Microclimates

Overview

In addition to changes in climate over large spatial scales (i.e. global climate zones), differences in climatological variables also exist within our local regions. Local features such as tall buildings, vegetation, bodies of water, and changes in slope or altitude can impact the temperature, wind speed/directions, and amount of moisture in an area. These small regions in which the climate differs from the surrounding area are referred to as **microclimates**. In this activity, students will uncover the microclimates in their schoolyard by uncovering small scale temperature variations. While such minor fluctuations in climate may seem unimportant, they directly influence the distribution and abundance of many organisms. Additionally, the creation of new microclimates through paving, building, and development has altered the natural landscape and can result in the formation of urban heat islands (see the Heat Islands lesson for more information).

Materials

For the leader:

- ✓ *Whiteboard or chart paper and a marker*

For each group:

- ✓ *1 Pasco Spark unit*
- ✓ *1 Pasco noncontact temperature sensor*
- ✓ *Pens/Pencils/Markers*
- ✓ *Clipboard*
- ✓ *Datasheet (optional)*

Motivating Question: How does our landscape influence climate?

Engage:	Students discuss their understanding of how temperatures vary on local scales	10 minutes
Explore:	Students will collect data to determine how the amount of heat at a location changes based on its characteristics	20 minutes
Make Sense:	Each group shares and compares their results. They will also utilize mapping skills to explore how location and conditions can impact the amount of heat or weather at a location.	15 minutes

Total: 45 minutes

Preparation (10 minutes)

1. Write the motivating question on the board or a large piece of paper:

   Q. How does temperature vary in my local environment?

2. Ensure that the PASCO Spark handheld devices are charged and ready to be used with the non-contact temperature sensors attached.

Engage (10 minutes)

1. Ask the students to share their ideas on the following questions with the person next to them.

   Q. Can you think of any other factors (other than seasons) that might influence the amount of heat there is in an area?

   Q. Do you think that the temperature at all areas around the school is the same? If so, why? If not, which areas of the schoolyard are the warmest, and which are the coolest?

2. Have the students report and share their ideas with the group.

Explore (20 minutes)

1. Head outside into your schoolyard on a sunny, warm day. If you are in an area with deciduous trees, you may wish to do this activity at a time when the trees have leaves because of the shade they provide.
2. Assign appropriate roles (i.e. recorder, non-contact temperature data collector, reporter, etc.) as necessary. Tell students to switch roles at each location.
3. Distribute the Spark Handheld devices.
4. Tell the students that they will have 20 minutes to follow the instructions on their Spark Handheld device and record their answers to the journal questions. Students can either record their data on the spark unit or on the datasheet.

Make Sense (15 minutes)

1. In the classroom, create a chart or map of the locations. Have student groups fill in the data about their location including average temperature, sun/shade, and ground cover.
2. Ask the students to compare what they measured and its temperature to what other students measured and their results. Prompt them with questions such as: *What physical objects were around? Was it sunny or shaded? What was the color of the surface? Were there trees or grass nearby?*

For more information on using the Pasco Science Learning System, see the introduction in the Leader's Guide.

Non-contact temperature sensors (or Infrared thermometers) are recommended for this activity. Non - contact temperature sensors measure temperature by assessing the amount of energy emitted from an object. When sunlight hits the Earth surface, some of that energy is absorbed and some is reflected.

3. Introduce the concept of Microclimates:

   - ✓ Today you investigated relatively small differences in temperature in the schoolyard. These differences reflect different microclimates.
   - ✓ The term microclimate can be used to describe differences in small areas of just a few square meters or much larger areas a few kilometers apart.
   - ✓ Factors that contribute to microclimates in a small area like a school yard include the presence or absence of shade (from trees or buildings), and the type of material an object is made of (dirt, asphalt, concrete, metal), and whether there is vegetation.
   - ✓ Shaded areas are generally cooler because much of the solar radiation is unable to reach the ground. Ground materials like asphalt and concrete absorb solar energy readily and dark paving will typically be warmer than light color paving because dark colors absorb more heat

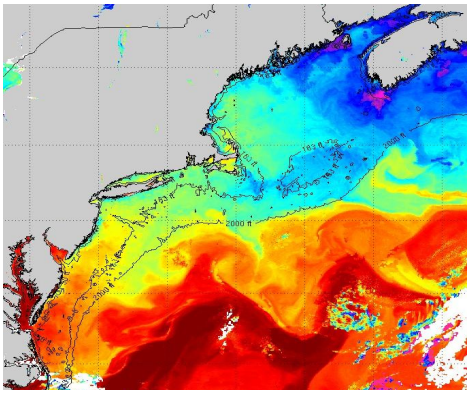
4. Ask the students the following questions

   Q: What kinds of differences would we find if we made our observations over a longer period of time? In different seasons?

   Q: Would temperatures be different deep in the ground instead of on top of it? Would they be warmer or colder? How could we find out?

   Q: What factors might cause water to evaporate faster in some places?

   Q: How may the microclimates in an area impact where animals and other organisms live?



Extension Activity

1. For an additonal activity involving microclimates, see "Teaching Temperature with Project-based Learning" by David Tumbarello in the April/May 2010 issue of *Science and Children.*

Parts of this activity were adapted from Feeling the Heat, A Windows to the Universe activity by Lisa Gardiner.

Investigating Microclimates

Group Name: _____

Date: _____ **Time**: _____

First, choose 10 different locations or materials to take a measurement of using the non-contact temperature sensor.

For each location, describe how sunny it is, what material it is made out of, its color, how protected it is from wind and weather, and any other factors you consider important.

Then, record its temperature (don't forget the units).

	Location Name	Location Description	Temp.
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Analysis #1

How did your predictions compare to the actual measurements? If there were any differences, explain why you think they occurred.

Analysis #2

How did the amount of sunlight affect the temperature of a location?

Analysis #3

How does protection from surrounding objects, buildings, or trees affect the temperature of a location?

Analysis #4

How does the type of material covering the location affect the temperature?

Analysis #5

How does the color of an object affect its temperature?

Synthesis

Using what you now know, why and how do temperatures vary in your local environment?