Schoolyard Quadrat Investigations

DRAFT

Topic
Biodiversity
Measurement

Grades
K-3

Site
Schoolyard
Classroom

Duration
Multiple Sessions throughout the school year

Materials
- Quadrats
- Thermometer
- Tape measure
- Magnifying glass
- Clear Tape

Vocabulary
Quadrat
Biodiversity
Temperature
Habitat

Next Generation Science Standards

Practices

Analyzing and interpreting data

Core Ideas

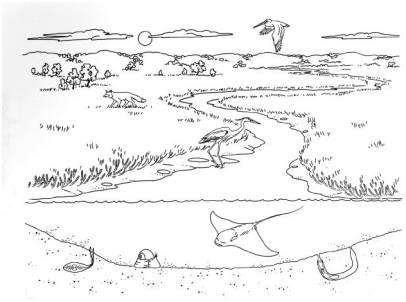
ESS3: Earth and Human Activity
LS2: Ecosystems

Crosscutting Concepts

Patterns

Performance Expectations

See page 4



Focus Question

How does our schoolyard change over time?

Overview

Young children can use observation and measurement to find out more about an environment using simple tools that extend human senses and make the data collected more accurate. This activity includes using a quadrat to help students investigate a plot of land over time.

Outcomes

Students will:

- Investigate an area of their schoolyard over time.
- Record and analyze quantitative and qualitative data.
- Describe the biodiversity of their plot.

Background

Quadrats are a tool ecologists typically use to collect biodiversity data both on land and in aquatic environments. They can be used to count the number of organisms, number of different organisms, and percent coverage (i.e. 75% of the plot is covered by grass.)

Over a period of nine months, students collect temperature data. To help investigate if temperature changes over time in the schoolyard, we set up a fair test. A fair test is an experiment where most of the variables are kept the same and just one is changed. In this case, students are putting their quadrats in different places, but to reduce the amount of human choice in the data, we ask our students to throw the quadrat behind their back, as the beginning of a later discussion on randomization. We collect data multiple times (monthly) and use consistent tools (thermometer) in the same way (taking temperature from the center of the quadrat) to ensure a fair test.

DRAFT

VOCABULARY

Vocabulary word:

Quadrat: a rectangular plot used in ecology to study biodiversity

TEACHER TIP

HAVE STUDENTS TAPE THEIR STUDENT SHEETS INTO THEIR SCIENCE NOTEBOOKS TO HELP THEM KEEP TRACK OF THEIR DATA.

THE MISSION OF THE MONTEREY BAY AQUARIUM IS TO INSPIRE CONSERVATION OF THE OCEANS.

Teacher Preparation

Build quadrats for your class . Directions for building quadrats are at the end of this lesson plan. Decide if you will assign the students a location or if you will allow them to choose their location (using the behind the back method.)

Procedure

1. **Introduce the focus question to the class.**
   Share the question: *How does our schoolyard change over time?* You may write it up on the whiteboard or have students add it to their science notebook. Give students time to write their initial thoughts down or discuss with a partner. Depending on their prior knowledge, you may need to spend some time exploring the concepts of biotic and abiotic first.

2. **Introduce the activity.**
   They will be adopting a plot of land for the rest of the year and taking observational data from it every month. Explain that this is something scientists do: collect data over time.

3. **Introduce the tool.**
   Explain that a quadrat is a tool scientists use to collect data about a small plot of land or microhabitat. Show them the data sheet and explain that this is where they will record their findings.

4. **Find a plot.**
   Go outside and allow students to stand in an area that interests them. Have them turn around and gently toss the quadrat behind their back. Where it lands is their special plot of land they'll go back to throughout the year. GPS mark, take pictures, or carefully notate where each student's plot it.

5. **Sketch the plot, take data.**
   Ask students to sketch what they see, make a list of all the things they can find in their plot, and take a temperature reading from the center of their plot.

6. **Classroom Discussion**
   After students spend time collecting their data, return to the classroom and discuss what they found. Discuss the differences in the temperature readings they got; did some students take readings in the shade? You can have them sort their list of things into living, nonliving, or once living and make a class bar graph. You can also have them make predictions about how the temperature readings might change throughout the year.

7. **Change over time**
   Each month, go back to the exact spot and take a temperature reading. A suggested topic for data and classroom discussion each month is provided on page 3.

8. **Return to the focus question.**
   Now that students have collected data about a specific ecosystem and discussed their results, have them revisit the question: *How does our schoolyard change over time?* Students may think on their own or discuss with a partner. Then in their science notebook, you may have them draw a line of learning and under it add to their original thoughts about the question.

Extensions

- Have students come up with a testable question and use some tools to collect data other than temperature on an ongoing basis.
- Have students compare their temperature data to each other, across years if possible to look for patterns.
- Ask students to develop an action plan that will encourage the conservation of their plot.

Resources

Monterey Bay Aquarium. www.montereybayaquarium.org

References

Broda, H. W. (2007). *Schoolyard-enhanced learning: Using the outdoors as an instructional tool, K-8*. Stenhouse Publishers.

Standards

Next Generation Science Standards www.nextgenscience.org

Performance Expectation
Supports 1-ESS1-2 Make observations at different times of the year to relate the amount of daylight to the time of year.

Supports K-LS1-1 Use observations to describe patterns of what plants and animals (including humans) need to survive.

Common Core State Standards www.corestandards.org

Mathematics, 1.MD.C.4
Organize, represent, and interpret data with up to three categories.

Instructions for building half-meter quadrats:

Supplies:
All supplies can be purchased at your local hardware store
- 3/4" Sch (schedule) 40 PVC (at least 2.2 m for each quadrat)
- 3/4" 90° angle PVC elbows (4 per quadrat)
- Hack Saw (or ask the nice person at the hardware store to cut it into ~0.48m each (adding the elbow should bring it to 0.50m)
- Meter tape
- Vise
- Pencil

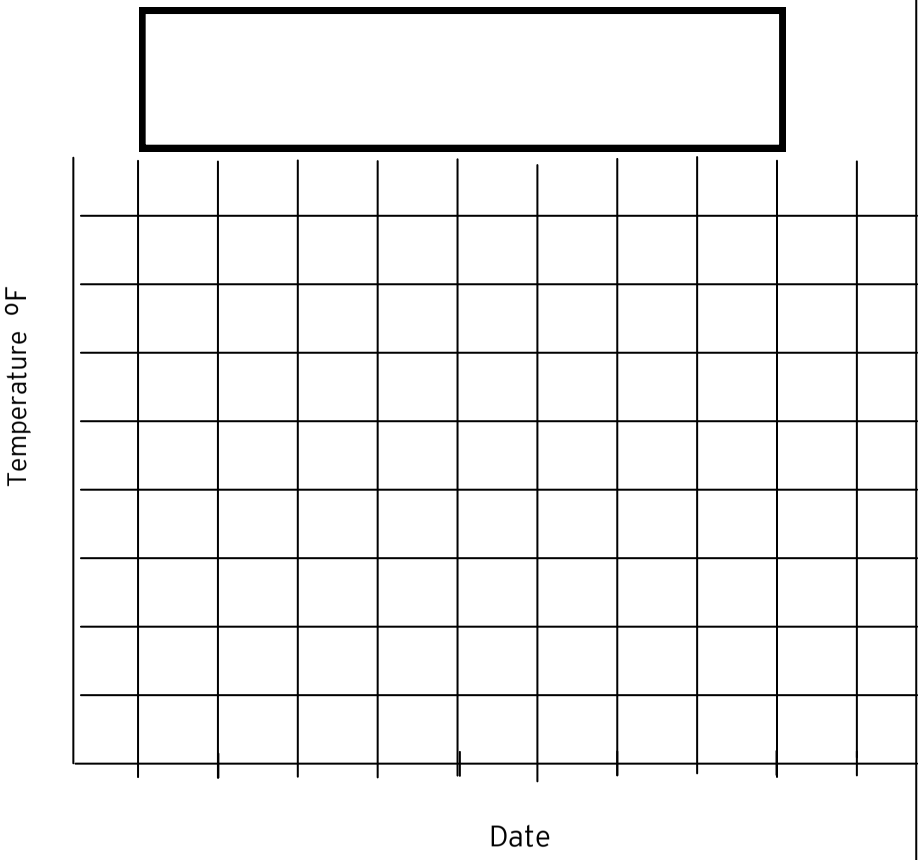
Instructions:
1. Use your meter tape and pencil to mark off the 0.48m sections
2. Secure the PVC in the vise and very carefully cut the PVC pipe into the correct lengths
3. Attach an elbow to one end of 4 pieces
4. Assemble your quadrat!

Tip: You may want to leave your quadrats unglued so you can place it around taller plants and trees by detaching and reattaching one side. If you will be using the quadrats in a more dynamic environment (e.g., rocky intertidal) where there is the risk of losing a piece if the quadrat comes apart too easily, you might want to glue it.

Monthly Data Collection Plan:

Month	Outside	Inside
Month 1	1. Draw a picture of what your plot looks like. 2. Make a list of at least 10 things found in your plot. 3. Take a temperature reading from the center of your plot	• Classify your list into living, nonliving, and once living. • Share your temperature data. • Predict: How might the temperature change throughout the year?
Month 2	1. Observe your plot and write questions you have about your plot. What are you curious about? 2. Take a temperature reading from the center of your plot.	• Set up a line graph for you to put your temperature data on. • Optional: Choose one question you can investigate and write a prediction.
Month 3	1. Look inside and outside your plot. Have humans impacted this area? Note any ways you think humans have changed your plot. 2. Take a temperature reading from the center of your plot.	• Add to your temperature graph. • Discuss: How have humans impacted this area? (i.e. Was there any trash in your plot?) • Discuss: What can we do to help keep our plot healthy?
Month 4	1. Take temperature readings from the center of your plot. 2. Take a temperature reading at each of the corners.	• Add the center temperature to your graph. • Discuss how your readings were similar or different across different areas in your plot. • Discuss how your temperature readings have changed since September.
Month 5	1. Identify things in your plot that provide plants and animals with what they need in order to live. 2. Take a temperature reading from the center of your plot.	• Discuss how your plot is a home for plants and animals. Is your plot a good habitat? • Add to the temperature graph.
Month 6	1. Predict what might happen to your plot if there was a heavy rainstorm. Draw a picture of what it might look like. Do the same if there was an extreme drought. 2. Take a temperature reading from the center of your plot.	• Share your drawings with a partner. Discuss how this extreme weather might effect the animals and plants that live in your plot and near your plot. • Add to the temperature graph.
Month 7	1. Use your senses to make five qualitative observations of your plot. 2. Take a temperature reading from the center of your plot.	• Use your senses observations to write a paragraph about your plot. Include personal connections you've made, and any questions you are curious about. • Add to the temperature graph.
Month 8	1. Make a list of at least 10 things you see in your plot. 2. Take a temperature reading from the center of your plot.	• Compare this list to the list you made in September. Discuss any similarities and differences you find. • Add to the temperature graph.
Month 9	1. Draw a picture of your plot 2. Make a Box and T chart of the similarities and differences you notice in in your plot compared to month 1. 3. Take a temperature reading from the center of your plot.	• Compare this picture to the one you drew in September. • Use your Box and T chart to write a paragraph comparing and contrasting your plot. • Finish your temperature line graph. • Write about your graph, what do you notice? What could this mean for your plot? Was your prediction consistent with your data?

Data Collection Sheet:



Month	September	October	November	December
Temperature Reading:				
January	**February**	**March**	**April**	**May**

Month 1, Date:_____

List 10 things you see:

1._____
2._____
3._____
4._____
5._____
6._____
7._____
8._____
9._____
10._____

Draw what you see inside your quadrat:

Surface Temperature:

°F

How will you be able to find your same spot again?

_____

_____

MONTEREY BAY AQUARIUM

Month 2, Date:_____

Write 5 questions you have about your plot:

1._____

_____

2._____

_____

3._____

_____

4._____

_____

5._____

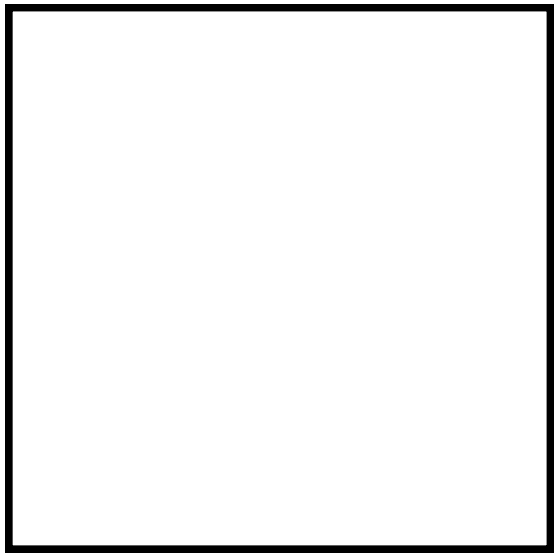
_____

Surface Temperature:

°F

Month 3, Date:_____

Draw any signs of humans impacting your plot:

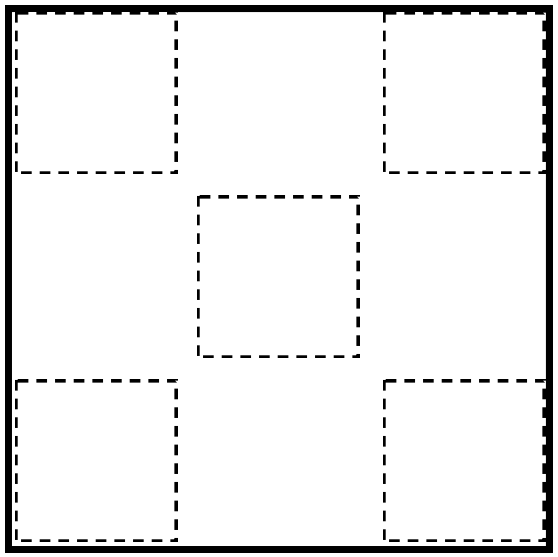


°F

MONTEREY BAY AQUARIUM

Month 4, Date:_____

Record your temperature reading in each box:



Surface Temperature:

°F

Month 5, Date:_____

What is in your quadrat that helps plants and animals survive?

1._____

2._____

3._____

4._____

5._____

Surface Temperature:

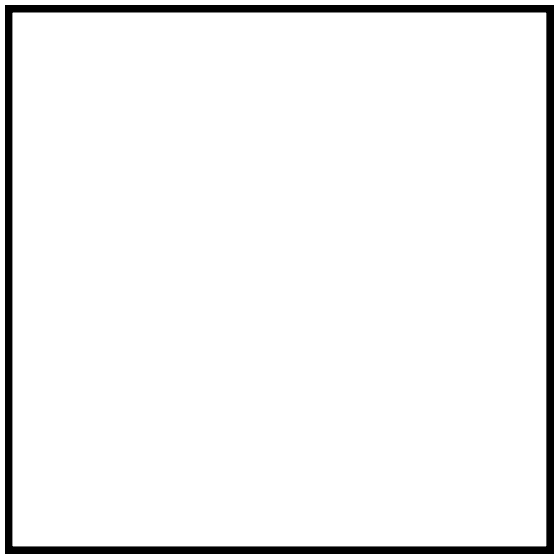
°F

MONTEREY BAY AQUARIUM

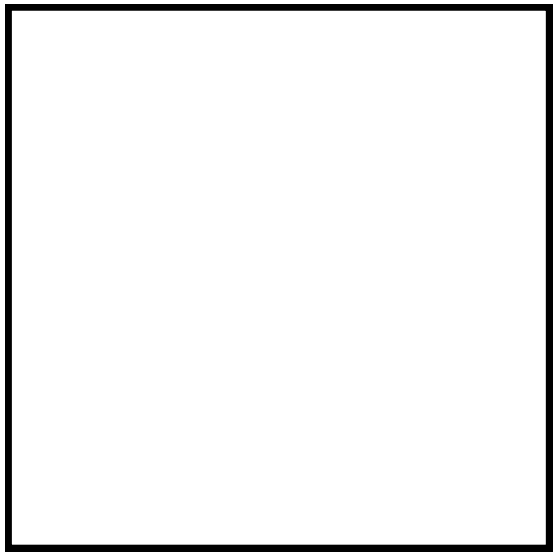
Month 6, Date:_____

Draw a picture of what your plot might look like in an extreme flood and an extreme drought:

Flood



Drought



Surface Temperature:

°F

Month 7, Date:_____

Use your senses to make observations:

1. I see _____

2. I smell _____

3. I hear _____

4. I feel _____

5. I taste _____

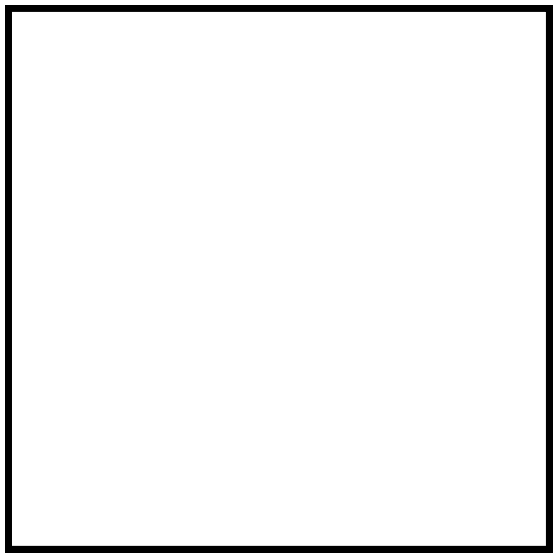
Surface Temperature:

°F

MONTEREY BAY AQUARIUM

Month 9, Date:_____

Draw what you see inside your quadrat:



Surface Temperature:

°F

Look at your data from September. Write the **similarities** you see in the box. Write the **differences** in the T chart.

In both September and May I noticed:_____

_____

In only September I noticed:_____	In only May I noticed:_____

List 10 things you see:

1._____

2._____

3._____

4._____

5._____

6._____

7._____

8._____

9._____

10._____

Surface Temperature:

°F

MONTEREY BAY AQUARIUM