

Getting Micro with Climate

Key Topics: Climate, Weather, Season, Microclimate, Sustainable Design, Habitat, Heat Island Effect/Urban Heat Island

Grade Levels: K-3, 5-8

Inside and Outside

Lesson Overview:

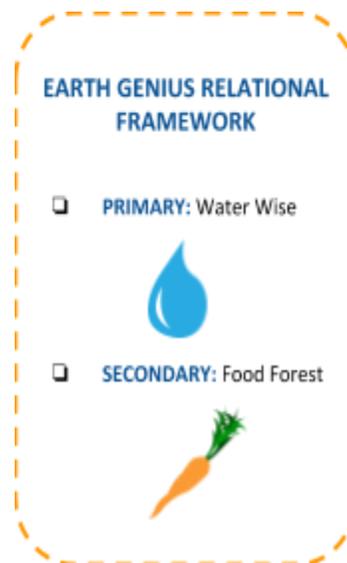
In this lesson students will explore the difference between climate, weather, and seasons. Each is related and can affect the growth of plants. Field observations and data collection of microclimates that exist on campus will give students real data to argue why certain designs and landscapes are more ecologically friendly than others, as well as more comfortable to people, animals or plants.

Activities:

Intro - 10 min.

Activity - Exploring Microclimates Outside - 20 min.

Followup - 15 min.



Suggested Activities and Learning Objectives by Grade

Level:

- K:
 - K-PS3-1 How does sunlight affect temperature?
- 1:
 - 1-ESS1-2 How does the amount of daylight change throughout the year?
- 2:
 - 2-ESS2-1 How quickly does the weather change vs. the climate?
- 3:
 - 3-ESS2-1 Measure and record weather conditions.
- 5:
 - 5-LS2-1 How do sun and wind affect moisture?
- MS:
 - MS-LS2-3 How does sunlight affect plant growth?
 - MS-ESS2-1 How do sun and wind affect moisture?
 - MS-ESS2-6 How does unequal heating and rotation of the Earth affect the circulation of the atmosphere and ocean to create climate?

Essential Question(s) that Connect CCCs and SEPs:

- How do habitats change at different scales? Can I look at habitats on a smaller scale? ([Scale](#); [Asking Questions and Defining Problems](#))
- What kinds of scientific investigations can be done to study microclimates? What tools will we need? ([Scale](#); [Planning and Carrying out Investigations](#))

- What patterns did you notice in the plants and animals found in the colder microclimates vs. the warmer microclimates? Did you notice any differences between the plants and animals that live in the other locations? What were the differences? ([Patterns](#); [Asking Questions and Defining Problems](#); [Obtaining, Evaluating, and Communicating Information](#))

Materials:

- 1 soil thermometer/moisture meter per team of 3-4
- 1 regular thermometer per team
- Clipboard, paper, and pencils for each team (you can use scratch paper or notecards)
- Compass

EG Team Support Needed:

- None

Prep:

This activity is designed to take place outside! The only exception is if you are displaying the powerpoint to 6-8th graders. An outside adaption to this is doing the same visualization activity you would do with the younger students, but using more advanced vocabulary. Alternative options in case of rain: have students wear rain jackets and ponchos to do the microclimate walk if the rain is light, if the rain is heavy take photos of real microclimates on campus and print them out for students to assess.

- For grades 6-8, adapt and use this [powerpoint](#).
- Set materials up in your outdoor classroom.
- Familiarize yourself with some of the natural and human-made microclimates on campus.

Activity Procedure:

Engage:

Address students inside the classroom or in the seating area of the garden after they are calm and ready to transition into the activity with you. Today, we are going to learn about microclimates on our campus! What does the word “micro” mean? Ex. microscope, micro-organism, small, tiny.

Introduce vocabulary:

Climate: Climate is the average of weather conditions in a place over a long time.

Microclimate: The climate of a particular, small area. Often this is in comparison to the larger habitat. (i.e, the microhabitat under a log might be warmer and damper than the surrounding forest.

Habitat: Habitats provide living beings with food, water and shelter.

- How do habitats change at different scales? Can I look at habitats on a smaller scale? ([Scale](#); [Asking Questions and Defining Problems](#))

Microhabitat: A microhabitat is a very small or specialized part of the habitat, or the immediate surroundings of an organism. Depending on the size of the organism, this could refer to a particular tree, a particular branch, or the particular part of a single leaf.

Weather: Weather is made up of all the conditions in one place (temperature, wind, precipitation, humidity, etc.) at a particular time. Weather changes often.

Season: Each of the four divisions of the year (spring, summer, autumn, and winter) marked by particular weather patterns and daylight hours, resulting from the earth's changing position with regard to the sun.

Action:

For grades 6-8, adapt and use this [powerpoint](#). For all other grades, Use a visualization: "OK, I want you to close your eyes for a minute, and imagine...pretend that you are as small as an insect. You have shrunk way down, and you are just a tiny little thing the size of a fly. Winter is coming, there's been a bit of snow falling, and you want to find a good place to get warm for the day. Where are you going to go? You can fly and crawl around, just like a fly. You are buzzing around outside, on the schoolyard, and checking out different places...maybe the playground, maybe the trees. Notice what it feels like in these different places. Notice what places are nice and warm, which spots seem nice to hang out in for a while. What places are the coldest? Where do you not want to be?"

After students open their eyes again, explain that animals really do make choices like this about where they hang out, in the winter, on hot days, during the night, when it's windy or even on days that are just a little chilly. Explain that today we are going to test some of our predictions about what microhabitats at the schoolyard will be warmer or cooler places for an animal to be.

Explore:

Why study microclimates? *Temperature has an impact on the kinds of plants and animals that can live in a particular place. Varying types of land cover can affect temperature.* What kinds of [scientific investigations](#) can be done to study [microclimates](#)? [What tools will we need?](#) ([Scale](#); [Planning and Carrying out Investigations](#))

Action: Exploring Microclimates

- 1) Introduce students to the callback you will be using for this activity (silent coyote, give me 5, etc.) and stick with it!
- 2) Have students form groups of 4-5. Explain the tools they will be using (compass, thermometers, moisture meters, and their senses--if you don't have enough measurement devices, the senses are great for studying microclimates as they can measure temperature, moisture, wind, sun and shade).
- 3) Pass out 1 clipboard, piece of paper, and writing utensil to each group. Tell them they are to record on their piece of paper: 1) the area they observed and quickly draw a picture of it 2) tools they used to observe 3) observations of the area: Who lives there? What does it feel like? Record any data too including direction of wind (they can look at trees or shrubbery and use their sense of touch to feel the wind direction and speed), temperature (Fahrenheit), whether it's sunny or shady (light levels), and moisture level. Give students time to write out on their paper notes and draw out a template for them on how they are to record each area they go to. Set up a draft of how you would record so they are learning how to take valuable notes. Drawing is strongly encouraged and writing basic words down for students that are learning to write (K-2).
- 4) Let them go explore certain zones in the garden, nearby around perimeter of campus on soccer field, on asphalt, etc. and identify areas teacher can help you supervise. Do not let a team go to

areas where teacher or you can not supervise them. Are they allowed to dig up everything? Throw things? How are they to treat tools? (Not like toys!)



Comprehension Check

- 5) Gather back up in the garden and call back students. Have students share their experiences and compare their findings. Use the Think-Pair-Share recommendations to have kids partner up with classmates outside of their groups to share their findings. Have them change partners for each new question. Focus them on the following questions:

Describe a microclimate that you found. What was the temperature in this spot? What might be making this a hot or cool spot? How does this spot compare to your partners hottest (or coolest) spot? What plants and animals did you notice living there? What **patterns** did you notice in the plants and animals found in the colder microclimates vs. the warmer microclimates? Did you notice any differences between the plants and animals that live in the other locations? What were the differences? (**Patterns; Asking Questions and Defining Problems; Obtaining, Evaluating, and Communicating Information**) How might the highs and lows change during the day? The year? How might these changes affect the plants and animals?

Explain:

Studying microclimates can help us understand a lot about different species. Small-scale variations can play a large role in determining where animals live or choose to spend time. For example, insects, fish, reptiles, and amphibians are cold-blooded. This means that they depend on their body temperature depends on the temperature of their surroundings. Have you ever wondered why lizards like sunning themselves on rocks? Or why there are more insects around in the summer? Also, amphibians spend part of their life cycle in water, so depend on the presence of moisture--if their skin dries out they die! Have you ever wondered why you see frogs, toads and salamanders around wet places?

When we talk about how animals deal with the changing seasons, we often focus on physical changes (growing a winter coat), physiological changes (slowing down the metabolism in hibernation or in torpor) or large-scale movement (migration of birds and mammals). Another very important way that animals deal with changing temperatures is by changing their behaviors. Animals make countless decisions about where to spend their time. Choosing between the cool and the warm side of a log could make a life and death difference for something the size of a beetle that does not regulate its own body temperature the way we do. Plants are like animals too. Some plants will adapt to changes in the climate by freezing or bolting.

Creating microclimates can benefit us as humans by reducing energy needs to cool or heat an area, by making areas more comfortable for ourselves, and by allowing desirable plants to grow. Did you know that planting trees on the south side of your house can help cool it down during the summer? And planting trees around streets and parking lots can help keep people, cars and buildings cool? Trees that block wind can help reduce evaporation and water loss, as well as keep us warmer, out of the wind.

We live in the northern hemisphere. Based on the tilt of the earth, the sun is usually to the south, making the south side of buildings, mountains, etc. hotter than the shady north side. If you observe tree growth on the hills around San Luis Obispo county, you can often find more trees on the shady (and

therefore wetter north slopes). Likewise, citrus trees like orange and lemon don't usually grow in North San Luis Obispo County because of the cold winters. But a few people have managed to grow them by planting them on the hot south side of houses where they get extra heat reflected off of the building. It is also said that if you ever find yourself lost, you can find out which way is north by looking at where moss grows on trees. Moss grows on the north side of trees in the northern hemisphere because moss likes shady, cool conditions. Which side of the tree does moss grow on in Australia (hint: they are in the southern hemisphere)?

Use some examples from gardening too, to explain the effects of microclimates: lettuce grows best in cooler seasons. But it can be grown in the hot summer planted in shady areas. Which side of a building would you grow lettuce on in the northern hemisphere? In what other microclimates might lettuce grow?

Elaborate:

What are some adaptations that humans create that can alter climates and form microclimates to benefit humans? (Example: awning for shade to eat lunch; drip irrigation to create moist soil and grow food; greenhouse/hoop house; pavement causing the heat-island effect.)

Discuss heat-island effect and identify places on campus where it occurs. How might we reduce the heat-island effect in these places? (Discuss solar panel installations over parking lots, trees, and changing the color of parking lots from heat-absorptive black to reflect white.)

Evaluation:



Each team can report their findings and create a class data sheet to look for patterns and make more comparisons. Have students mark their findings on a map of the schoolyard. Complete the investigation by having students reflect on the activity by writing about their observations during the activity. What did they learn about microclimates? How do they know this? What kinds of microhabitats are best suited for species trying to keep cool? Stay wet/look for water? Stay warm? What further questions do they have about microclimates? Ask where on campus a particular plant, animal or human might enjoy living. For example: citrus - likes sunny, dry and warm areas, cannot freeze; ferns - like cool, wet, and shaded areas; frogs - prefer cool, shady, wet areas; lizards - inhabit sunny, dry areas, especially rocks that absorb heat and re-emit it after the sun sets.

Also, refer back to the Learning Objectives for your grade level and ensure that they have been met by asking the given learning objective question.

Extension Activities:

- Use the [Old Farmer's Almanac](#) to learn how to convert and compare Celsius and Fahrenheit
- [Climate Types for Kids](#)
- Watch these videos as a way to prepare for the lesson or as a follow up to dig deeper into scientists studying the Heat Island Effect:
 - [Urban Heat Islands](#) Talk with NASA scientists
 - [What Is the Heat Island Effect?](#) Student asks Weather Man
 - [TurfMutt and Green Ranger Tackle the Heat Freak](#)

- [PowerPoint created by Jesse Gibson, former One Cool Earth educator](#)
- Evolutionary adaptation and examples of species adapting:
 - https://www.youtube.com/watch?v=ZCKRjP_DMII
- We endorse this on their website and they have flyers to download/use:
 - <http://www.healslo.com/outsidein-slo/>
- Climate Change and Weather... PDF guide and graphic of interactions with spheres
 - <https://aamboceanservice.blob.core.windows.net/oceanservice-prod/education/pd/climate/factsheets/whatrelationship.pdf>
- Climate Quest Game OnLine
 - <http://www.scholastic.com/turfmutt/climatequest/>
- [Efficient Energy Planning - Permaculture Design and Zoning](#)

Tips and Caveats:

Adaptations for K-2

For kindergarten students, have them draw the plants and animals they find as accurately as possible rather than use thermometers, compasses, etc.

Provide assistance to 1st and 2nd grade students with tools (thermometers, etc.)

Cited Curriculum:

- [Exploring Microclimates in Your Schoolyard](#)
- [Schoolyard Microclimates](#)