Exploring the Outdoors

OVERVIEW

Students will learn how to make observations about the natural world and identify trends and patterns in data.

GRADE LEVEL

Kindergarten to 6th, adaptable to higher grade levels.

SUBJECTS

Scientific observations, Data collection, Observing trends and patterns, Presentation

NGSS

- K-LS1-1
- K-ESS2-1
- 2-LS4-1
- 3-ESS2-1

DURATION

Two lessons total that are 1.5 hr each (1.5 x 2 = 3 hrs total)

SIZE

Preferably, class size no larger than 25 students.

SETTING

Can be indoors or outdoors.

MATERIALS

- Chalkboard/whiteboard
- Students' journals
- Pencils and colored pencils
- Hand lenses (optional, recommended)
- Timing device
- Assortment of items for visual/creative project (paint, glue, crayons, random objects, etc. - likely found at home or in the classroom)

LESSON SUMMARY

A two-part lesson where students will practice making observations about the natural world, collect data, identify trends and patterns and data, and represent data in a meaningful way through a creative project. Students will come up with a creative representation of the data they work with.

LEARNING OBJECTIVES

At the end of this lesson students will be able to:

- Make observations using their senses.
- Differentiate between observations and inferences.
- Ask questions about the natural world around them based on those observations.
- Make connections from their personal experiences to those observations.
- Collect data based on their observations and questions.
- Interpret pre-collected phenology data by finding trends and patterns.
- Display data trends and patterns in a creative project that can be understood by anyone.

KEY CONCEPTS

Nature Journaling, Research Question(s), Hypothesis, Prediction(s), Data Interpretation, Data Trend/Pattern, Data Presentation.

VOCABULARY

- Abiotic and biotic
- Data trend
- Hypothesis
- Inference
- Monitoring
- Nature Journaling
- Observation
- Phenology
- Phenophase

BEMP
Bosque Ecosystem Monitoring Program

ETO

BACKGROUND:

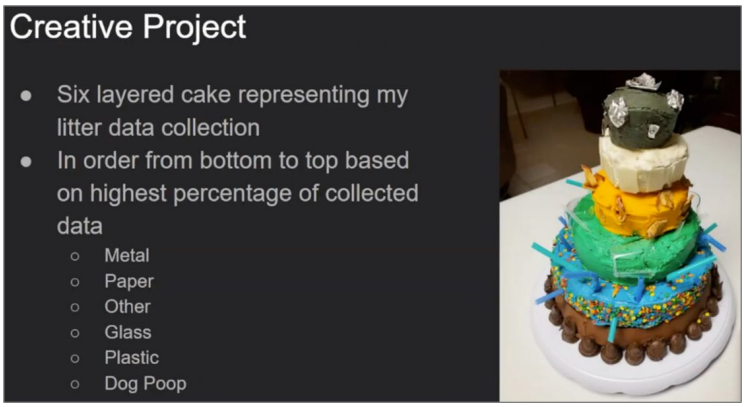
The Bosque Ecosystem Monitoring Program was established in 1996 as a collaboration between the University of New Mexico's (UNM) Department of Biology and Bosque School. In 2020, BEMP became a non-profit 501(c)(3) corporation retaining the same partnerships and mission (below). For the past 25 years BEMP has engaged K-12 students from across New Mexico and their teachers to track long-term ecological changes in the Middle Rio Grande and the surrounding riparian forest, or bosque.

Managers make decisions within the bosque in response to fire, floods, anthropogenic impacts, and climate change by using community scientist collected data. Engaging students in the scientific processes of collecting data and understanding ecosystem responses both in the field and through additional classroom programming is essential towards creating stewards of this special place.

BEMP's Mission

Community Science, Education, and Stewardship: Equitable and inclusive hands-on student research essential to the management of the Rio Grande ecosystem.

BEMP engages thousands of students each year virtually, in the classroom, and in the bosque utilizing lessons similar to this. In this lesson, students will make observations, ask questions, and make connections using the nature journaling prompts "I notice, I wonder, it reminds me of." Once they've made those observations, they will learn that they collected data with their observations and can continue to collect data to answer questions and hypotheses. To represent the data they collect, students will create a visual project accurately displaying their data in a way that anyone (without a scientific background) can understand. The photo on the right is an example of a creative project tracking the abundance of jack rabbits in the spring and fall.



Additional Resources:
To identify local plants use the free iNaturalist app:

Phenology neighborhood scavenger hunt: https://www.youtube.com/watch?v=X7QRtk6qG9s

BEMP YouTube Channel: https://www.youtube.com/channel/UCZFY31NlhtZFTd0ixAaEMSw

Downloadable at home, place-based activities can be found on our website:
https://bemp.org/education-outreach/education-resources/

National American Association of Environmental Education - A brief illustrated guide to nature journaling:
https://naaee.org/eepro/blog/brief-illustrated-guide-nature

BEMP Bosque Ecosystem Monitoring Program

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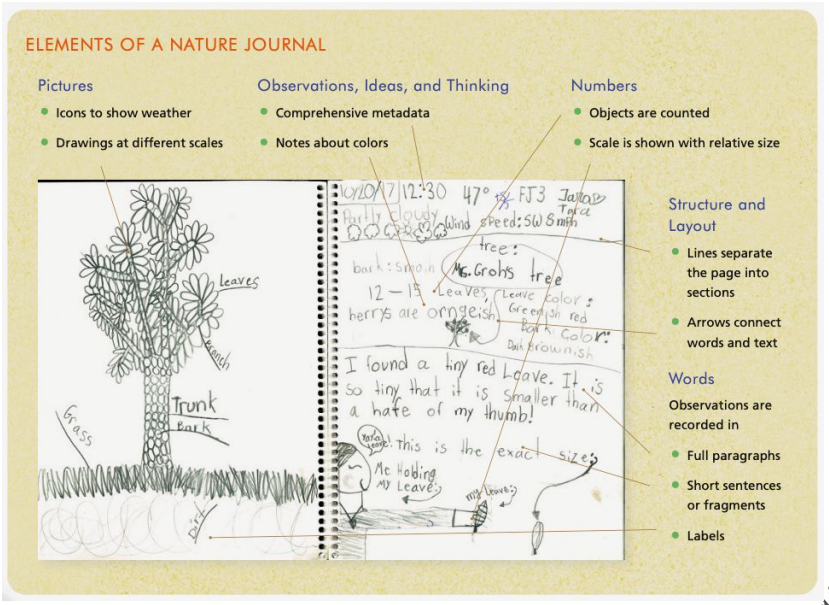
SESSION ONE: ES, MS, HS

Nature Journaling

1. Intro to BEMP: If students are unfamiliar with our program, go through this section. This can also be used as a quick refresher.
    a. Go over these terms: B - bosque; E - ecosystem; M - monitoring; P - program
    b. Ask students: *What have you seen in the bosque? What lives there? What does bosque mean in english? Is it any kind of forest?*
    c. Define the terms biotic and abiotic with examples. Abiotic- Nonliving parts of an ecosystem like the sun, rocks, and water. Biotic- Living parts of an ecosystem like plants, animals, bacteria.
    d. Ask students: *If you could do a movement with your body that represents monitoring what would it be (binocular sign)?*
2. What we do at BEMP?
    a. Put acronym works together: We **monitor** the **bosque ecosystem** with many different kinds of people (**program**).
    b. Ask students: *Why do we monitor?* To get general knowledge about the ecosystem, to learn how we can help it, to learn how we can coexist with it, and so much more.
    c. Ask students: *What do you think a healthy ecosystem means?* Animals and plants have access to food and shelter and are reproducing.
    d. Why do we monitor? To get general knowledge about the ecosystem, to learn how we can help it, to learn how we can coexist with it, and so much more.
3. What we're doing to do today: Collecting some basic data by nature journaling. Use three prompts: "I notice," "I wonder," and "It reminds me of." (1)
    a. What goes into a nature journal? (2)
        - Anything! Words, sentences, paragraphs, drawings, leaf/flower presses, etc.
        - Emphasize that for science some pieces of information are very important. Have them write their name, the date, the time, and the location at the top of their journals.



[1] Adapted from *beetles project:* "I notice, I wonder, it reminds me of."
http://beetlesproject.org/resources/for-field-instructors/notice-wonder-reminds/
[2] Image citation: How to Nature Journal by John Muir Laws and Emilie Lygren

BEMP Bosque Ecosystem Monitoring Program

b. Introductory questions: Ask students these questions before they begin the prompts. *What does nature mean to you? How do you interact with nature? How do you see yourself as part of nature?* Allow students to share in pairs or as a group what they wrote in their journals.

c. "I notice"…
   - Ask students: *What is an observation? What is an inference?* Focus on making observations!
     - Observation: the leaf has small holes in it.
     - Inference: the leaf has holes in it because a bug ate it.
   - If you are at home, find an object that is part of nature around you (like a plant or animal!) or look outside. Ask students to take a quiet look around them and make some observations using their senses (see, hear, smell, and touch). Have students write/draw in journals for 5 minutes.
     - Example: "I notice speckled leaves on the forest floor"
   - Ask: *What did you see/hear/etc that you never noticed before?*

d. "I wonder" …
   - After students make observations, have them ask some questions based on the same piece of nature. Ask: *What are you curious about?* We are all naturally curious, making us scientists! Have students journal what they wonder about their piece of nature for five minutes.
     - Example: "I wonder how long these leaves have been on the ground."

e. "It reminds me of" …
   - Have students make connections from your personal experiences and memories to your piece of nature. These connections can be to physical objects or memories. Five minutes of journaling.
     - Example: "the shape of this flower reminds me of the Ninja Turtles I used to watch when I was younger."
     - Share your observations, questions, and connections.
   - Share as a group or in pairs. **Sharing can be after each section or after all 3 prompts are completed. Emphasize that students collected real data!**

4. Nature Journaling and Data Collection (**For MS and HS**)
   a. The observations made today are data! Data collection doesn't need to be complicated. It can be simple observations based on your senses.
   b. A dataset that can easily be collected through nature journaling is phenology (the study of how living things react to the changing seasons).
   c. Pick a tree, bush, flower, or any other plant that you want to monitor. Continue this journaling exercise on your chosen tree weekly to see how it changes as the seasons progress. Focusing on the color of the leaves is an easy one to track. You can compare this data to other data like temperature or precipitation.
   d. You can compare your data to nationwide phenology data on the National Phenology Network website: https://www.usanpn.org/data/visualizations
   e. BEMP collects cottonwood phenology data at Bosque School and Tingley Beach!
   f. You can look at our data by going to the Nature's Notebook website: https://data.usanpn.org/vis-tool/#/explore-phenological-findings;group_id=527 From there you can select which type of data visualization you'd like to use and customize the phenophase you'd like to see represented.

SESSION TWO: Elementary

Interpreting and Graphing Data Trends and Patterns

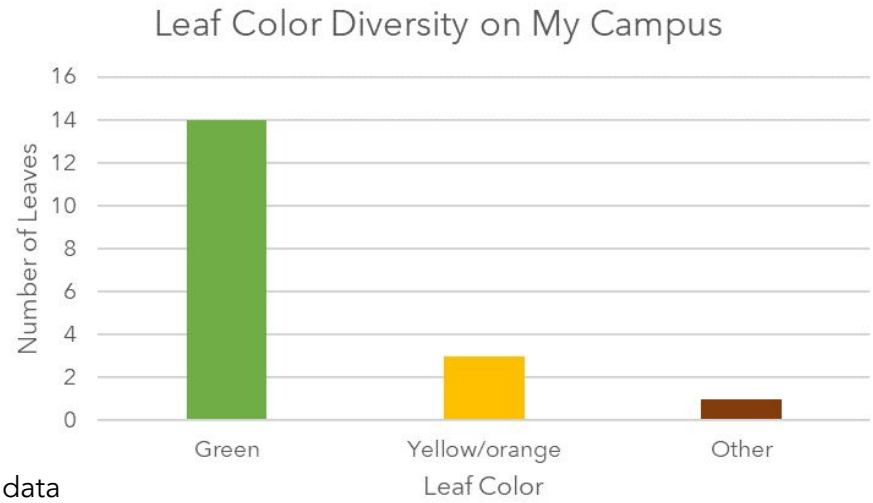
1. Review of Session One
    a. What did we do last session? What goes into a nature journal? Why do we nature journal?
    b. What can nature journaling tell us about an ecosystem?
2. Collecting Data
    a. Discuss with the students what data is and why someone would want to collect data on an area
        i. What examples of data can you think of?
    b. Data can be easy to collect! The students collected data when they were nature journaling. We will be collecting some data together and then creating a way to display that data.
        i. The data you will be collecting is about plant leaf color. We will be looking to see whether plants have green, yellow/orange, or a different color leaves. Have students create a scientific question based on this data being collected.
        ii. Example: Which color will be seen the most in our school yard/park?
    c. Create a hypothesis as a class or individually
        i. Example: There will be more green leaves than the others because it is springtime.
    d. Collect plant color data with students. Have students close their eyes or look down while you count to three. Students then should look up and find the first plant they can. What color are the leaves? Have students put their answers into 3 categories: green, yellow/orange, and other.
    e. Once students have their answers, have them separate themselves into their plant leaf colors.
    f. On your whiteboard, create a table of your data and have the students record it down in their journals.

Leaf Color	**Number of leaves**
Green	
Yellow/orange	
Other	

SESSION TWO: Elementary

Interpreting and Graphing Data Trends and Patterns

3. Graphing Data
    a. Using the table, create a graph. Discuss with students how to make graph.
        i. Graphs need two sides, a bottom and a left side. The bottom line is the x axis and the left side is the y axis.
        ii. Now we need to label our axes. X axis should have leaf color and y axis should have the number of people who saw that leaf color. Add your numbers to the x axis in even intervals.
        iii. Graphs also need a title. Create a title with the class that tells people what they are looking at in their graph. Now add the data that was collected to create a bar graph. Each student should have their own graph
    b. Interpret the graph. What trends do we find in this graph? What is a trend (or pattern)?
        i. How would this graph change if this was a different time of year? Would the data be the same?



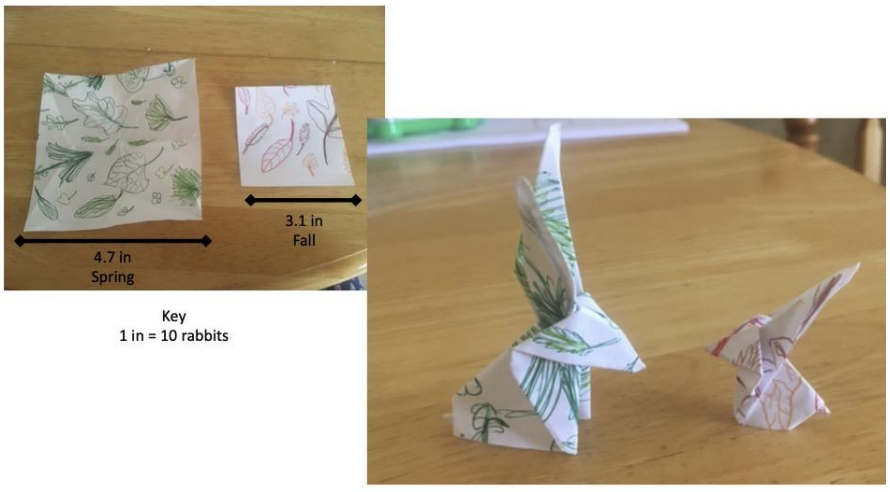
    c. Creative displays of data
        i. What are other ways we can display these data? Have students divide into groups and create a land art piece that displays their data.
        ii. Once students are done creating their land art piece, have them present their art piece to the class making sure to discuss the details of the data.
4. Reflection Questions
    a. Ask: *How is nature journaling and data collection related? What other types of data can you collect? What can a trend tell you about your data? How can a creative/visual project help others to understand data?*

*If you have extra time with the students, have them collect more data. Bring some magnifying lenses with you. First, have the students pick an object, like a leaf or pine cone, and have them draw it from about a foot away from them. Then have them bring it close and use the magnifying lens to look closely at their object and draw that. What did they notice about their object that they might not have noticed before?

SESSION TWO: MS and HS

Interpreting and Presenting Data Trends and Patterns (3)

1. Analyze Data
    a. Create a question and hypothesis that can be answered with your data. This question can be made individually or as a class.
        - Example question: What time of year will have the most yellow leaves?
        - Example hypothesis: The beginning of fall will have the most yellow leaves because the leaves die and drop for winter.
    b. Using the data collected, find trends of that data. Construct a basic data chart and bar graph of your data.
        - Which months had the most green leaves? What about yellow leaves? Brown/dead leaves?
        - Answer your question and create a conclusion based on your hypothesis. Was your hypothesis supported?
2. Creative Project
    a. Now that you have found trends in your data, create a project that will accurately display those trends. This project must accurately show your data so that anyone, regardless of their age/level, will be able to understand what it is saying.
    b. These projects can be made out of anything you'd like. It can be painted, sculpted with clay, baked, sung, 3D modeled, and much more. Below is an example of a project. It represents The amount of jackrabbits spotted at the Sevilleta National Wildlife Refuge during the spring and fall was displayed using proportionally sized paper, then folded into origami jackrabbits.



3. Reflection Questions
    a. Ask: *What did you notice about your piece of nature that you hadn't noticed before? How is nature journaling and data collection related? What other types of data can you collect? What can a trend tell you about your data? How can a creative/visual project help others to understand data?*

3 Adapted from Asombro Institute for Science Education "Desert Data Jam"
https://asombro.org/desert-data-jam/