 7 trees at each of the two locations. This allows students to see the variation of DBH measurements within each location and between the two locations. Here are some points that may be discussed:
  - *Are all of the trees within each location the same size? Do you think they are all the same age?*
  - *What factors might affect the growth of the trees?*
  - *Are the trees at the two locations similar in size, or different? Again, why do you think they are or are not?*
  - *Did you have any problems measuring the circumference of the trees? If so, how did you address the problem?*
- **Birds of the Bosque:** To compare the bird populations between the two habitats, students should total the number of species and the number of individuals in each habitat. Create bar graphs for the number of species and total number of individuals in the two habitats. Species identification is not important, but students can use field guides to try to identify the birds seen. Some points that may be discussed:
  - *Which habitat had more species? More individuals?*
  - *Were the same bird species seen in both habitats? Why might you see similarities or differences in the species present?*
  - *How might the time of day affect your sampling? The length of your sampling period?* Learn more about how ornithologists conduct bird surveys!

Extensions

- See *Bosque Nature Journals* activity for possible DCI connections.
- For older students, we have included "Guidelines for Keeping a Field Journal" to provide more advanced options for keeping field journals in a class setting and beyond.
- **Measuring cottonwood tree height.** There are several methods to measure height; this is the 45° triangle method. *Materials:* a measuring tape, piece of square paper or cardstock, folded diagonally to create a right isosceles triangle, notepad and pencil. Hold the paper up to your eye and look along the longest side of the triangle toward the tree. You will need to find a spot where you can see the top of the tree at the top of the angle of the paper; walk closer or farther until you are in that spot. The two shorter sides of the triangle will be parallel to the ground and the trunk. Measure the distance from the tree trunk to where you stand and add the distance from the ground to your eye to get the height of the tree. Compare different trees and different areas of bosque. *Does tree height correlate with diameter?*

If you were to visit this same area in three months, do you think it will have changed? In what way? Why?

Who uses this water? List all possible users, including both human and non-human.

What are some questions you have about the river? What else would you like to know about it? Write your questions here:

The Rio Grande

The Rio Grande flows 1,885 miles (3,016 km) from southern Colorado to the Gulf of Mexico, through three states in the U.S. and four states in Mexico. It sustains many plants and animals and is used by people for agriculture, hydropower, manufacturing, recreational, and domestic uses. Today you will make some observations about the river as it appears in your area.

Name:

Date: Time:

Location:

Temp:

Sky:

Wind Direction & Description:

Find a comfortable spot and spend at least five minutes observing the river.

Use words to record your observations.

I see

I hear

I smell

I feel

o Draw a shape map of the landscape in the box above.
o Begin by drawing a line to represent the top of the trees, or mountains, or whatever meets the sky.
o Next, drop down to the bank on the other side of the river and sketch in where the water meets the land.
o Now sketch in the near bank on your side of the river.
o Using simple images, draw in the trees, seedlings, and sand bars or whatever you see in front of you.
o Label what you draw.
o If the river is not bank-full, take a walk along the river bed to see the exposed gravel, sand bars, clay and/or silt (collectively called sediment).

Add these features to your landscape drawing.

o Make sure you also indicate the direction the river is flowing.

How high do you think the river needs to rise to flood over the banks? How high to flood where you are sitting?

Calculate the speed of the river. You will need 5 sticks of similar size. Measure 20 feet along the river, marking the distance at 0, 5, 10, 15 and 20 feet. Toss in a stick above the upstream end, yell "start" when it passes 0 feet; start timing and record the time it takes to reach 5 feet. Repeat to record the time to travel 10 feet, 15 feet and 20 feet. Then repeat one more time and record the time one stick travels 5, 10, 15 and 20 feet. You will calculate the speed back in the classroom.

Measure these with four different sticks:

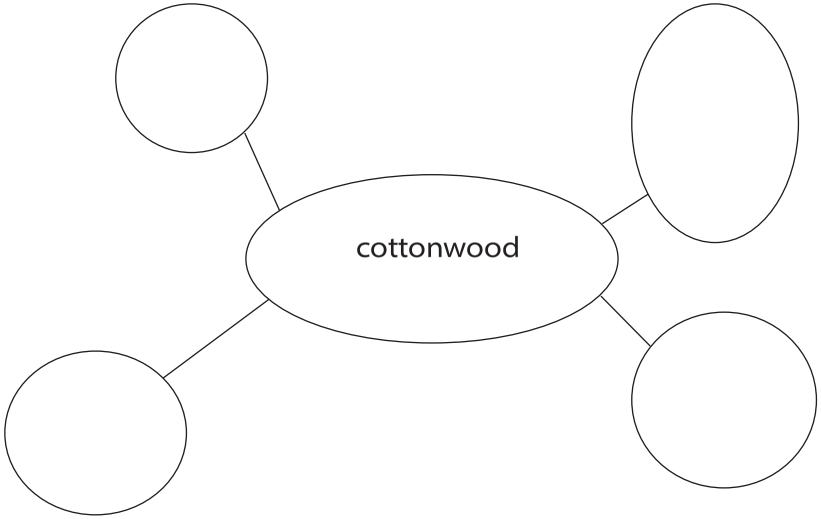
Distance (units =)	Time (seconds)
5	
10	
15	
20	

Measure these all with one stick:

Distance (units =)	Time (seconds)
5	
10	
15	
20	

4

As a keystone species, the Rio Grande cottonwood is connected to many elements of the bosque. Using the web below as a starting point, fill in the elements that are connected. You may add more elements or connections.



What are some questions you have about this tree? Anything you might want to know more about? Write your questions here:

Rio Grande Cottonwood

1

The Rio Grande cottonwood is a keystone species in the bosque. The word "keystone" literally refers to the piece of a stone arch that locks the other pieces in place. Without a keystone, the arch would collapse. Without the cottonwoods, the bosque would cease to exist as we know it. Many animals use it for shelter or food. The health of the cottonwood forest is also a good indicator of the overall health of the bosque. Today you will take a close-up look at a cottonwood.

Name:

Date: Time:

Location:

Temp:

Sky:

Wind Direction & Description:

Find a cottonwood in the bosque. You will recognize it by its large size and triangular-shaped quaking leaves. Look at it very carefully for a least a few minutes. Use words to record some observations about the tree.

What does it look like?

What does it feel like?

What does it sound like?

Does it remind you of anything?

What other organisms do you see on or near the tree?

2

Make a simple drawing of the whole tree. Focus on the outline. What is the shape of the tree? Where do the branches begin? Do all of the branches have leaves?

Pick one part (branch, leaf or anything that looks interesting). Examine it closely and draw it here:

3

A cohort is a group of trees that are all the same age—they germinate during the same event—but they may not be the same size. Some trees may grow bigger because they have more space, get more nutrients, or have a genetic tendency to grow faster.

Scientists compare tree sizes using a measurement called "Diameter at Breast Height" or "DBH". This is determined by measuring the circumference of a tree at 4.5 feet (1.4 meters) above ground, and then calculating the diameter. You will measure the circumference of 7 trees at two locations, one closer and one farther to the river, and then calculate the diameter back in the classroom. Do you think trees within one location belong to one cohort? What about the trees at the two locations?

Location 1

Tree	Circumference (cm or inches)	DBH (cm or inches)
1		
2		
3		
4		
5		
6		
7		

Location 2

Tree	Circumference (cm or inches)	DBH (cm or inches)
1		
2		
3		
4		
5		
6		
7		

4

Based on your observations, why are the birds here? Give three possible reasons.

What was similar or different in the birds found in the two habitats? What about the habitats was different, and how might that affect the birds present?

Now that you have observed the birds and their behavior, what else do you want to know? Write your questions here:

Birds of the Bosque

1

There are many different species of birds that live in the bosque. Some of the species are year-round residents; others spend only the summer or winter here. Still others only pass through as they migrate in the spring and fall. The goals today are to find as many species of birds as you can and to discover what they are doing and why they might be here. Remember, some of the birds are very secretive. You have the best chance of seeing birds if you are quiet.

Name:

Date: Time:

Location:

Temp:

Sky:

Wind Direction & Description:

Scientists often look for bird evidence as much as for birds themselves. Write or draw the evidence of birds you find:

food
nests
feather
droppings
tracks
calls
holes

Where do you hear the birds in relation to you? Put marks in the box below to represent the birds. (You might want to use different marks to represent whether the birds are up high or at your level.)

YOU

We are going to examine some of the different habitats in the bosque. Ornithologists (scientists who study birds) spend many hours sitting quietly, watching and listening to birds. Go to each area and sit quietly for at least five minutes. Look and listen not just for the birds themselves but also for evidence of the birds.

Along Water

Draw in detail one bird that you see in the area.

Describe what the bird is doing.

In the Trees

Draw in detail one bird that you see in the area.

Describe what the bird is doing.

Record the number of birds you see in each habitat. Record the name, if you know it, or describe the bird briefly so you can distinguish between species.

Along Water - Bird Species or Description	# individuals
1	
2	
3	
4	
5	
6	

In the trees - Bird Species or Description	# individuals
1	
2	
3	
4	
5	
6	

Field Journal Guidelines

Naturalists keep field journals to record their observations and track their thinking about experiences in the outdoors. There are many ways to keep a field journal; methods vary depending on one's purposes. Here is one set of guidelines for keeping field notes in a "class" environment where notes will be turned in for grading and review.

Your assignment is to keep a field journal throughout our project. You are expected to maintain the index and to take notes in the field, during labs, on pertinent conversations, in class, and any other time you are working with things related to your field experience. The notes may be important to yourself or others many years down the line. You are expected to write your notes in the field or during the actual lab. Although you should try to be neat, field notes should not be perfect but rather reflect the conditions under which they were written.

Maintaining the Index

To help find information quickly in the future, it is important to dedicate the first few pages of your journal to indexing. (You may want to save the first page for a title page.) Make sure the journal has page numbers; if not, number the pages in the upper outside corner of each page. Each time you participate in an activity related to your study, make an entry in the index, which includes:

- page number(s) where you write your comments (drawings, etc.)
- your name or initials
- the date
- location (if applicable)
- a short description of what you were doing

Example: Page 32 mmm 12/18/22 RGNC BEMP Site, Albuquerque, NM, BEMP monthly collection

Taking Field Notes

Every time you go to the field, write notes. These notes should include:

- the date and day of the week
- your name and the names of your companions
- a brief description of the weather including the temperature (if you have no thermometer, use words like "chilly," "mild" or "hot"), cloud cover, any precipitation (rain, snow, hail, etc.), amount of wind
- a brief description of the location including the name of where you are and, if reasonable, travel directions so someone can find the site again
- notes about observations you have made (wildlife sighted, changes to the site, phenology of plants—such as cottonwood leaves are turning yellow on 25% of trees—etc.)
- notes about your work; explain what you are doing and why

You may also want to include:

- a sketch of something you have observed that you found interesting
- at least one question that you have thought of relating to your work in the bosque or relating to your understanding of the program
- natural history samples such as flat things like plant leaves or seeds which you tape into your notebook to aid with identification
- a map of where you are and what you are seeing

Taking Lab Notes

When you are no longer in the field, but working with materials collected in the field, such as water samples, or other kinds of data, this is considered lab work. Write notes while doing lab work to help:

- record pertinent data
- keep track of questions you have that you need to find answers to
- document any unusual observations
- record what day you are doing the work, what work you are doing, and who is working with you.
- include printouts of tables and graphs you generate from your data

Other Things to Include

Remember that other people will examine your field journal. Naturalists' field journals can be considered legal documents and have occasionally been used in legal cases. We hope this inspires you to do a good job of keeping notes, but remember we are all human and nobody keeps perfect field notes. Do the best job you can when you are in the field or the lab, and do not wait to make your notebook entries as a homework assignment to catch up on later—do them in the field or the lab.

Remember, your field journal is a written record. It documents the effort you put into a course of study and observation. From a legal perspective: if it is not recorded, it wasn't done. From a practical perspective: if you don't record something, you may forget about it later.

Be Sure to Include	Do NOT Include	Optional
◦ field notes with data ◦ lab notes to document samples worked on, dates, problems, data ◦ pertinent information from phone calls or conversations related to your field work ◦ drawings and diagrams to help illustrate your observations	◦ unprofessional remarks about other people ◦ inappropriate information ◦ class notes	◦ thoughts and personal insights on readings, class discussions, conversations with others ◦ notes on related lectures and programs ◦ newspaper clippings and other information that relates to your field work ◦ natural history notes, plant pieces, drawings, etc.